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# GIVING VOICE TO CHAOS

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22.02

# LOOKING TO OLD WAYS TO UNLOCK NEW VALUE

**Attention to the metadata allows content owners and distributors to fulfill their true potential**

**ABSTRACT:** As bundles and ad-supported services once again become the new normal for video distribution, the value of metadata cannot be ignored. Content discovery and ad-insertion are impossible without aggregated and enriched metadata. Cloud-enabled metadata processing is the key to ensuring video service evolution.

**By Peggy Dau, Marketing Director, MetaBroadcast**

The definition of TV continues to evolve as traditional broadcasters also make content available directly to consumers via branded streaming services. Pay TV providers deliver linear and streaming channels. Smart TV providers aggregate free ad-supported TV (FAST) channels. And some streaming services (e.g., Amazon Prime Video, Apple TV+) enable incremental subscriptions to other streaming services. Audience engagement is the name of the game and metadata is the key to unlocking value for the consumer.

As of early 2022, Nielsen listed 817,000 program titles across both traditional linear TV and streaming services in the United States. Many of these titles include hundreds of individual episodes. Now, expand that figure to reflect regional programming around the globe. The investment in content development continues to rise, but how do consumers navigate their video services to find the programs they want?

More importantly, how can video platform providers entice, engage, and retain subscribers as they all face the age-old challenge of subscriber churn. The current strategy is familiar: introduce bundles and advertising.

A Nielsen study indicates that 64 percent of global viewers want bundled streaming services. 46 percent say it is harder to find content because too many

services are available. The industry is responding by making bundles or the ability to bundle available to consumers.

By aggregating a variety of services, the provider hopes to appeal to the varied interests of the target household. For example, Disney's bundle leverages Disney-owned services to combine Hulu's variety of linear on-demand and streaming content, the branded assets of Disney's renowned vault, plus the all-important sports content of ESPN. The consumer household benefits from a cost-effective bundle and access to a wide variety of content.

Alternatively, Amazon Prime Video subscribers can add subscriptions to Amazon Channels such as Acorn TV, Discovery+, Paramount+, Showtime and more. In this case consumers benefit from consolidating subscriptions under one entity, Amazon, while building their own streaming bundle. In the UK, services such as SkyQ and Virgin Media TV enable similar bundles via their pay TV platforms.

The challenge in both scenarios is still federated content search, discovery and recommendation across the various platforms. The solution is the effective use of metadata. Metadata is used by platforms to classify content under different categories such as movies, TV shows, documentaries, etc. Further elements such as genre, artist, producer, and release date are added to help viewers search based on specific criteria. Video service providers must make use of metadata to enhance the way their viewers interact with their platform. When it comes to search, the platform's search engine will use the metadata information provided about each title to make it discoverable based on a viewer's search criteria.

Metadata is also the source for recommendation algorithms to identify a user's consumption patterns based on titles, genres, actors, and other metadata. With thousands of hours of content available, the goal is better and longer user engagement. This is an indication of the consumer's perceived value received from the video service.

The second business model being introduced by almost every streaming service is that of advertising. While consumers once indicated that "too many ads" was one of the main reasons for discarding their pay TV subscriptions in the U.S., the aggregated cost of multiple streaming subscriptions is forcing consumers to rethink.

OMDIA research indicates that by 2027 revenue from online video advertising will surpass revenue from pay TV subscriptions, traditional TV advertising and online video subscriptions. It is no wonder that streaming platforms are pursuing ad-based models. There is also a belief that ads found in online video services will be more targeted, personalized and less frequent.

Consumer interest in avoiding increasing subscription fees in exchange for ads has given rise to free ad-supported TV (FAST) platforms. These services (e.g. Pluto, Roku, Crackle) are free to watch, providing both linear channels and on-demand programming in a single user experience. Revenue is derived from ad-insertion. The interest in FAST services has attracted new market participants to an increasingly crowded market — smart TV manufacturers. Vendors like Samsung and LG are integrating video services directly into the core of their user interfaces.

The challenges of search, discovery and recommendations still exist in this ad-supported business model, but a new challenge emerges. This is one of aligning the right ads to the right content and to the consumer's interests. Again, metadata plays a key role in enabling effective ad-insertion. The more robust the descriptive metadata about individual programs the more relevant

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increase in quality and customization of synthetic voices has made tasks such as audio description, which consists of a complex scripting but straightforward recording process, prime candidates for fully online workflows. "This is the reason behind our partnership with Veritone whose 100-plus synthetic voices are now available through the OOONA Integrated platform and already used in production by end clients," Garb said.

At OOONA we make sure to listen to all our users' needs. "We ran a contest earlier this year," said Shlomi Harari, OOONA global account manager. "We wanted to collect ideas from our users on functionalities they think we need to focus on." The results of the #OOONA2022 contest have included many of the features translator associations have been vocal about, such as concordance and termbase searches, predictive typing, and dictation support.

More automation is certainly on the roadmap for OOONA Tools, made possible by solid API connections to third party tools and software that can further facilitate the localization workflow. A selection of speech recognition and machine translation engines have already been integrated so OOONA's clients have the option of selecting the right engine for each language they work in. A deeper integration of these tools is envisaged, with support for customized solutions and toggles for the use of metadata collected upstream to inform the system output. This will provide solutions tailored to the workflow, be it a subtitling or revoicing one. ⊞

the inserted ad. For example, understanding the program genre helps platforms align complementary ads, while metadata related to specific scenes allows for greater accuracy in ad-insertion.

The importance of metadata and its ability to differentiate video services is clear — particularly as bundling, aggregation and ad-based models evolve. A persistent issue is the quality of the metadata residing within platform content management systems. Most platforms enable ingest of metadata from a single source. However, there is no one source that provides the depth and breadth of metadata needed to support the analytics and algorithms needed for federated content discovery or dynamic ad insertion.

The answer is in the aggregation and enrichment of the metadata describing the content assets. By consolidating structured, semi-structured or unstructured metadata from multiple sources, content management systems become more valuable. Enriching existing metadata with complementary data that provides the who, what, when, where of a program makes content libraries more accessible and monetizable.

The evolution of TV is ongoing. The technologies enabling creation, distribution and consumption will continue to advance and challenge the status quo. However, without attention to the metadata describing the content we all crave, content owners and distributors cannot fulfill their true potential. ⊞

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random numbers are only 32k, finding lucky random can be usually achieved within less than one minute. PAN and PXN are in place to prevent the kernel from accessing or executing user-mode memory.

### STACK CANARIES (IN THE KERNEL AND TAS)

Stack canaries protect against buffer overflow vulnerabilities. We found a textbook stack-based buffer overflows, in which we control the size of the copy and the buffer contents. In total, up to 1275 bytes can be copied, enough for storing shellcode. However, the TA uses stack canaries, therefore exploitation of this vulnerability is not trivial. Since we have arbitrary read and ASLR bypass, we can simply read the value of __stack_chk_ guard and fill it in our shellcode so that the canary verification succeeds.

### PRIVILEGE ESCALATION AND ACCESS TO FULL TEE MEMORY

We take our investigation one step further to gain runtime control of the TEE kernel. Historically, exploit mitigations in TEE OSes have been lackluster compared to other modern OSes. However, for our attack success multiple vulnerabilities in TEE need to be exploited.

The kernel exposes a driver that can be used by privileged TAs to map physical memory into the TA memory space. We will leverage this driver from the hacked TA to map secure registers and unprotect the TEE memory. Finally, we use the same hacked

TA to modify the hypervisor page tables and allow Android apps to map the (now unprotected) TEE memory with complete read/write access.

We focused our attack on registers since they contain all the configurations of peripherals, including the ones used to secure the TrustZone. The two registers that are commonly used for configuring TrustZone are TZASC and TZPC. If a TA could access any of them, it would be possible to read the contents of such registers but also write to them, removing the protection of TEE memory. In principle, modifying any of the two could allow the REE to access the TEE, effectively compromising the security provided by the TEE. We decided to target the TZASC using our exploit and remove the protection of the TEE memory space. We managed to map all the TEE memory into an Android application, meaning that we can:

■ *Modify the code of TAs and TEE kernel since the permissions restrictions do not apply to the Android application;*

■ *Bypass countermeasures implemented in the kernel such as KASLR, PAN, and PXN;*

■ *Gaining full TEE control and performing attacks like modifying the phone unlock functionality implemented in the TEE (fingerprint or face recognition) to bypass the screen lock.* ⊞