WHITEPAPER

A vision of the future

Transforming the content supply chain through AI-driven forecasting of linear viewership, and optimization of linear schedules

fractal

The industry as it stands

The viewership patterns of traditional television audiences are rapidly changing. In an era dominated by the COVID-19 pandemic, OTT platforms, and 5G technologies, staying relevant in content is critical for broadcasting units in the Media and Entertainment (M&E) business.

Traditional TV viewership has declined, dropping by an average 5% YoY between 2017-2019, before a temporary upswing during the pandemic-driven lockdown in 2020.

The challenge for broadcasters is no longer just about serving an audience with the right content, but also about what, when, and how to engage their viewers within the complex constraints of contracts, costs, rules, and regulations.

One of the keys to meeting these challenges is the Content Supply Chain (CSC) function, which has evolved significantly in recent years. The CSC undertakes a number of activities related to creating, managing, and delivering the content, from the point of origination to its destination. Much like a physical supply chain, the digital media goes through a standard process (sourcing rights, schedule calendar, rights validation) before the content can be made available.

Pricing pressures and customer expectations are driving companies to look for sophisticated solutions that improve process efficiency across the supply chain. By creating consistent, reusable, and measurable processes, broadcasters can make significant advances in how content is managed. The need to do this, and the complexities that have to be managed, make CSC one of the most critical functions in the industry, one that's uniquely placed to drive industry-wide transformation.

Source: Media Nations 2020 – UK Report, Ofcom (August 2020)

The new structure of supply chains

Editorial planning lies at the center of the decision-making process and is responsible for producing content schedules and calendars. The illustrative calendar below depicts a future list of programs to be aired at each time slot, each day, over a short, medium, or long-term window (e.g., three, six, or 12 months), with an objective to maximize viewership or any other business KPI of interest.

Broadcasters need to take many factors into consideration before they finalize their schedules, including historical viewership trends, content characteristics, external event and business and contractual constraints. This enables multiple business decisions, including the rationalization of content investment (production, acquisition and decommissioning) and better-informed negotiation of advertising deals.

Illustrative weekly TV broadcast schedule at an hourly level. Most of the schedule requires finalization up to 12 months in advance

October 5-11, 2020													
	0600 hrs	0700 hrs	0800 hrs	0900 hrs	1000 hrs	1100 hrs	1200 hrs	1300 hrs	1400 hrs	1500 hrs	1600 hrs	1700 hrs	1800 hrs
Monday	Sound of Music			Promo	Baby's Day Out			Trailer	Taxi Driver			Promo	Promo
Tuesday	Promo	Star Trek			Trailer	Interstellar			The Incredibles			Santa Fe	
Wednesday	Promo	Bruce Almighty			Mission: Impossible – Ghost Protocol				Taxi Driver			Utah Blaine	
Thursday	The Incredibles			Promo	Promo	Bridge of Spies			Trailer	Trailer	Star Trek		
Friday	Trailer	Sound of Music			Trailer	A Christmas Reunion			Promo	Gone with the Wind			
Saturday	Aladdin (2019)			Finding Nemo			The Departed			Trailer	Interstellar		
Sunday	Promo	Finding Nemo			Trailer	Promo	Avengers: Infinity War			Promo	Avengers: Endgame		

The challenge

It's unrealistic to create and scale broadcast schedules in a reliable, cost and time-efficient manner while simultaneously accounting for future fluctuations in market dynamics and evolving viewing habits – whether manually or by using traditional drag-and-drop solutions. A robust scheduling framework is required to take into consideration several complexities:

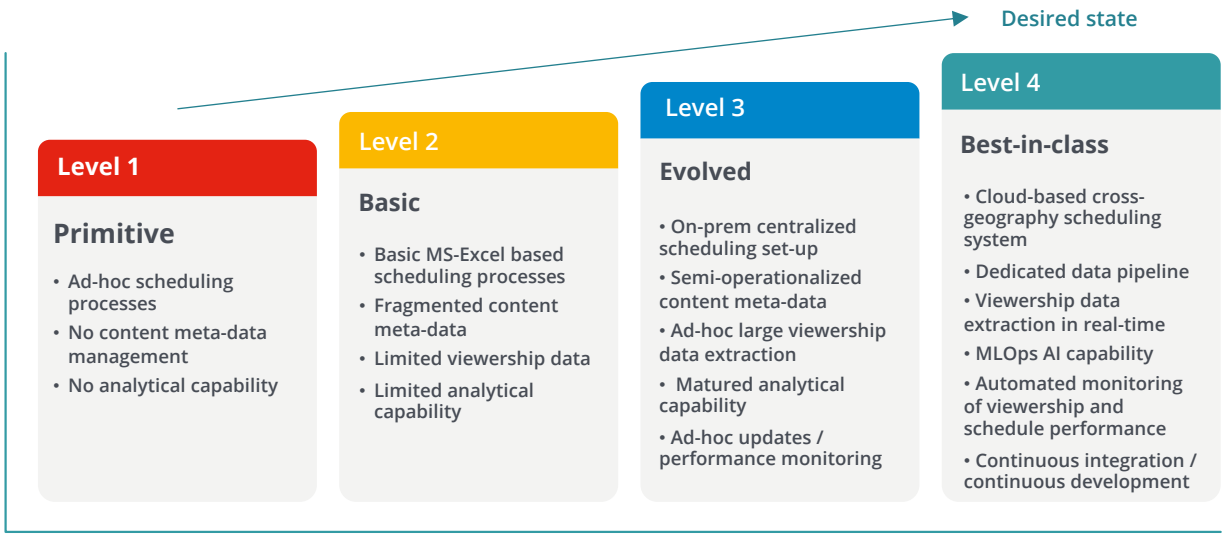
- **Varied consumption patterns:** linear/live, time-shifted, and on-demand (VoD)
- **Mode of consumption:** traditional TV, web streaming
- **Content genre:** TV-series, sports, movies, etc.
- **Scale enormity:** 100+ channels, multiple geographies for broadcast
- **Regulatory constraints:** fixed content, budget restrictions, contract specifications
- **Cannibalization of viewership:** split in viewership due to the presence of competing programs in the same broadcasting group

Driving change through AI

AI and user-centric design, combined with sophisticated cloud platforms have the potential to generate huge efficiency, revenue gains, and cost reductions. With the right methodologies, this trifecta can solve a variety of business problems, ranging from churn management to product recommendations to call-centre analytics.

This whitepaper talks about its application and provides a blueprint for transforming the traditional linear content scheduling processes into a best-in-class automated intelligent planning hub, built on the cloud.

Path of evolution for editorial planning capabilities



The transformative approach

The approach for an editorial planning function is designed through the integration of the following principles:

Artificial intelligence

- **Robustness**: advanced AI algorithms are tuned optimally on past viewing patterns to provide accurate forecasts
- **Adaptive learning:** continuous learning, re-training and iterations across thousands of schedules ensure that the framework is always updated according to the latest shifts in viewing behavior

User-centric design

- **User-centricity:** flexible solutions with customizable options for the end-users to ease transition, consumption and adoption at enterprise-levels
- **Production pipeline:** streamlined and automated deployment, monitoring, management, and governance of models in production ensure continuous integration and delivery

Cloud engineering

- **Data transformations:** cleaning, pre-processing, harmonization, and feature engineering across multiple raw data sources in a serverless fashion gain efficiency and speed
- **Cloud services:** leveraging cloud infrastructure automates, adapts and scales end-to-end workflows across various portfolio types and geographies

End-to-end development and deployment on cloud environment

Integration of enterprise data	Forecast of linear viewership	Optimization of linear schedule	User interface
			
Base schedule + Raw data • Base schedule • Raw data (historical demand/viewership, content metadata)	**Forecaster** • Input data leveraged to generate accurate understanding of viewership trends in future	**Objective and constraints + Efficient optimizer** • Optimizer to build schedule generating maximum viewership based on available titles and rules • Optimization goals adjusted and rules amended	**Schedule planner** • Output schedule reviewed / signed off

Integration of enterprise data with external sources

The fundamental building block is good-quality, operationalized data. The nature and type of datasets can broadly be categorized into two:

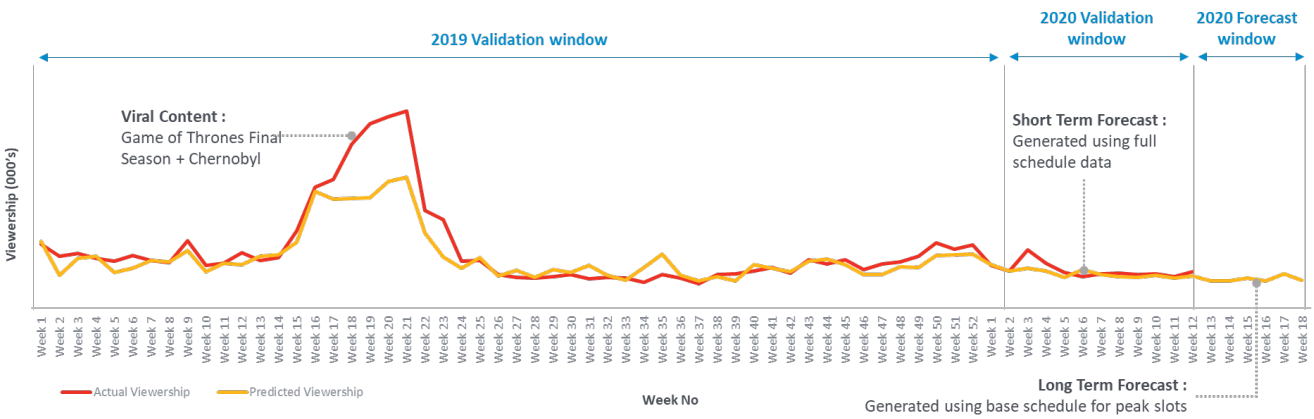
1. The base schedule used by the editorial planning team, including pre-fixed tentpole contents in specific time slots, new content, etc.
2. The raw enterprise data comprising of:
   - Historical viewership: information on the past two or three years of viewing patterns at each time slot for each channel, which allow the modelling and optimization algorithms to train and learn effectively.
   - Content metadata: the characteristics of each program across multiple dimensions, for instance content type (e.g. movies, TV series, etc.), genre, sub-genre, content length, lead actors, production houses, etc., which help identify the key drivers of viewership.
   - External factors: data such as key global events (English Premier League matches, presidential debates, Olympics, season premieres, etc.), macro-economic trends (GDP growth rate, inflation, unemployment, etc.), holiday calendars, COVID lockdown announcements, help to understand and predict sudden shifts in viewing patterns.

Predicting linear viewership

Integrated data can be fed into an AI-based time-series forecaster to predict short, mid and long-term viewership across predefined channels, programs, and time slot levels. To ensure actionability and transparency, the models are designed to incorporate business intelligence and user inputs wherever necessary (e.g., structural change-points, custom seasonality).

This chart illustrates the performance of the forecaster for a single channel compared to actual viewership. The 'human-in-the-loop' design ensures that even the viral content (with ~15x bump in viewership compared to usual programs) gets predicted accurately, with the analysts flagging a new show as potentially viral based on domain knowledge.

Weekly viewership forecast - 2019 and 2020



Optimizing the linear schedule

The schedule optimization layer ingests two levels of information, on top of the forecaster, to deliver a schedule that maximizes the objective function i.e. viewership (it can also be easily customized to account for additional inputs and/or optimize a different objective):

- Predictions generated from the forecaster for all possible options (1 to N) for content and time slots (the viewership matrix)
- Business inputs on editorial constraints and other considerations like costs, broadcasting regulations, etc.

The solution is based on custom-built Mixed-Integer Linear Programming (MILP) algorithms. It can account for multiple factors such as competitors' schedules and non-uniform show lengths to refine the optimized schedule. The resulting output is a finalized schedule which can be passed onto the user interface for consumption.

Illustrative view of the schedule optimizer output

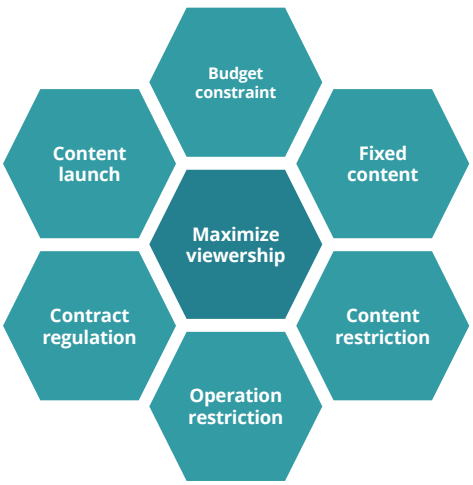
Output from Forecaster

Slots	Content	Predicted viewership
18:00-20:00	Taxi Driver	20
20:00-22:20	Die Hard	32

Slots	Content	Predicted viewership
18:00-20:00	Se7en	37
20:00-22:20	Forrest Gump	25

Viewership matrix
All combinations of content / time slots

Schedule optimization



Objective and constraints

Output from Optimizer

Slots	Content	Predicted viewership
18:00-20:00	Se7en	**40**
20:00-22:20	Die Hard	**35**

The solution helps find the optimal sequence/ordering of contents

Optimized schedule
Maximum viewership feasible subject to the list of constraints

Ease-of-use through automated process

A key consideration in the entire solution construct is its ease-of-use and consumption for both schedulers and business users. A live centralized dashboard, along with an easy-to-understand user interface, allows the end-user to make changes without increasing the workload of analytics/IT teams.

The secure cloud-based automation and MLOps workflow allows broadcasters to run hundreds of iterations and scenarios with varying constraints to generate optimized schedules in real-time without delving into the technical/coding requirements. In addition, the serverless processing of data, modelling, and optimization activities, offered by cloud services enables efficient scale up or down at any time-point without manual interventions. Finally, the end-to-end open-source software-based solution is packaged to ensure quick setup within any organization's tech stack – on-cloud or on-premises to minimize configuration overheads.

The end-to-end solution in action

Base Schedule

Slots	Schedule
18:15-20:00	Taxi Driver
20:00-22:20	Die Hard
22:20-22:30	Break slot
22:30-00:20	Se7en

Viewership forecast and schedule optimization

Slots	Iteration 1	Iteration 2	Iteration n
18:15-20:00	Taxi Driver	Se7en	Se7en
20:00-22:20	Die Hard	Die Hard	Die Hard
22:20-22:30	Movie trailer	Ads	Ads and movie trailers
22:30-00:20	Se7en	Taxi Driver	Taxi Driver

Slots	Iteration 1	Iteration 2	Iteration n
18:15-20:00	17	19	20
20:00-22:20	27	15	27
22:20-22:30	3	1	5
22:30-00:20	13	14	19

User interface

The impact

The framework enables the following insights and efficiencies for the editorial planning function:

Better strategic decisions

Estimated impact:

30% improvement in forecast accuracy, savings equivalent to $10-12M annually on content costs and a 1% decrease in customer churn worth $15-18M annually

Incorporating white-box AI solutions into the framework provides deeper insights into how the viewership trends would change, and what drives those changes. It empowers the content acquisition team to make better and more informed decisions, thereby driving significant revenue and return-on-investment improvements.

Reduction in data to decision time

Estimated impact:

70% reduction in schedule development time and effort leading to $8-10M reduction in annual costs

The automated framework significantly reduces manual efforts, with the total time taken for the analytical aspects of CSC pipeline execution going from months to days. The reduced effort in viewership forecasting also frees up analysts to focus on studying auto-generated patterns and understand drivers, whilst enabling more efficient collaboration.

Reduction in complexity and errors

Estimated impact:

Replacement of legacy systems with a consistent forecasting approach across the board

Highly-manual tasks and laborious processes are prone to human error, which can have business (sub-optimal schedule) and even legal consequences (non-compliance with regulations). With the automated pipeline, errors are reduced significantly while also reducing time, effort, and costs spent to avoid such errors.

The foundation for CSC transformation

These benefits are only some of the tangible outcomes. With scalability being one of the core ideas driving the framework, it lays the foundations for a radical transformation in the CSC pipeline.

An identical solution design can help drive similar business decisions for time-shifted and on-demand consumption. The customizable AI-driven framework, combined with automated workflows, makes the extension easy without any loss of efficiency, while social media, marketing spends and customer viewing data can widen the scope for greater accuracy and insights.

It's easy to foresee a future where every human decision within the CSC is powered by real-time insights generated by an integrated AI system – much like the current industry standard for physical supply chains and other areas like customer analytics within M&E.

Not only can AI improve the quality of decision making throughout the chain, it can also help break down the silos that currently exist between disparate functions and teams.

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