



Now

Dream Small

Life as an Album

Thoughts from Work

Links

Thoughts from Work / Tuning the Supply and Demand in RPM Ads Serving Model

#ProductInsights #Ads #DataScience #StatisticalModeling

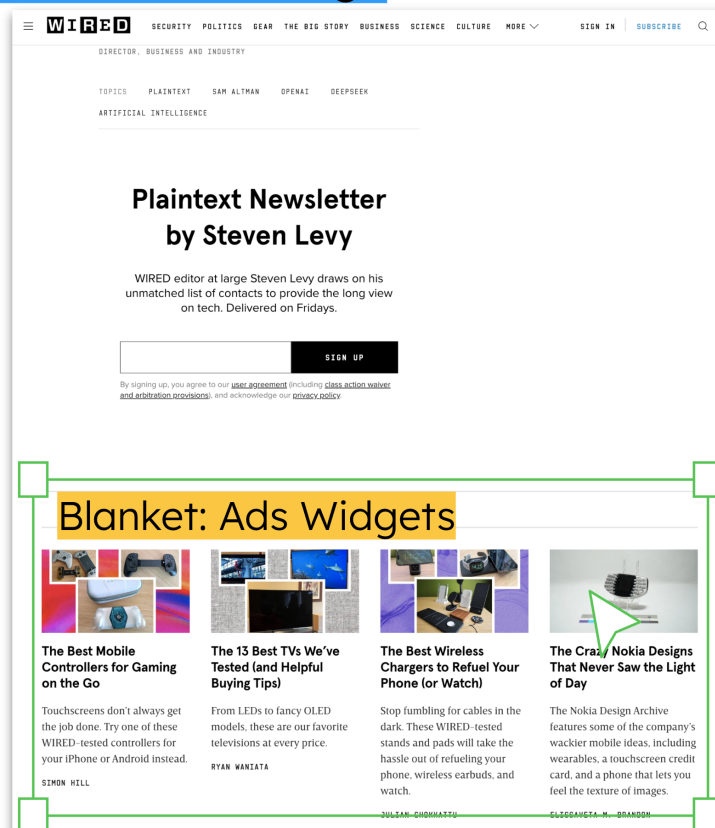
Ads Mediation Platform in a Nutshell

An **ads mediation platform** like **Outbrain** or **Taboola** acts as a **marketplace that connects publishers (websites) and advertisers** through a supply-and-demand model.

- **Publishers (Demand Side):** These are websites that **want to maximize revenue** by displaying ads. They integrate **native ad widgets** (those “You May Also Like” sections) to monetize their content. Think of the **publisher's website as the bed**—it’s the foundation where everything happens.
- **Advertisers (Supply Side):** They are **spending money on campaigns** to drive **brand awareness, impressions, clicks, and ultimately, purchases**. They place their ads on these publisher sites, using a bidding system to get the best placements. The **ads are like the blanket**—they cover the bed, making it more appealing and valuable.

Because from mediation layer perspective, it is the Advertiser side supply the ads NOT content, or NOT exactly contents. Because audience goes to publisher's website for content NOT ads

Bed: Publisher Page



How It Works (Supply & Demand)

1. **Demand:** Publishers offer real estate (ad space) on their sites.
2. **Supply:** Advertisers bid for these spots, aiming to **attract users** and drive conversions.
3. **Mediation & Optimization:** Platforms like Outbrain/Taboola use algorithms to decide which ads to show, maximizing **revenue for publishers** and **ROI for**

advertisers.

In essence, this model works because publishers need revenue, and advertisers need customers— ads mediation platform needs balance the perfect balance of supply and demand. Because they get mainly get paid Advertiser's budget spending on campaigns (although, it will do rev-share with publishers as well), but we are talking about the source of income.

Core Formula

$$RPM = CPC * CTR$$

- **RPM:** revenue per mille (1000 impressions)
- **CPC:** cost per click

This is the major parameter advertiser could set and “fine tune” to have their campaign to compete for ads spaces.

- **CTR:** click thru rate

This is determined by the ads format, actual content and audience.

Bed & Blanket Model

The **Bed & Blanket model** helps optimize ad placement by analyzing **publisher inventory (the "Bed")** and **advertiser demand (the "Blanket")** across different content categories. It ensures that the network can absorb **more and better ad campaigns** while maximizing revenue for both publishers and advertisers.

- **Bed (Publisher Inventory):** Represents available ad impressions across different content categories.
- **Blanket (Advertiser Demand):** Measures the total potential impressions advertisers can generate for a category.
- The system identifies gaps where either **more ads (Blanket)** or **more publisher content (Bed)** is needed to balance supply and demand.

Actionable Insights: Blanket & Bed Strategies

For Amplify sales representatives and account managers. It provides optimal spend and CPC suggestions for each category, along with examples of top-performing articles and marketers in those areas. This empowers sales teams to target the most promising opportunities.

For Publisher sales representatives, focusing on optimizing existing publisher inventory. It highlights potential revenue and RPM growth achievable by driving more page views to specific content categories. The tab also showcases top-performing publishers in each category, enabling sales teams to collaborate with them and unlock further potential.

A little bit on Recommendation Engine

A good recommendation engine takes the RPM as the core rank factor, why? Because by doing so, we let CTR i.e. audience give the feedback whether content is good or not? Whether they click or not. On the other hand, it still allows Advertiser to toggle CPC i.e. their spending to signal whether they want a better ads space or more exposure or not?

By maximizing revenue in a long run, Ads mediation should dance beautifully with both Publisher and Advertisers, to reward good content improve the CTR and optimize toward an ideal CPC!

A Calculator for Advertisers to get an optimal CPC

Internally, we build a small tools to help Advertiser to fly their campaign in following two scenarios:

- Prospect: i.e. brand new campaign, with no history of their ads performance, they want know what initial CPC (CPC_initial) to start
- Existing: i.e. a campaign has been flying for a little while, they need look at their performance to tweak the CPC

Some advertisers especially with huge budget, sometimes will set extremely high CPC to offset the poor CTR to get high RPM, but that not necessarily work every time, because this might push your ads to wrong audience segments, then people still don't click, which leads lower CTR. And as mediation layer, we don't want them to do this either, because expose audience with wrong content hurts publisher and will hurt us.

AMPLIFY

CPC Calculator
[About CPC Calculator](#)
[Need help?](#)
[Feedback](#)

Existing CPA Goal

Existing Spend Goal

Prospect CPA Goal

Prospect Spend Goal

Input Campaign ID ?

Campaign ID

12454

No. of days of actual performance ?

10

days

Cost Per Acquisition Goal ?

\$

70

USD

Submit

CPC Recommendation

\$6.168(6.168 in USD)

w/ Ref. Exchange Rate: 1.000

Ref. CPC Range:

for CPA: **\$6.112 - \$10.416**

for RPM: **\$1.101 - \$1.135**

Performance Snapshot:

lal-day-heel_day-heel_instyle_retail

Curr. CVR: 8.224%

Curr. CPC: 0.900(USD)

by Everlane(Brand)

It is from **US** running in **Whitelisted Network** being served as **Entertainment/Fashion** w/ Avg. daily budget **3000.000(USD)**

□: dummie data.

\$CPC Calculator - \$CPA Taget Mododule

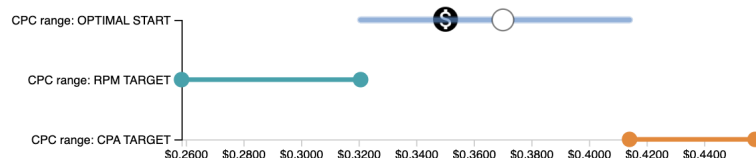
\$CPC Calculator - \$CPA Taget Module ^{Beta}

Introduction

This CPC Calculator is designed and built for Campaign manager to fine-tune CPC for existing Campaigns to hit CPA Target. Optimal CPC range is calculated by campaigns' historical performance.

NOTE: Rec'ed CPC range is calculated to hit CPA target by not losing current RPM/Serving. Click thru rate and conversion rate need to be carefully monitorred for further CPC tuning. And no significant content chagne happened.

- **Optimal Start Range:** The sweet CPC range of hitting CPA target and not losing RPM serving.
- **RPM Target CPC Range:** CPC range of not losing RPM serving.
- **CPA Target CPC Range:** CPC range of hitting CPA target.



Quick FactSheet: BPS Whitelist(1000561442)

Date Range: 2017-08-25 - 2017-09-07

It is under US buyer - Primal Health(20203), with daily budget: 15000 (Average Budget Usage rate: 36.2344%, Budget Pacing Type: SPEND_ASAP) and current CPC: \$0.345 , and running in WHITELISTED_NETWORK and being served as Health > Heart Disease .

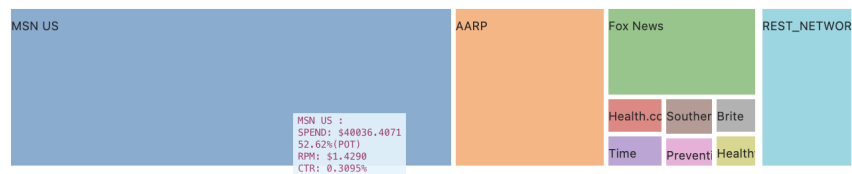
CPC Fine-Tune Instruction on hitting CPA Target \$80.0000

- CPA Target CPC Range: \$0.4141 - \$0.4577
- RPM Target CPC Range: \$0.2585 - \$0.3207
- Optimal CPC Range: \$0.4141 - \$0.3207

With Optimal CPC setting: \$0.3701

by not losing current serving RPM around: \$1.2329 %CTR to monitor: 0.3331% %CVR to monitor: 0.4627%

Spend Distribution among Major Publishers/WhitelistGroup



The Treemap shows your campaign spend among top publishers(whitelist groups)

Spend Highlight:

- TOP 1: 40.04K spent on MSN US (52.62%) of Total
 - TOP 2: 13.77K spent on AARP (18.09%) of Total
 - TOP 3: 7.65K spent on Fox News (10.06%) of Total
- and 8.64K spent on REST_NETWORK_PUBLISHERS (11.35%) of Total

Existing Scenario

1. **Spend Target** – Ensuring a specific budget is spent efficiently over a set duration.
2. **CPA Goal (Cost Per Acquisition)** – Ensuring each conversion (purchase, sign-up, etc.) remains within a target cost.

1. CPC Calculation for Spend Goal

The script determines how much CPC should be adjusted to meet a given **spending target** over a specific time period:

- It analyzes past campaign performance (CTR, conversions, CPC) over **7-21 days**.
- It calculates the **daily spend target** based on pacing settings (e.g., **spend ASAP vs. automatic adjustment**).
- Uses **percentiles of past CTR (Click-Through Rate)** to estimate a range of possible CPC values.
- Adjusts CPC further based on **competitive RPM (Revenue Per Thousand Impressions)** to ensure the advertiser is bidding optimally against competitors.
- The **final CPC range** is set to maximize budget usage without drastically increasing cost.

2. CPC Calculation for CPA Goal

If the advertiser's main goal is a **target Cost Per Acquisition (CPA)**, the script determines the optimal CPC that balances cost efficiency while still driving enough conversions:

- It retrieves past **Conversion Rate (CVR)** and estimates future performance using percentiles (55th & 85th).
- It derives an initial CPC based on **CPA = CPC ÷ CVR**.
- Adjusts the CPC range using **RPM constraints**, ensuring it aligns with revenue expectations.
- The final **optimal CPC range** is the intersection of CPA and RPM-driven values, ensuring the advertiser stays profitable while scaling.

Prospect Scenario

1. CPC Calculation for CPA Goal

When the advertiser wants to **achieve a specific Cost Per Action (CPA)**, the model:

- **Sets a baseline CPA** within a reasonable range (e.g., \$1 to \$500).
- **Retrieves past conversion performance** by country, advertiser type, and content category.
- **Adjusts conversion rate (CVR) discounts** based on device type (desktop, mobile, tablet).
- **Uses machine learning models (pre-trained predictors)** to estimate the ideal CPC for desktop traffic.
- **Applies device-specific adjustments** for tablet and mobile CPCs based on CVR differences.
- Converts CPC values into **local currency using exchange rates** to match regional markets.

Final Output: A CPC recommendation for desktop, tablet, and mobile that ensures the CPA remains within the desired range.

2. CPC Calculation for Spend Target

If the advertiser's goal is to **spend a specific budget over a set period**, the model:

- **Ensures the spend target is valid** (minimum \$10, default \$100).
- **Distributes the budget over the campaign duration** to determine a **daily spend target**.
- **Retrieves past campaign data** (CTR, conversion rates, competitive CPCs) based on country and category.
- **Applies CTR discounts** by platform (desktop, mobile, tablet) to adjust expected engagement.
- **Uses machine learning models** to estimate an **initial CPC** that meets the daily spend goal.
- **Checks against competitive RPM (Revenue Per 1000 Impressions) benchmarks**, ensuring CPC is competitive but not excessive.
- **Applies pacing adjustments** based on **spending urgency** (e.g., spend ASAP vs. automatic pacing).

Final Output: A CPC recommendation that ensures the budget is spent efficiently while maintaining performance.

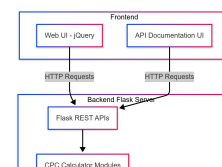
Some words on Actual Implementation

Like the screenshot above, the overall architecture application of CPC calculator goes like this:

After Advertiser set up initial parameters under each scenario → API call will pull relevant datasets → for `Bed_Blanet.py` to conduct the calculation (basical math + regression model)* → Output optimal values of CPC

*In real life, we need monitoring campaigns with CPC value output from our suggestion and tune our math + regression model, as well as when Rec Algo each time have major change.

An Architecture Diagram Attached here





If you ask me to redo this application now, I might still use python to set up flask RESTful API and backend pipeline and modeling but with next.js front-end

Final Thoughts

People sometimes will ask, since you can calculate, why not just auto-pilot for advertisers right? We thought about it, one our calculation wasn't that smart! And we trust advertisers who understand their content best and it is their budgets, they should have the control on how to spent their money. Second, if this becomes an automatic algo in a massive scale, basically, we are have two algos (Rec Algo and CPC Algo) competing each other, which we found difficulties to test this idea with meaningful size of samples and right metrology till the time this blog is being written.

But, I think overall, this Bed and Blanket way of looking at what's role of an ads mediation platform is interesting and meaningful!

LICENSE: [CC BY-SA 4.0](#)

[Previous](#)

[Next](#)

2018-12-31

Seeing Tomorrow Too Soon: My Earl...

1st April 2025

Vector Search in BigQuery - Test Drive

Klyn | © 2022-2025

[Tags](#) [Archive](#) [RSS feed](#) [Twitter](#) [Instagram](#) [GitHub](#) [Youtube](#) [Email](#) [QR Code](#)

Made with [Montaigne](#) and [bigmission](#) 