

Enhancing Learning Environments with Stories-as-a-Service:

How Content Collection, Automated Tagging, and
Service Architectures Enable Knowledge Sharing



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Motivation

Make stories available to training & education on-demand, when learner is doing or thinking something that makes a story instructionally meaningful

WHAT: Enhance digital learning systems with informal instruction

- Tacit knowledge transferred from experts/peers during routine interaction
- Making “war stories” available within or beyond workplace

HOW Augment any API-compliant learning environment w/”Story Appliance”

- Create SOA capability to offer client learning applications *Stories-as-a-Service*
- Develop simple, flexible indexing organizes stories for instructional relevance
- Build story collection platform and story browsing interface

Sponsor: Advanced Distributed Learning Initiative



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Armed Forces Interest in Video Stories

- Stories for recruiting, public affairs, education, training
- Online video collections professionally produced, edited
- Organized by high level topics areas or general questions



Airman Video Contest, AFBlueTube



armystrongstories.com

Limitations of Today's Practices

- Online video collections
 - Purpose-built and labor-intensive
 - No (or limited) meta-tagging
 - Content is siloed



Veterans Affairs (recovery, addiction, depression)

- Result: Good content but not scalable/repurposeable



Project Objectives

- Encapsulate tangible, relevant content in stories
 - lessons learned, advice, warnings, tradecraft
- Enhance Training Simulations with Video Stories
 - Tacit knowledge transfer via 1st-person “war stories”
 - Long-standing practice across diversity of communities

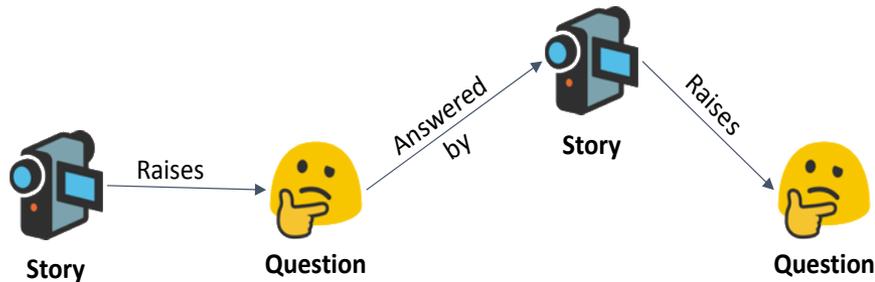


Augmenting Next-Generation Learning Environments with Stories

ANGLES

- Content meta-tagging/indexing
- Story Collection
- Client Learning App
- Sample Videos
- API
- Storyboard

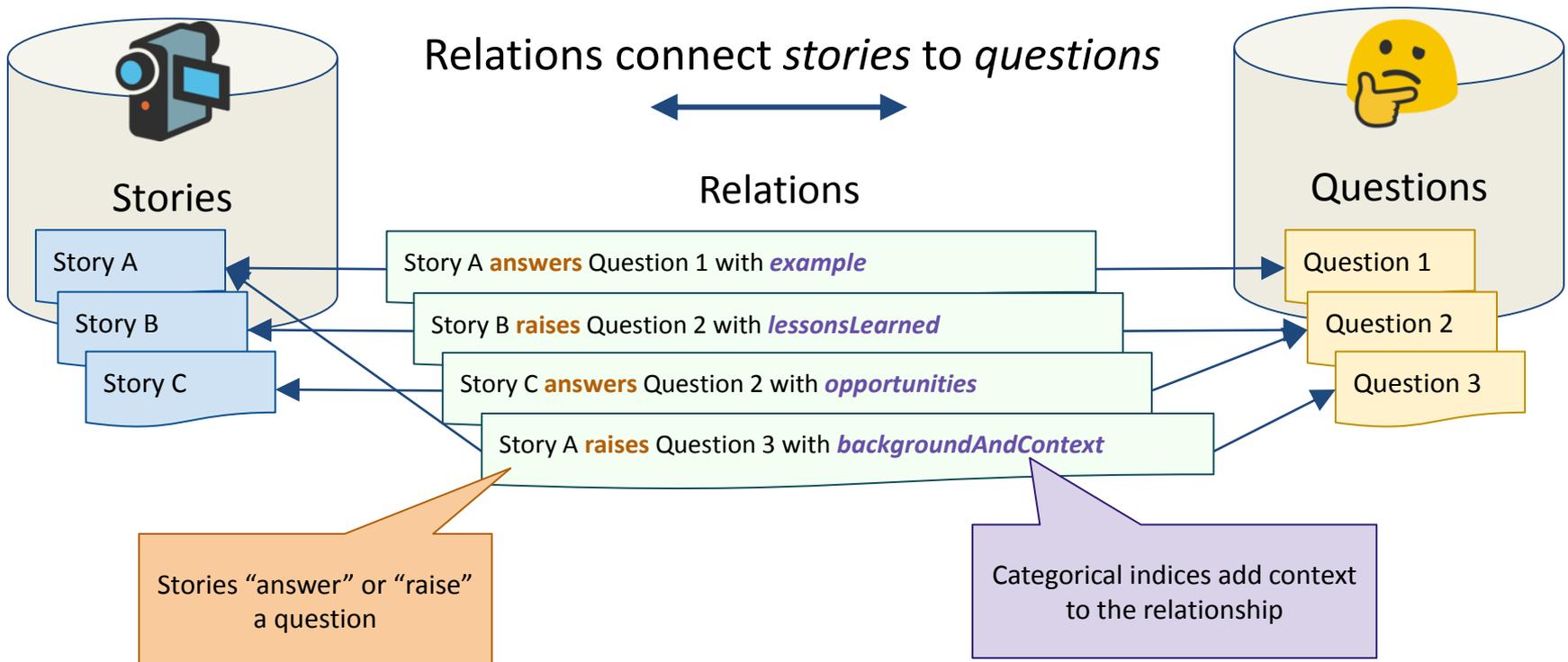
Linking Stories w/Question Indexing



- ACOA: **Alternative Courses of Action** to the advice discussed in the story
- TT: **Tips & Techniques** that can be extracted from the story
- EX: **Examples** of the issue discussed in story
- C: **Consequences** or later events following the situation discussed in the story
- LL: **Lessons Learned** from the story
- A story is related to other stories...
 - It raises questions another answers
 - It answers questions raised by others
- Questions can be coded thematically
- BC: **Background & Context** that led to the situation discussed in the story
- IW: **Indicators & Warnings** about the situation discussed in the story
- RM: **Response Measures** that were taken in the story
- O: **Opportunities** related to the situation discussed in the story

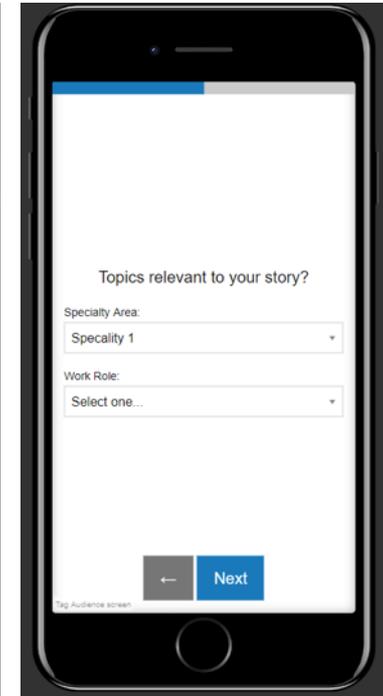
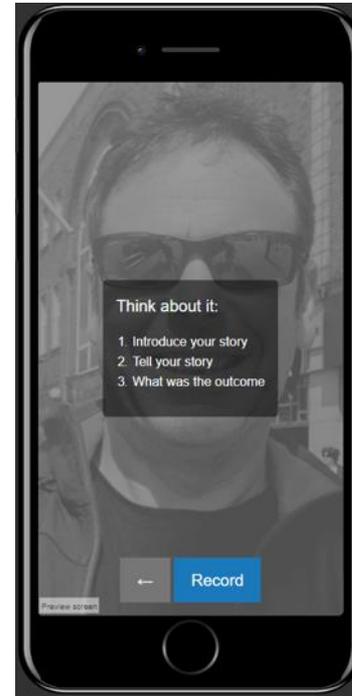
Story and Question Data Models

Index	Example Question
BC: Background & Context	What vulnerabilities will attackers try to exploit?
IW: Indicators & Warnings	What indicators of an attack do you look for in the network traffic?
RM: Response Measures	What steps do you take once an attack has been detected?
ACOA: Alternative Courses of Action	How can <i>least privilege</i> & <i>need-to-know</i> enhance a security policy?
TT: Tips & Techniques	How does pattern recognition help detect cyber anomalies?
EX: Examples	Has poor team collaboration ever resulted in a negative outcome?
C: Consequences	What are the vulnerabilities created by damage from an attack?
LL: Lessons Learned	What cyber risks are emerging along with the Internet of Things?
O: Opportunities	Are there ways of detecting insider threats before they attack?

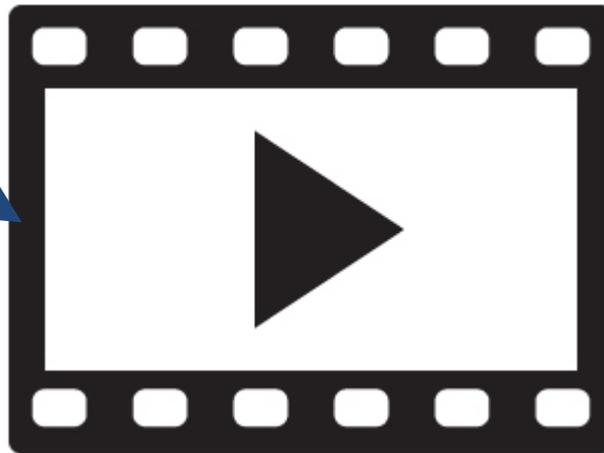
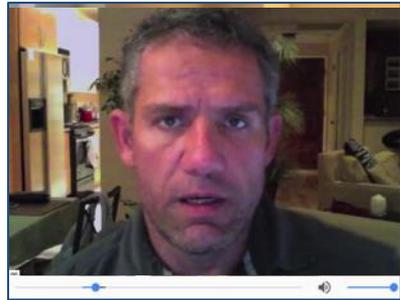


Story Collection

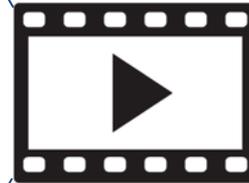
- Video Capture, Compression
- Speech-to-Text
- User Selected Indexing
- Metadata Generation
- Automated Alignment



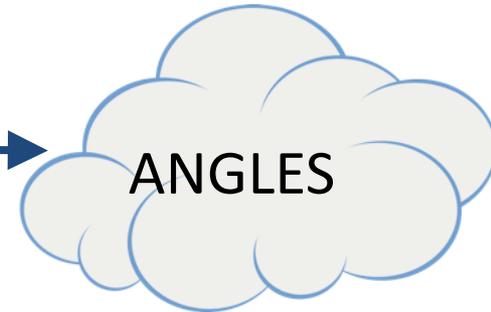
Video Capture / Compression



Most phones record video at
~150MB per Minute

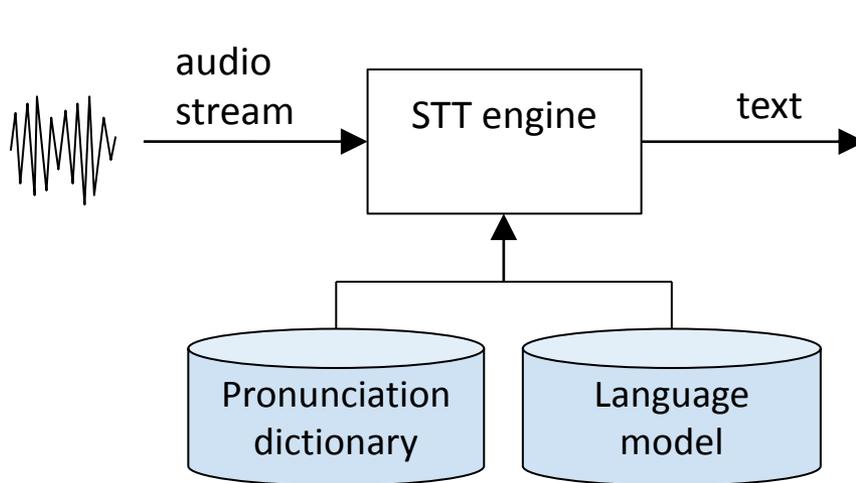


~10MB per Minute



On Device Compression

Speech-to-Text

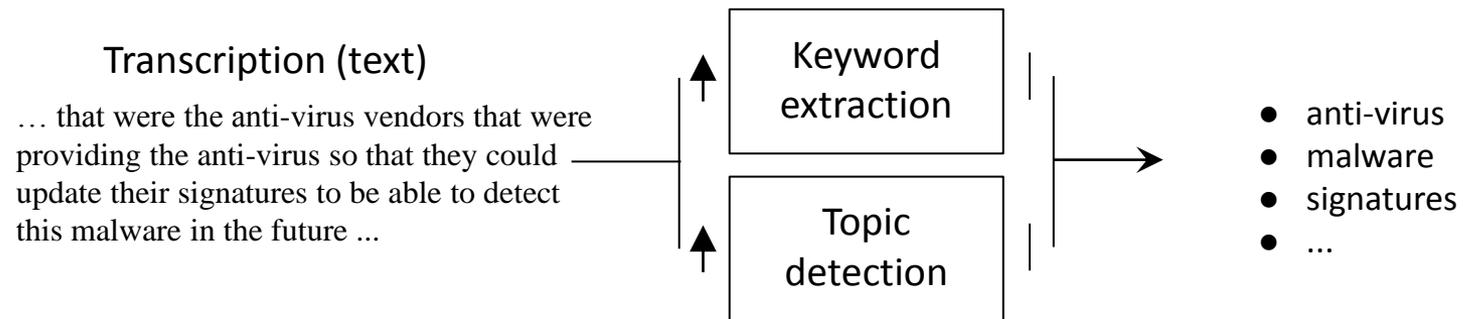


... that were the anti-virus vendors that were providing the anti-virus so that they could update their signatures to be able to detect this malware in the future ...

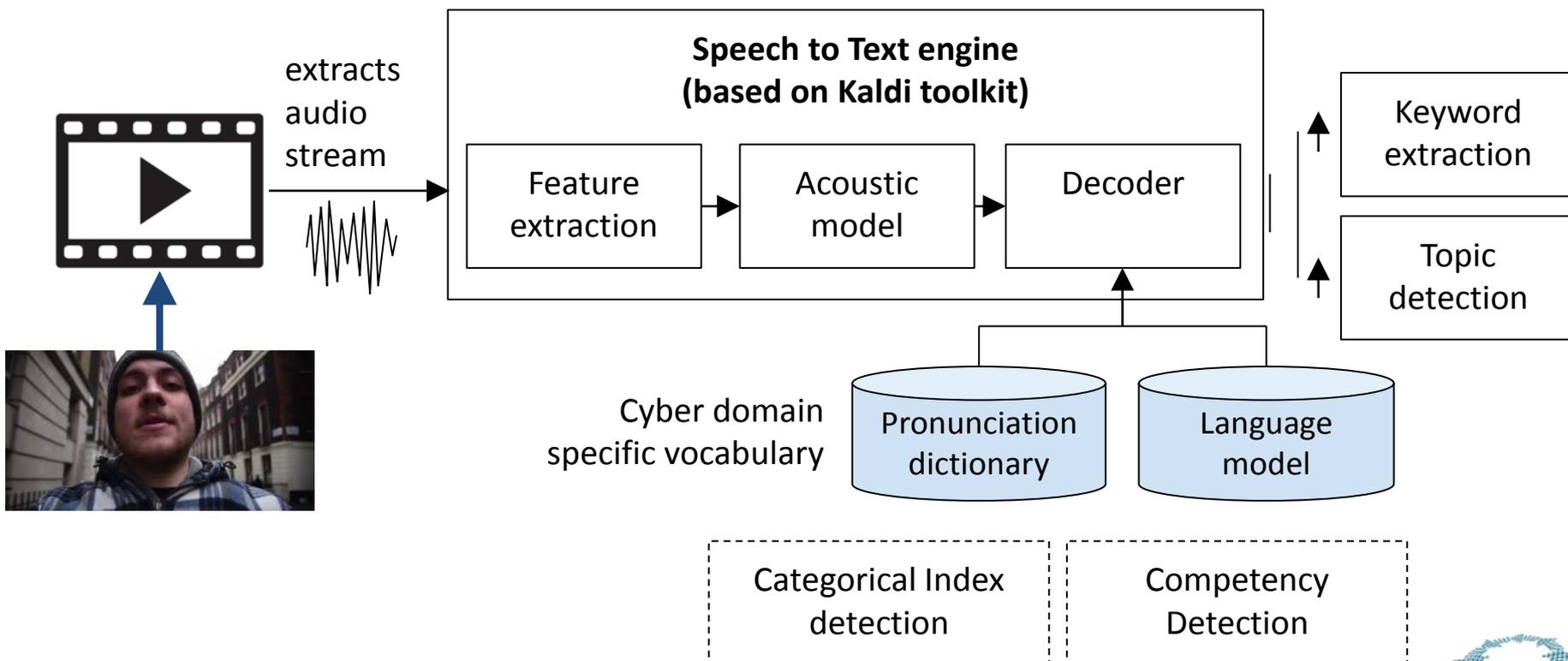
Word	Pronunciation	Bi-/Trigram	log-likelihood
Darknet	d aa r k n eh t	antimalware scanner	-0.989783
honeypot	hh ah n iy p aa t	get antimalware	-4.149837
malware	m ao l w eh r	launch antimalware	-2.580665
truecrypt	t r uw k r ih p t		

Metadata Generation

- Proof-of-concept for keyword extraction incorporated into collection app



Server-based Speech-to-Text & Automated Metadata Generation



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User Selected Metadata Tagging

The screenshot shows a mobile application interface with a status bar at the top displaying icons for messages, calendar, and battery level at 27% at 7:39 PM. The main content area is divided into two sections. The first section, titled "Add keywords for your story.", features a text input field with an "Add" button to its right. Below this, several keyword tags are displayed in grey boxes: "attack", "employees", "password", "privileges", "victims", "call", "claim", and "security desk". The second section, titled "Add topics for your story.", has a text input field with "Add" and "Clear" buttons to its right. At the bottom of the screen is a large blue "Next" button.

- Keyword suggestions from domain-tailored speech-to-text
- User-provided tagging:

The screenshot shows a mobile application interface titled "Additional Information". It contains several form fields: "Title:" with the prompt "Please provide a title for this story.", "Description:" with the prompt "Please fill out the description.", "Method of Storytelling:" with a dropdown menu showing "Select one...", "Security Classification:" with a dropdown menu showing "Select one...", "Type of information:" with a dropdown menu showing "Select one...", "Lesson:" with a dropdown menu showing "Select one...", and "Level of Complexity:" with a dropdown menu showing "Select one...". The screen is labeled "Tag Audience screen" at the bottom.

The screenshot shows a mobile application interface with a dropdown menu titled "Select one...". The menu options are: "None", "Unclassified", "Controlled Unclassified", "Statement A", "Statement B", "Statement C", "Statement D", "Statement E", and "Statement F". Each option has a radio button to its right.

Automated Alignment to Questions

- Ontological expansion
- Topic detection
- Deep and shallow learning techniques

Transcribed Text

...once the client was aware of this problem um that this problem was a real problem for them that needed to be addressed things moved very swiftly perhaps within hours my team had been deployed and we were doing analysis regarding the malwares it might be available over the next two weeks and months additional analysis relating to the chronology how widespread was the problem um how the network had been infiltrated um what were the points of egress in the network by which stolen information was being exfiltrated back to the perpetrator...

...we left some of that malware in place so as not to alert the operator that we have as much knowledge as we did regarding what they were doing we wanted to analyze its behavior to understand its behavior and to be able to craft more effective long term defence...

Probabilistic alignment using ontological expansion, topic detection, and deep and shallow learning techniques

List of Questions

- What resources are available to monitor cybersecurity systems and train users?
- For a cybersecurity data collection project, what is necessary for the project to be successful?
- Once a cybersecurity problem is detected, what initial and longer-term steps can be taken to address the problem?
- What are the roles of a cybersecurity professional team

Automated Alignment to Competencies

Transcribed Text

...so the first thing that I will do is look at the open cases so I'll take that data I'll review what the attack activity is I'll apply that to the cyber kill chain for security I'll use a variety of tools and knowledge as a security analyst to do this then I'll be able to cross-pollinate with other teams in the organization when I've made a decision on the threat type and how it is propagated then next I'll very quickly update the operations team and what is happening and how we might use that data to create an incidence response methodology and more importantly how we can remediate the threat...

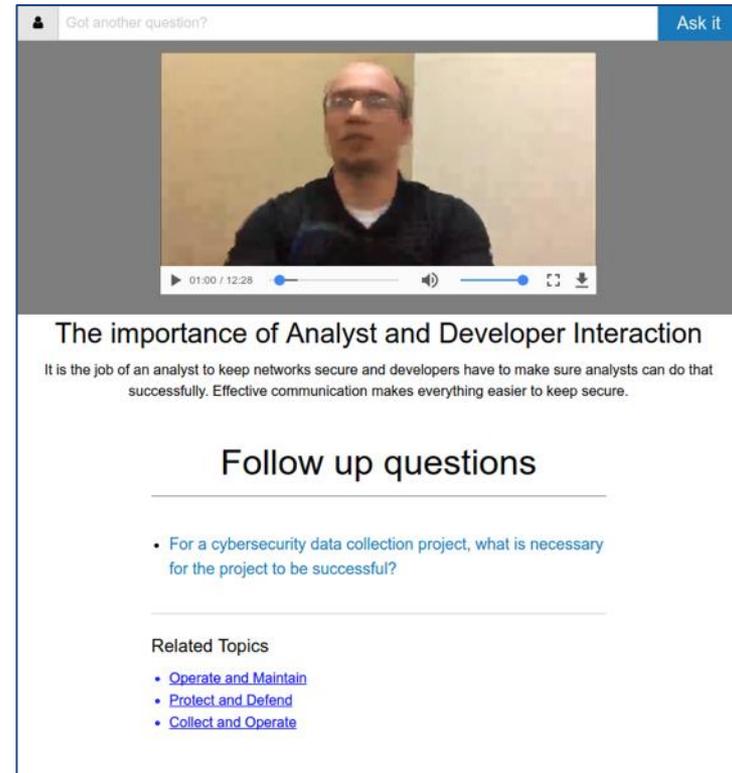
Probabilistic alignment using ontological expansion, topic detection, and deep and shallow learning techniques

Competency Framework

T0174	Perform needs analysis to determine opportunities for new and improved business process solutions.
T0175	Perform real-time cyber defense incident handling (e.g., forensic collections, intrusion correlation and tracking, threat analysis, and direct system remediation) tasks to support deployable Incident Response Teams (IRTs).
T0176	Perform secure programming and identify potential flaws in codes to mitigate vulnerabilities.

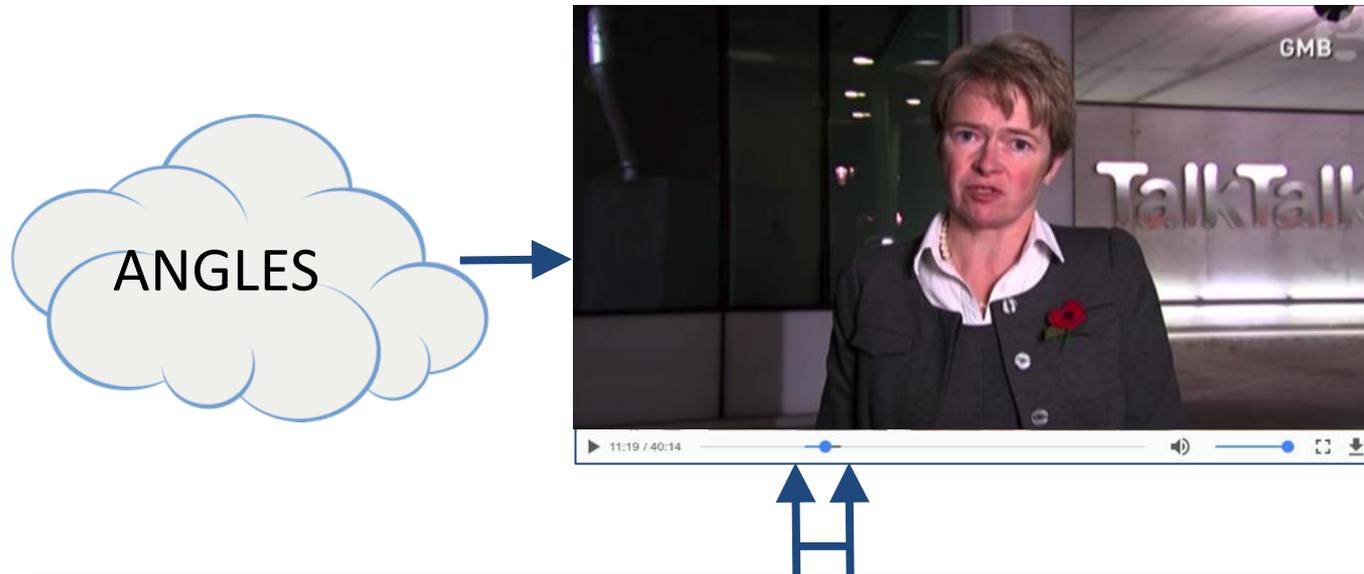
Example Client Learning App

- Surrogate Simulation Environment
 - Story Browser
 - Uses API to ANGLES server
- User can
 - Ask Questions
 - Browse Topics
 - Traverse links for virtual conversation



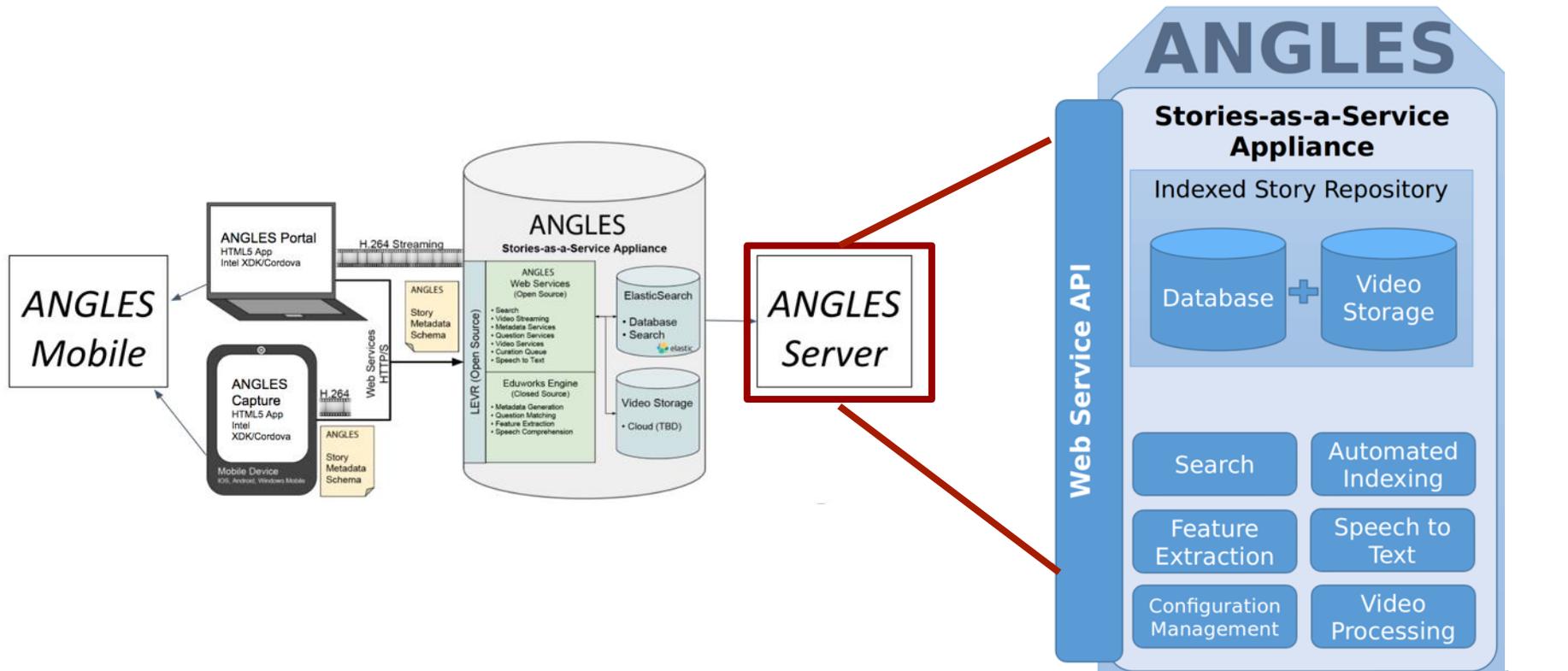
The screenshot displays a user interface for a learning application. At the top, there is a header with a user icon, the text "Got another question?", and a blue "Ask it" button. Below the header is a video player showing a man speaking. The video player includes a progress bar at 01:00 / 12:28, a volume icon, and a download icon. Below the video player, the main content area features the title "The importance of Analyst and Developer Interaction" followed by a paragraph: "It is the job of an analyst to keep networks secure and developers have to make sure analysts can do that successfully. Effective communication makes everything easier to keep secure." Below this is a section titled "Follow up questions" with a single bullet point: "For a cybersecurity data collection project, what is necessary for the project to be successful?". At the bottom, there is a "Related Topics" section with three links: "Operate and Maintain", "Protect and Defend", and "Collect and Operate".

Streaming Playback



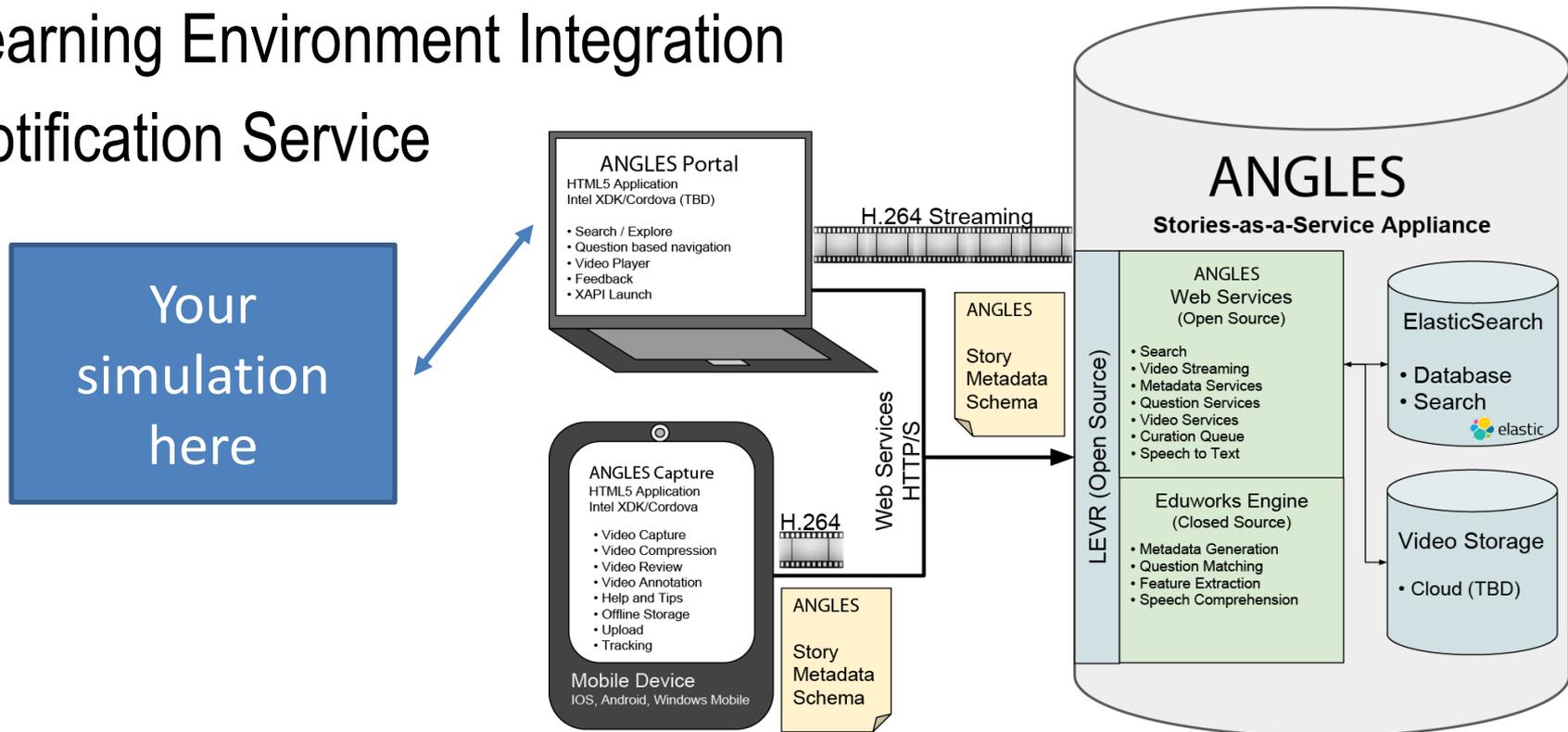
Streaming Playback enables reuse of videos for multiple stories (or other purposes)

Architecture: Server, Mobile Client



API

- Based on Open Linked Data
- Reuses/extends common schemas
- RESTful, JSON-LD
- Learning Environment Integration
- Notification Service



Example App: Cyber Security

- [Sample stories](#) told by cyber security SMEs
 - machine-transcribed for semantic analysis
- Tagged w/ANGLES indexing
 - 66 Stories
 - 148 Questions
 - 246 Relations (between stories and questions)



Contributions

- Tools for Content Collection
 - Keyword recommendations to support user-tagging
- Advances in Automated Tagging of Content
 - Metadata generation / Question generation
- SOA capabilities for delivering content to 3rd-party learning environments
- Broadening Community of Content Providers

Benefits to Armed Forces

- Enhanced services/tools
 - can add scale and utility
- Used for training, recruiting, public affairs



Airman Video Contest,
AFBlueTube



#AskASailor, America's Navy
Youtube Channel



armystrongstories.com

Benefits: Enhance Current Video Services

- How can ANGLES help?
 - Story collection via mobile app
 - Enhanced story navigation/browsing
 - Automated content analysis/tagging
- “War stories” -- on-demand relevant expertise
 - Interagency disaster response: Supplemental training
 - Public Health education – overdose reversal, vaccines, infant and pre-natal care, substance abuse, STDs
 - Public Safety education - driving, fire prevention, gun safety, emergency preparedness

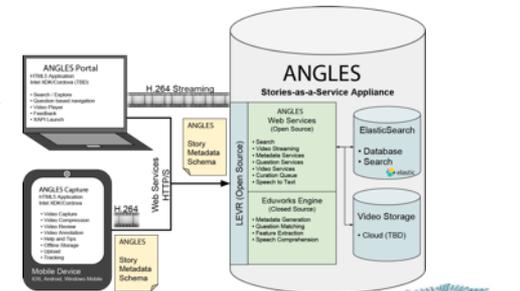


Applications: Private Sector

- Stories-as-a-Service
 - Integrated w/web-based eLearning, mobile learning
- Corporate Workforce Development
 - On-demand access to relevant, first-person narratives
 - Supplement formal online training and education
 - Compliance, retention



How do I know what to wear to a job site?



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Summary

- Enhances online learning w/Stories on-demand
 - SOA for delivering content to learning environments
- Broadens community of content providers
 - Videos scalable; no professional cameras, production
- Tools for content collection
 - Keyword recommendations to support user-tagging
 - Automated metadata generation / question generation
 - Content can serve multiple learning goals & apps
- API exposes Story Services to diverse simulations



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