Linear TV ad insertion

The technology groups behind television advertising (SMPTE, SCTE, CableLabs) have spent the past few decades developing advanced digital insertion technologies and standards and practices for the business systems to interoperate and employ the new technologies to suit evolving ad sales strategies. While the technologies for ad insertion have been widely successful, adoption of the business system interfaces has lagged.

Time Window ad insertion

- Time Window is a holdover technique for ad replacement systems, where the network could only send minimal cue information (on/off) in DTMF signal cueing.
- SCTE-35 break messages replaced DTMF with similar cue-only information
- Ad schedules are created around the “window” of time that breaks are expected in the network feed.
- Time windows allow the programmer to make ad schedule changes without coordinating with affiliates, which was critical in the early evolution of cable ad insertion.

Program-specific ad insertion

- Unique Program IDs carried in the SCTE-35 break messages communicate programming information from the Network to their affiliates in real-time.
- SCTE-30 interface from the splicer to ad insertion system allows splicers to recognize UPID in the video feed and instruct the server to fetch relevant ads for the program and break.
- SCTE-118 XML is a specification for schedules from T&B, including UPIDs for ads inserted by the network programmer.
- Live programs can move in time (for example, accommodating a rain delay) or change duration (accomodating extra innings), and the insertion will occur in-program.
- There is no practical workaround. Adoption would require new interfaces between T&B and ad insertion and cooperation of networks to supply schedules and UPIDs.

Client-switched addressable ad insertion

- Vendor-specific extensions to MPEG to support ad switching in the client STB
- Enabled through extensions to the CCMS files and work-around systems

IP Client ad insertion

- Delivery of content to IP devices creates an opportunity to serve ads at the TV device level, similar to mobile tv devices. Ad insertion could deliver the same addressable state as internet and mobile.

Current State

These systems rely on text file merge utilities developed in the 1990s to serve interconnects. These utilities initially replaced local spots with interconnect spots by depending on record types within the CCMS file structure.

More complex technical workarounds have evolved to accommodate new inventory carves for marketing and other external groups, as shown in *Figure 1*.

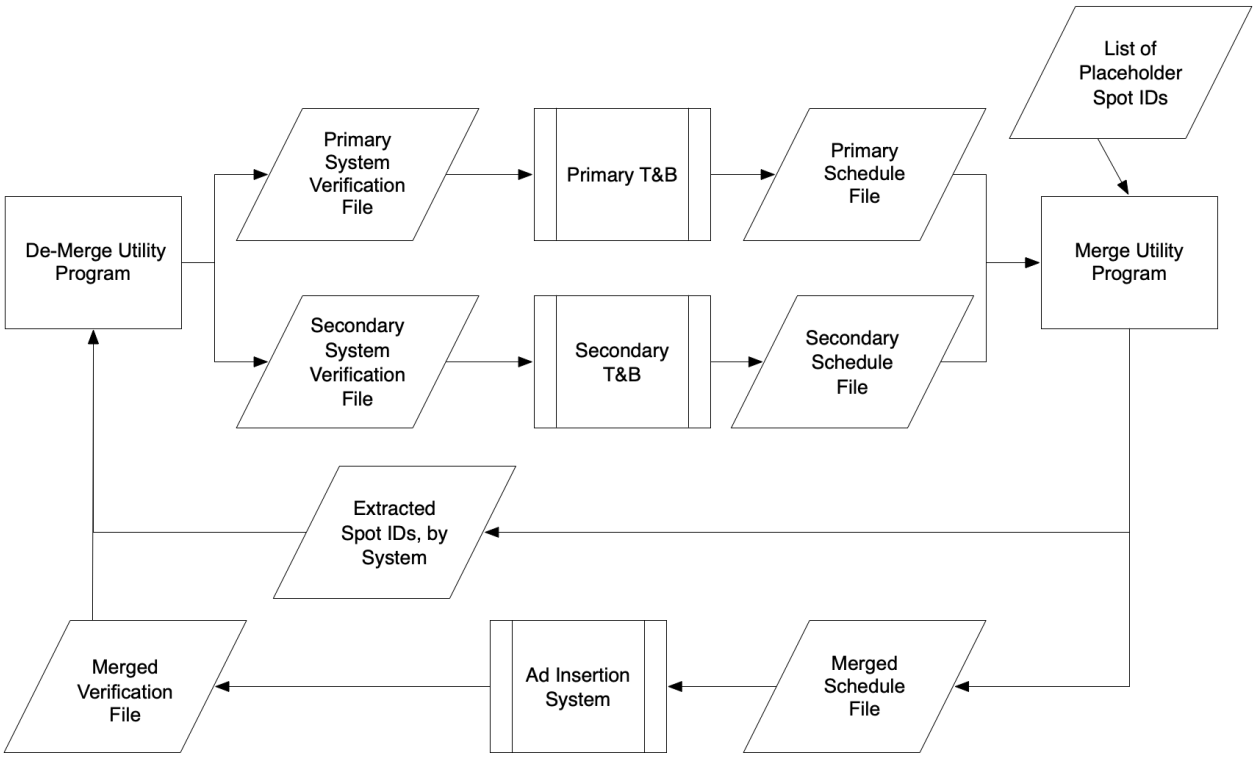

Figure 1 - Typical File Merge Flowchart

MSOs and their technology partners have complex, bespoke systems to manage the expanding number of participants. These systems and the files they generate daily require people monitoring the routing, such as SMMS in *Figure 2*.

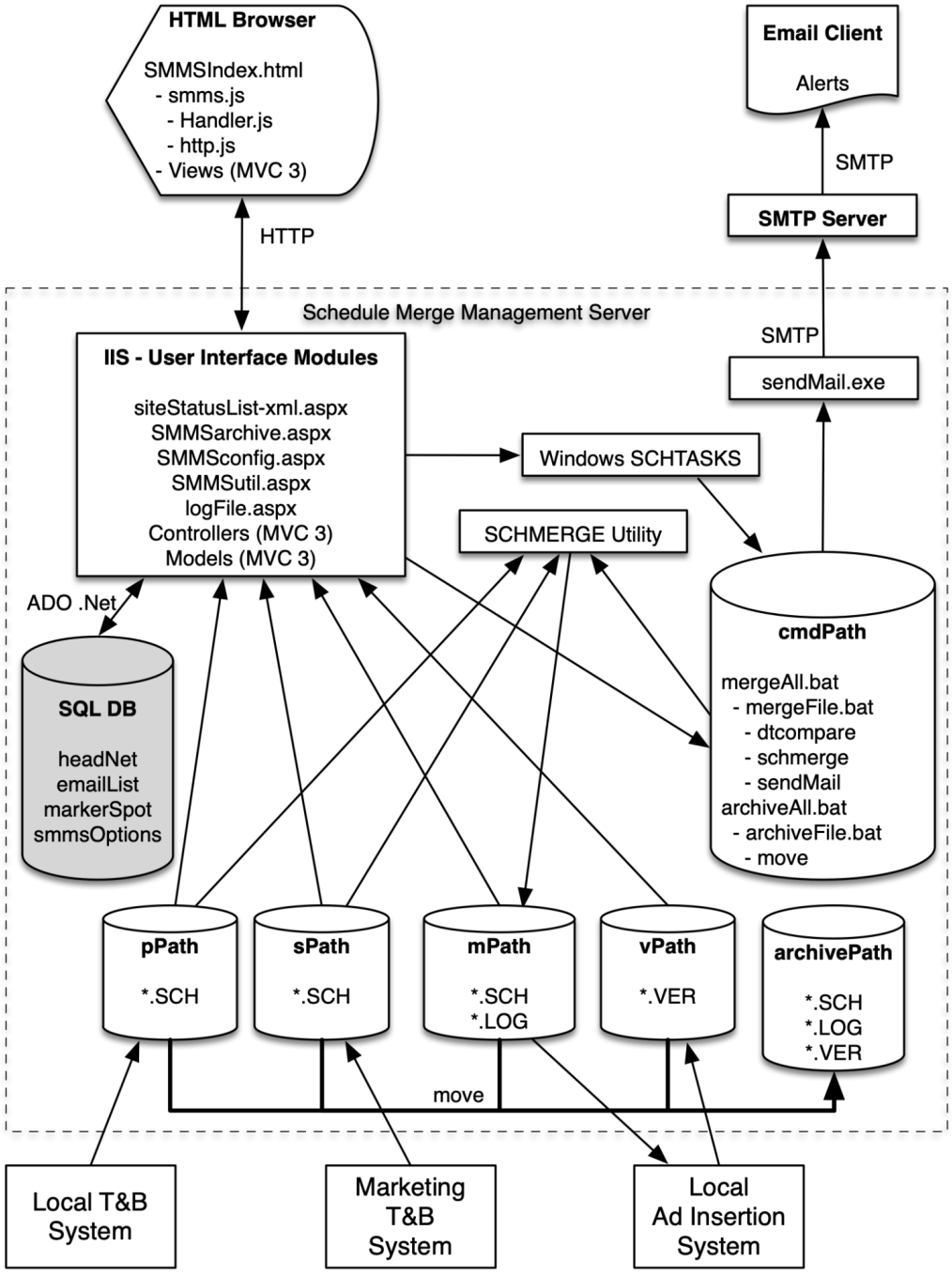

Figure 2 - Managing CCMS Files and Multi-System Merges

Primary Objectives

- Make the system compatible with digital and inclusive of the burgeoning OTT market so that business owners can add new sellers and inventory owners.
- Technology transition must not negatively impact current capability or revenue.
- Simplify and secure the ad transaction chain from the schedule thru verification.
- Automate *everything*.

Tech Objectives

1. Replace all of the schedule and verification CCMS file interfaces of T&B systems with API calls.
2. Create a secure API for inventory owners to publish inventory shares to participating ad sales organizations.
3. Integrate universal inventory identifiers to facilitate the communication of ownership classification and verification for qualified playout.
4. Use business rules to direct the precedence of unexpected inventory opportunities at the time of playout.
5. Identify unused and misclassified inventory for the owner to reclaim lost inventory opportunities.
6. Use business rules to automatically re-classify unused inventory based on time-bounded criteria.
7. Eliminate placeholder, marker, and other unrelated events from the schedules.
8. Replace schedule and verification CCMS file interfaces with SCTE 130 API calls wherever head-nets can be upgraded.
9. Provide real-time status via API to populate business owner dashboards.
10. Universally support systems with different capabilities. For example, legacy systems using a cloverleafApi-CCMS endpoint would be prevented from issuing a *get* to digital ad servers in real-time due to text file endpoint overhead. But the same location will support perpetual schedule/log updates for same-day makegoods and inventory allocation changes.

Constraints

1. Small market ad insertion systems may not be upgradable and must remain in place.
2. Some ad insertion systems may not be upgradable to SCTE 118.
3. Constraints related to business owners using satellite broadcast, proprietary client-switched insertion platforms, bespoke addressable advertising systems, and other information systems will be evaluated in the project discovery phase.

Proposed Design

System Context

Figure 3 illustrates the overall context of the cloverleaf Web Services to connect authorized Selling Partners to control ad playout. The cloverleafApi publishes ad insertion systems as a service, directly available to any authorized consumer, i.e., sales and billing systems.

The product launch should support API-ready Ad Sales Systems via web service interfaces (schedule API put/get, avails notifications API, and log API get). Legacy T&B Systems will connect via virtual filesystem endpoints created by the API.

Future phases will make programmatic interfaces available for Digital Ad Sales Systems (real-time audience buy API).

Similarly, Phase 1 will support Legacy Ad Insertion file system interfaces, while future phases may include program-aware delivery platforms such as SCTE 130.

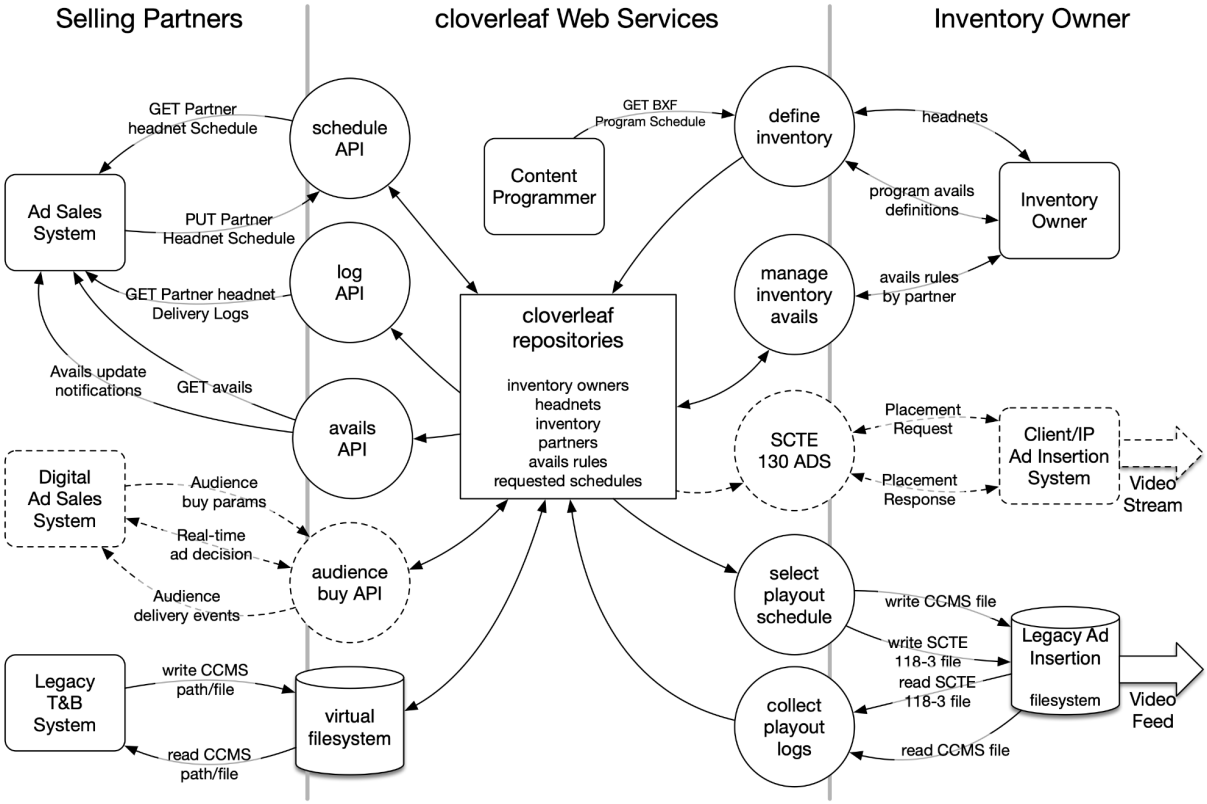

Figure 3 - cloverleaf Web Services Context

The architecture supports either single or multiple MSO per instance. A single cloverleafApi cloud instance will be architected to support many MSO Inventory Owners and their ad delivery markets with appropriate segmentation.

The **Inventory Owner** uses the **define inventory API** to manage headend and network combinations (head-nets) and its established definitions of the programming and ad breaks for the carried networks. Inventory owners connect to a standard API using a spreadsheet or an inventory optimization system. The Inventory Owner uses the **manage inventory shares** API to PUT the rules for sharing portions of their inventory with authenticated **Selling Partners,** either with automated systems or spreadsheets.

The details of these interfaces will be defined in the Phase 1 design.

To support a quick launch, Legacy T&B System can connect through a virtual file system endpoint created by cloverleafApi. We will emulate CCMS for the handshake – reading/writing CCMS schedule and log files to a share. Legacy systems will transition to a secure platform without modification while replacing ongoing file handling and embedded markers with business rules.

Programmatic T&B Systems using the avails API to GET their allocation with inventory and program identifiers required for program insertion. T&B can subscribe to avail notifications ensuring current day +1 synchronization to accommodate network program changes. T&B will produce schedules and PUT them to the schedule API. This will move the linear ad sales model from time windows to a program-specific capability. T&B will GET verification via API as transactions are logged and may revise schedules up to air time.

cloverLeaf audience API would GET audience metrics from the MSO audience system for a head-net when network cue is received enabling true digital impression compatibility. Audience parameters would be included in a GET to Digital T&B Systems at the time of network break. This could be the first cloverleafApi deliverable if the business owners prioritize digital over legacy linear T&B interface.

We expect the installed ad insertion systems will require CCMS file interfaces for some time. The cloverleaf services will write the necessary CCMS schedule files and read the resulting CCMS log files as frequently as feasible to ensure compatibility with market changes for inventory and same-day makegoods. Where those systems can be upgraded to SCTE-118 XML schedules and logs, cloverleaf can move those head-nets to the program-specific tier of operations.

In future phases, an ad-decision interface such as the SCTE-130 API would support Client/IP ad insertion in response to real-time requests containing audience and program targeting data.

Logical Data Model

Data model centered on:

- Inventory (Placement Opportunities) with unique identifiers
- Inventory owners
- Selling Partners
- Inventory shares (avails)
- Requests for scheduled spots and their owned inventory
- Business rules for selecting spots for actual playout
- Future: Placement requests/responses.

API Overview

cloverleafAPI/avails/headend/network/partner

An endpoint for the Selling Partner to GET their allocated inventory (avails) for a head-net and current time period.

For example: to discover their allocated avails (time period, program titles, breaks, positions, etc) in the Manhattan East headend for CNN:

https://cloverleafapi.com/avails/manest/cnn/nyi

cloverleafAPI/schedule/headend/network/partner

An endpoint for Selling Partner to PUT expected schedules for head-net and arbitrary time period

For example: to populate their available inventory for CNN on the Manhattan East headend, NYI will PUT the properly formed XML including a time period to:

https://cloverleafapi.com/schedule/manest/cnn/nyi

Schedule XML PUT Content

cloverleafAPI/schedule/headend/network/date/partner

An endpoint for Selling Partner to GET schedules including current status and history for a head-net and date.

For example: to see the current schedule for all partners (final playout schedule) for CNN in the Manhattan East headend for Feb 22, 2022 a partner would GET from:

https://cloverleafapi.com/onramp/mane/cnn/2022-02-22

Or, to get only the schedule for NYI owned inventory, GET from:

https://cloverleafapi.com/schedule/manest/cnn/2022-02-22/nyi