Data Sharing for Attribution in the Age of MTA, GDPR and Walled Gardens

What Marketers Need to Know About Consumer Data Sharing Restrictions, and Effective Workarounds for MTA Analytics

APRIL 2019

TABLE OF CONTENTS

Data sharing, and more specifically, the ability to link ad serving and content viewing with conversions at a user level, is the heart of Multi-Touch Attribution (MTA), and a necessary factor to a successful deployment. However, a few obstacles stand in the way of data sharing.

Some media companies, for example, restrict unfettered access to data and inhibit marketers from linking all ad serving and/or conversion data to user profiles and to events that occur in the open web or in another restricted area. These practices are known as "Walled Gardens" practices that can compromise the completeness and accuracy of MTA modeling. Another obstacle is GDPR (General Data Protection Regulation), which went into effect in the EU last year but is causing changes in practices globally as well. The GDPR increased concerns among companies about data privacy and caused companies to significantly tighten rules for sharing ad serving along with matchable user IDs.

These obstacles pose a real threat to MTA modeling, since – when it is employed – its upside is thought to be as high as a 30% improvement in marketing ROI, as marketers who use MTA report a 9% average improvement in ROI on the 34% of marketing funds that marketers report as the average scope of their MTA modeling (Mobile Marketing Association marketer surveys, Bakopoulos, 2016-2018).

The purpose of this paper then is two-fold. It first gives an overview of the data restricting factors, such as Walled Gardens and GDPR … generally and specifically for major publishers … and their effect on MTA analytics. It then provides four workaround strategies marketers can consider when implementing MTA in a data sharing restricted environment continually striving to expand ad serving data coverage, look for analytic methods that can accommodate truth coming from multiple types of analysis, and align expectations to what is realistic given data availability.

Marketers should not retreat to a simplified world of analytics done from aggregated data; they need to use MTA and constantly search for ways of expanding their access to data that makes the models as strong as possible while accepting that user-level data will not be 100% comprehensive.

This document guides marketers to:
1. Broaden data access (offered by some MTA providers, by selected ad servers, and possibly through different working approaches with major publishers)
2. More comprehensive analytics (offered by some MTA providers)
3. Align expectations by understanding that expectations and capabilities based on available data are a problem that is somewhat iterative. The marketer can realistically drive for fulfilling higher expectations by constantly searching for new ways of expanding the user-level data available.

Background

Marketers are under increasing pressure to justify their media investments with hard evidence. One of the most important approaches for optimizing marketing investment is MTA.

As defined in the MMA's **MTA Decision Guide**[1],published in 2016:

> Multi-Touch Attribution (MTA) is "the science of using advanced analytics on user-level data to allocate proportional credit across a granular list of marketing touchpoints across many, and hopefully all, online and offline channels, leading to a desired customer outcome. (Methods might be augmented with aggregated data.)"

Providers of MTA solutions claim there is significant benefit from applying it. For example, Visual IQ says its clients can see 15-35% improvement in marketing ROI. Others, such as **Marketing Evolution**[2], make similar claims. In addition to the MMA marketer surveys documenting an average increase of 9%, there would be an estimated 30% prorated improvement if all marketing funds could be optimized. Other evidence demonstrates that MTA leads to bidding rules that generate much better effective cost per acquisition (eCPAs) vs. last touch attribution methods (Geyik, Saxena, and Dasdan, 2015). The MMA's groundbreaking series of **SMoX**[3] (Cross Marketing) case studies, which involved companies such as Allstate Insurance, AT&T, Mastercard, The Coca-Cola Company, Unilever, Walmart and a major U.S. fast-food chain, examined mobile's role in the MTA world, and also showed that a 10-20% upside in sales could be attributed to a campaign as a result of optimization.

However, the successful application of MTA methods requires that a marketer has put an effective user-level data strategy into place that enables MTA analysis -- by linking many types of ad exposures to conversion outcomes. The more types of media tactics that can be linked at a user level, the more comprehensive the model and the greater its potential impact.

What Is a Walled Garden?

In practice, the scope of MTA is limited because numerous media companies have complete or partial restrictions on making user-level ad serving data available, which results in incomplete modeling. When publishers decide not to provide access to user level data, it is commonly referred to as a "Walled Garden practice." Please see the **grid**[4] we have prepared that shows data sharing policies for a number of major media companies.

The decision to become a Walled Garden – therefore preventing the free flow of user-level data that is often characteristic of the open web (Burri and Schär, 2016) -- is driven by the desire to protect competitive advantages, commercial value, and user privacy (now intensified by the implementation of GDPR -- and sometimes by professed technical limitations). Publishers say, "It comes down to the governance challenge that we face when seeking to protect privacy in the digital age" (Erdos, 2016; Gasser, 2015).

[1] https://www.mmaglobal.com/documents/multi-touch-attribution-decision-guide
[2] https://www.marketingevolution.com
[3] https://www.mmaglobal.com/smox
[4] https://www.mmaglobal.com/publisher-data-sharing-practices

By working together with marketers via the MMA's Marketing Attribution Think Tank (MATT) initiative, and supported by published reports (Baker, 2018; De Poulpiquet, 2017; Kamdar, 2015; O'Reilly, 2018) it is possible to document the main challenges that Walled Gardens present.

It is critical for marketers to be knowledgeable about practical solutions for today's reality.

Though we've described what a Walled Garden practice is in broad strokes, advertisers use the term to refer to any or all of the following, that result in restricting MTA analytics:

1. When marketers cannot link user-level ad serving events that occur within the publisher's properties or ad networks. Even when the ads are served to users who are part of segments that are provided by the marketer, the user-level events are not passed back to the marketer.

2. When those with purchase data do not provide user-level sales results back to marketers, preventing a preferred approach for determining the outcome of marketing actions.

3. When marketers must accept the publisher's campaign effectiveness calculations, or, revert to Marketing Mix Modeling (MMM) approaches which are based on aggregated numbers for ad impressions. Many marketers don't find these desirable.

4. When marketers are not completely free to choose the MTA or MMM provider they prefer, as some publishers favor preferred relationships with certain MTA providers that give them deeper access to ad serving data.

Other notable limitations:
1. When a marketer cannot use its chosen ad server and must use the publisher's ad server instead. This presents additional challenges:
   a) When the Walled Gardens control the platform as a whole, they control the data.
   b) The platform a Walled Garden chooses means the marketer needs to split its media across multiple platforms and makes pulling a holistic view very difficult, adding to the complexity of managing media in general. This also means a marketer cannot properly calculate campaign reach and frequency across both Walled Gardens and the open web for the same users.

2. When a marketer cannot access that publisher's inventory via programmatic bidding outside of the publisher's environment.

3. When a marketer wishes to use third-party profiling data, but is not permitted by some publishers to use it as the basis for targeting within Walled Gardens' environments. This trend has increased since the implementation of GDPR.

The amount of inventory within the Walled Gardens is extremely significant. In fact, most major publishers (Google, Facebook, Amazon, Twitter, Snapchat, etc.) have some form of Walled Gardens practice, and they account for well over 60% of digital display advertising (see **grid**[5]).

---

[5] https://www.mmaglobal.com/publisher-data-sharing-practices

Why Linkability Is Important

Contemporary marketing calls for an integrated view of the consumer that can help marketers track the consumer journey, and allow them to manage ad exposures across any device a consumer happens to be using. The rise of MTA is about developing a single view of the messages a consumer has been exposed to, and properly assigning credit to individual platforms and messaging that lead to those conversions.

"Linkability" is the term MATT uses for the ability to connect ad serving to user-level journey data. Walled Gardens specifically limit linkability.

Based on input from MMA members, getting the full picture and being able to receive all data throughout the consumer's journey are universally significant issues. These are examples of what a few of them said:

> "Not being able to get data is the biggest problem we struggle with."

> "We need completeness for MTA to work properly. Because tags cannot be used in Walled Gardens, it restricts MTA's usefulness."

> "We marketers need reach and frequency calculations across devices and publishers."

> "We need the ability to map and market to the customer journey. Marketers want to be able to put together all the activities and events for a consumer."

Lack of Linkability Creates Important limitations on MTA:

It limits completeness. MTA requires user-level analysis, which means ad serving events and conversions need to be integrated for the same user in order to get the right answers. When ad serving from a particular environment cannot be included in MTA, the ability to determine the effectiveness of ad serving in that environment cannot be analyzed on an apple-to-apples basis with other ad serving that CAN be linked.

It limits accuracy. Lack of linkability also compromises the accuracy of the MTA analytics that can be done. To illustrate the problem, marketers need to find out the answer to questions concerning where and how frequently a user who converted was exposed to messaging by that marketer – is it true that the user who had six ad exposures on the open web also saw ads within environments on desktop and/or mobile that were not linkable? Almost certainly, but this information cannot be integrated into the dataset. Therefore, more credit is given to trackable marketing events than they deserve, creating an inaccuracy in the contribution of one media method versus another.

An experiment by C3Metrics, a prominent MTA provider, illustrates the point. As reported in *Ad Age* (Neff, 2018), an MTA analysis conducted with a highly restricted ad serving data set wildly inflated the return on ad spending associated with the linkable touchpoints.

Clean Rooms

Several Walled Gardens – including Google and Facebook (Moked, 2018; Schiff, 2017) -- have created their own "clean rooms," to help ameliorate the concerns of marketers who want to link at least some Walled Garden data with other data. Other publishers are in the process of creating them. An "ads hub" is a related term that refers to the larger purpose of a clean room -- which is to integrate data from the publisher and marketer via clean room procedures, to produce more complete media effectiveness analysis. Google's Ads Data Hub is one example (Marvin, 2017).

In our discussions with marketers as part of MATT, we have found that marketers view clean rooms with a mix of optimism and caution. The potential benefit is the ability to connect ad serving data to a marketer's data assets, which can be done if the marketer governs the merge behind the publisher's Walled Garden in a clean room. In fact, data can be linkable that were not made available for linking otherwise (e.g. in app data).

However, there are some drawbacks. The marketer's MTA provider might not be approved for accessing such data. Another disadvantage is that data from one publisher cannot be combined with data from another publisher creating separate analyses that have to somehow be integrated. Furthermore, some marketers will not be comfortable with clean room procedures and providing their first-party data due to their own privacy and competitive concerns.

> **What is a Clean Room?**
> Data clean rooms allow large inventory partners ... to share customer information with brands, [in ways] that are completely secure from external access. Each company can decide on the level of visibility to their data... [which] eliminates the possibility of data leakage..." (Moked, 2018)

While the development of clean rooms is promising, marketers will still have to run in multiple environments and bring their data into each separately, so they won't be able to run all their data using one model. Evaluating the degree to which each channel contributes to marketing success, and the ways in which channels influence one another, will still remain challenging, as will being able to generalize insights on channel effectiveness in multichannel settings (Anderi, Becker, Von Wangenheim, and Schumann, 2016).

The Implications of GDPR

As was referenced earlier, on May 25, 2018, the EU enacted GDPR (for a legal and technical description from the EU see footnote[6]), which led to even less access to user-level ad serving information. Bloomberg Businessweek (Westgard, 2018), described GDPR as "tougher rules for how data collectors gather and use [EU] citizens' information and let consumers control their own data." The biggest immediate implication for MTA was Google's announcement that because of GDPR it planned to stop sharing DoubleClick IDs as part of logfiles (It has not happened as of this writing, but will begin at some point in the future, still to be announced). Since DoubleClick[7] Ad Manager is estimated to have the lion's share of ad server traffic, this was clearly a blow to the MTA sector of analytics.

In June 2018, *The Wall Street Journal* discussed GDPR's ramifications: "Many marketers don't collect customer data themselves, so they use the information from other vendors, to help them target ads. Now they must make sure those vendors are in compliance with GDPR standards." Hence, marketers' analytic teams need to engage with this issue.

[6] https://www.eugdpr.org/the-regulation.html
[7] The DoubleClick brand name is being sunsetted.

Exhibit 1 Shows a decision tree for the MTA strategy response options to Walled Gardens and the new limitations on sharing user IDs due to GDPR.

MTA Strategy Response Options

		Pros	Cons
YES	Choose MTA provider who is approved to operate in clean room	Access to richer user level data on more media tactics	You might not be comfortable with placing your data in publisher environment; You will have to assemble an analysis across multiple clean rooms
	Use publisher's analytics	Efficient	Grading own homework
NO	Use MTA provider with tagging infrastructure	Maintain control of your data; Greater MTA flexibilty	Less user level coverage of media tactics; Chance for discrepancies between ad impression counts between tags and ad servers.

Are you willing to put your data in clean rooms?

How Can Marketers Respond?

There are four response strategies -- which are not mutually exclusive -- for implementing MTA despite Walled Garden practices:

1. Go all-in with one of the publishers offering a clean room approach. This might include using the attribution method offered by that publisher or using an independent MTA provider who is approved to move their modeling code inside of the clean room and ad hub environment.
2. Switch ad servers to one that does not restrict IDs.
3. Use an MTA provider which can leverage an approved tagging system.
4. Create an 'uber-model,' combining the characteristics of MMM and MTA (and possibly A/B testing).

No one strategy completely compensates for not having a perfect world where all data are linkable, but marketers can also combine some of the above strategies to get the most complete results possible. Below is more detail on each:

1. **Go all-in with one of the publishers offering a clean room approach.**
   How does this work?
   Google, Facebook and (and other major publishers and ad tech companies, from confidential conversations) are among the publishers creating clean rooms so that marketers can bring their data into a protected environment, merge it with publisher data from within the Walled Garden, and then perform MTA analytics inside it. Findings (but not the raw publisher ad serving data) can then be extracted.

   Pros
   Inside the clean room, a marketer's modeling will now include user-level ad serving data, such as in-app data, that in all probability it did not have access to previously.

   Marketers with smaller digital budgets -- and less support for digital optimization -- might find this option attractive since it allows them to get close to one particular publisher and is the easiest approach to execute.

   Cons
   Numerous marketers express their own privacy concerns about giving up control of their data by sending it into a clean room. Also, marketers are concerned about the publisher "grading its own homework." Also, it is likely to be a slow process for MTA providers to move their code inside of clean rooms. The result is that a marketer's choice of MTA approaches will be severely restricted in practice.

   > As one marketer in the MATT discussion group put it, "As a marketer, and for the integrity of the industry, I believe it's best to have neutral third-party vendors assign credit for attribution and this will be a stumbling block for Google or Facebook to gain traction from major advertisers."

   As was stated earlier, another issue is that data from one Walled Garden cannot be included inside the clean room of another Walled Garden so the marketer would have to take the results from each environment and somehow integrate them via an "uber-model."

2. **Switch ad servers to one that does not restrict IDs.**
   How does this work?
   A number of alternatives ad servers, such as Sizmek, Thunder, and Flashtalking, just to name a few, continue to allow access to Unifying IDs via cookies and digital fingerprints. These are all smaller in market share than DoubleClick Campaign Manager (DCM) but are worth noting.

   Pros
   Using an independent ad server that gives access to IDs allows marketers to link ad serving outside of walled gardens who mandate their own servers be used, and conversions.

   Cons
   Switching ad servers is a major commitment affecting the whole tech stack the marketer has created, which can cause disruption to marketers' and media agencies' operational processes.

3. **Use an MTA provider which can leverage an approved tagging system.**
   How does this work?
   As of March 2019, Google has approved the tagging system of one MTA provider -- C3 Metrics -- giving it its own direct way to access to Doubleclick IDs once Google stops sharing them generally.

   In addition, there is a small group of vendors certified for measurement of YouTube .

   It is also possible that certain third-party tags will continue to be allowed that some MTA providers have focused on as alternative strategies.

   Pros
   Tagging allows ads to be linked to a Unifying ID if the ad is served into an environment that allows tags other than its own. It avoids a marketer having to release its data to a clean room to conduct MTA analytics.

   Cons
   Certain important ad serving instances still cannot be tagged, such as types of ads within Walled Gardens, and tags or ads are not allowed within mobile apps. Furthermore, tags don't always provide ad serving counts that match ad servers, so their use requires caution.

4. **Create an "uber-model," combining the characteristics of MMM and fractional attribution.**
   How does this work?
   In a perfect world, marketers would have one analytic approach that would give them all their answers about the relative effectiveness of media tactics; a single source of truth, so to speak. However, this is typically not possible since marketers pull answers from a number of different models, including MMM, MTA and A/B tests. The challenge becomes how to integrate findings from disparate sources into a cohesive view of what works.

There are a number of approaches for creating an "uber-model" that all have their strengths and weaknesses.

a. Integrated modeling.

How does this work?

The easiest form of modeled integration is to take the channel-level effectiveness results from MMM (top-down) and use MTA (bottom up) for more granular looks inside each digital channel wherever data can be linked. There are advanced methods to incorporate aggregate level variables in user-level modeling. In this approach, Walled Gardens ad serving could be represented as aggregated data variables for user level-modeling.

Pros

Integrated modeling is a trend we see in the marketplace, as noted in the [MATT MTA](#)[8] landscape published in 2016, and it allows for the most complete set of answers. It also integrates MTA results in a way that ties back to MMM, which is many marketers' anchor for media planning. Some analytics providers, notably Neustar/MarketShare and Analytic Partners, have models that operate at both levels so they achieve this integration for the client.

Additionally, a fully integrated model is an attractive feature because it is the only way to provide a single source of truth; it is unlikely MTA will ever have access to user-level data from all publishers and touchpoints.

Cons

Using top-down modeling might be a workaround but it is not preferred. According to MMA surveys, many marketers have less confidence that modeling off of aggregated data gives the right answer on digital marketing, so it calls into question how the more granular results from MTA are scaled to fit into the uber model. Also, the method by which MMM and MTA results are integrated will have assumptions that the marketer should question. For example, aggregate numbers for traditional media put into user models represent potential input error as the exposure levels for a given user become more assumed than measured.

b. Elasticity databank.

How does this work?

Another approach is based on collecting the results of different tests and putting them in one knowledge base. This is basically linear, as the marketer simply keeps a record of the relative effectiveness ("elasticities") of each tactic. This allows a marketer to put together results from MMM, MTA, A/B testing and so forth. If a marketer is using the elasticity databank approach, it must make sure each method is translated into a common productivity metric. We see Return on Ad Spend (ROAS) as a good choice, which is calculated as absolute incremental sales divided by absolute incremental media spending.

Pros

This is simple to understand and, therefore, simple to drive through the organization. It also makes sense to house knowledge, so regardless of other solutions, this should be done.

---

[8] https://www.mmaglobal.com/documents/multi-touch-attribution-assessment-and-landscape-report-2016

Cons

Achieving completeness might be laborious, as it implies running many analyses and tests. Secondly, it cannot really be used for optimization, since frequency response and saturation curves, which measure the diminishing effect of each additional increment of advertising, are unlikely to be estimated for each media tactic. This creates a bias in comparing results across tactics. Also, in terms of biases, it is likely that the sum of individual results will not equal the total contribution of running these tactics simultaneously. In sum, while this solution is practical, it has biases and substantial costs associated with it.

c. Simulation Systems.

How does this work?

Stock and flow models and agent-based modeling (ABM) allow results from different sources to be integrated into one system. The truth of each finding is assessed by the model's accuracy at simulating sales or conversion outcomes. Stock and flow models operate at an aggregated level while ABM operates at a user level. Stock and flow models are intriguing as they model processes such as a stock of considerers, flowing into a stock of shopping inquiries into a stock of converters. ABM can do this as well but also easily accommodate heterogeneity of consumers because the agents or "Sims" do not have to be given the same rules and preferences, which reflects real-life heterogeneity.

Pros

Simulation systems are comprehensive and allow for integrating learning into one system. Regardless of where each individual relationship comes from, the truth of the model is assessed by seeing if a simulation produces results that conform to marketplace campaign results.

Cons

Both modeling approaches are complicated and there aren't many providers who offer them. They also require a lot of tinkering as marketers are continually tempted to tweak the models to get the most accurate predictive fit possible to actual outcomes.

The Bottom Line for Creating Uber Models.

The first priority of marketer analytic leads is to access as much ad-serving information as possible.

However, that alone is not enough. They will also need an integration strategy to combine results across Walled Gardens and traditional media into one system that is cohesive, understandable, testable and usable. None are perfect, but the problem cannot be avoided.

The MMA's discussions with marketer members highlighted some other important concerns regarding Walled Gardens. They are discussed below:

Verification

Marketers need to verify ad serving to feel comfortable that they are maximizing their investments. Below are five verification methods:

 a) The ad impression was served (load took place).
 b) The ad was viewable for sufficient time.
 c) The ad met brand safety standards.
 d) The ad was served to the desired segment.
 e) The ad impression was not fraudulent, e.g. served to a bot.

In the open web, the marketer's agency is able to contract with vendors to obtain third-party verification, insights, viewability, brand safety -- and protect against fraud. Not all of the providers are approved to operate within every Walled Garden. Even when they are, the marketer cannot get this data broken out by segment (and certainly not by user). So, for example, a marketer that uses Moat viewability tags in Facebook might know the percent of ads that met viewability standards but would not have this separately for a key targeted segment. Also, according to marketer feedback, verification reporting comes via the Walled Gardens themselves, though some marketers feel that verification reporting should come from an independent source, in order to provide a higher level of assurance.

Standardization

Dashboards from different social environments all look different. There are different measures and ways of calculating these measures. This lack of standardization makes it hard to combine results from ad serving and earned media, which are very different environments.

In a search for standardization, Marketers advise us that there are two types of metrics:

 1. Media delivery reporting, which is reach, frequency, (viewable) impressions delivered, and time spent with the ad.
 2. Effectiveness reporting, which is number of conversions, clickthrough rates, and modeled assessment of media effectiveness.

Marketers may consider creating their own internal dashboards that translate information from different environments into a common framework.

Access to Other Useful Data

Walled Gardens generate data that can have value to marketers but that providers choose not to share. For example, search impression data would be valuable -- e.g. how many times did my brand show up in search results? -- but such data are not made readily available to marketers. Social media platforms do not share impression data such as organic comments about a brand seen by followers except under special arrangements like social ratings for TV shows. Walled Gardens also have data on lost bids -- where the bid is not high enough -- that would be useful to marketers in sharpening their bidding algorithms.

The marketer reality is that Walled Garden practices will limit marketers' ability to access user-level data needed for optimal MTA analytics. Currently, marketers who use MTA report to the MMA that they only cover about 34% of ad spending (due to Walled Gardens and traditional media that is not user based such as linear TV). The benefits of MTA should be directly proportional to expanding that percentage which is becoming harder due to additional restrictions on sharing of user-level data. In addition, marketers get frustrated as limitations in data sharing are often not made clear ahead of time as MTA is being on-boarded which leads to false expectations and lower satisfaction.

With new restrictions on user-level data sharing, marketers are faced with a dilemma. How to continue to use media they believe are effective but where ad placement with such media might not be analyzed in the most desired way … user-level analytics using MTA, delivered in time for in-campaign pivoting in order to maximize marketing ROI.

Marketers should not retreat to a simplified world of analytics done from aggregated data; they need to use MTA and constantly search for ways of expanding their access to data that makes the models as strong as possible while accepting that user-level data will not be 100% comprehensive.

This document was written to guide marketers to the options available:
1. **Broaden data access**
   a. Choose MTA providers in part based on their ability to offer better access to data due to relationships, tagging, and/or access to data sets that can be integrated via on-boarding platforms.
   b. Choose other partners (ad servers and other players in the tech stack) who offer work-arounds to reduced user-level data sharing because of their own tags or graphs (across users, devices, cookies, etc.) that they have created.
   c. Work with publishers to get maximum data sharing possible. This might lead to reallocation of media dollars … either spend more with a given publisher to get more leverage or where using their clean room makes sense, or spend more with publishers who naturally offer more data access as shown in the **grid**[9] we provide on the MATT website.

2. **More comprehensive analytics**
   a. Favor MTA providers who can integrate aggregated data (more readily available) into user-level modeling, in order to improve media coverage. However, please note that the goal is always user-level data so this is a fallback position.
   b. Commit to your best strategy for assembling truth across different methods. The reality is that most marketers, as they on-board MTA, will still use Marketing Mix Modeling of aggregated data and A/B testing against a conversion metric so answers coming from different places need to be assembled into a single source of truth for the organization about what works.

3. **Align expectations**
   a. The MMA surveys of marketers reveals that the Net Promoter Score for MTA is improving but still negative. One of the main reasons is that marketers go into MTA with inflated expectations relative to the reality of what data are going to be available. When delivery falls short of expectations, it creates dissatisfaction.
   b. Understand that expectations and capabilities based on available data are a problem that is somewhat iterative. The marketer can realistically drive for fulfilling higher expectations by constantly searching for new ways of expanding the user-level data available.

[9] https://www.mmaglobal.com/publisher-data-sharing-practices

Anderl, Eva, Ingo Becker, Florian Von Wangenheim and Jan Hendrik Schumann (2016), "Mapping the Customer Journey: Lessons Learned from Graph-based Online Attribution Modeling," *International Journal of Research in Marketing*, Vol. 33, issue 3, (September), 457-474, https://www.sciencedirect.com/science/article/abs/pii/S0167811616300349.

Baker, Gerard (2018), "For the Ad Industry, What a Difference a Year Makes," *The Wall Street Journal*, (June 18). https://www.wsj.com/articles/the-future-of-digital-marketing-in-a-data-privacy-world-1529341496.

Bakopoulos, Vassilis (2016-2018), "Benchmark MMA survey", *Mobile Marketing Association*. https://www.mmaglobal.com/matt

Burri, Mira and Rahel Schär (2016), "The Reform of the EU Data Protection framework: Outlining Key Changes and Assessing Their Fitness for a Data-Driven Economy," *Journal of Information Policy*, Vol. 6, 479-511, https://www.jstor.org/stable/10.5325/jinfopoli.6.2016.0479#metadata_info_tab_contents.

De Poulipiquet, Pierre (2017), "What is a Walled Garden? And Why it is the strategy of Google, Facebook and Amazon Ads platform?" *Medium* (November 3), https://medium.com/mediarithmics-what-is/what-is-a-walled-garden-and-why-it-is-the-strategy-of-google-facebook-and-amazon-ads-platform-296ddeb784b1

eMarketers Editors (2018) "Native Ad Spend Will Make Up Nearly 60% of Display Spending in 2018." *eMarketer PRO* (April 11th). https://content-na1.emarketer.com/native-ad-spend-will-make-up-nearly-60-of-display-spending-in-2018

Erdos, David (2016), "European Union Data Protection Law and Media Expression: Fundamentally Off Balance," *International and Comparative Law Quarterly*, Vol. 65, No. 1, (January), 139–83, https://www.cambridge.org/core/journals/international-and-comparative-law-quarterly/article/european-union-data-protection-law-and-media-expression-fundamentally-off-balance/A2A7076F4B8648BD263665E9CBEBFF3E.

Gasser, Urs (2015), "Perspectives on the Future of Digital Privacy," *Zeitschrift für Schweizerisches Recht*, 134, 339–448.

Geyik, Sahin Cem, Abhishek Saxena and Ali Dasdan (2014), "Multi-Touch Attribution Based Budget Allocation in Online Advertising." *ADKDD'14*, (August). https://dl.acm.org/citation.cfm?id=2648586.

Kamdar, Sachin (2015), "3 Things About Walled Gardens That Drive Digital Publishers 'Up the Wall.'" *Forbes*, (October 18). https://www.forbes.com/sites/sachinkamdar/2015/10/18/3-things-about-walled-gardens-that-drive-digital-publishers-up-the-wall/#5a39ea594aae.

Marvin, Ginny (2017). "Google Launches Ads Measurement System for Cross-Device Campaigns on YouTube, DoubleClick, GDN." *Marketing Land*, (May 26th). https://marketingland.com/google-ads-data-hub-beta-216059

Moked, Karen (2018), "Post-GDPR, Are Data Clean Rooms the Answer to Accessing Walled Gardens?", *Digital Content Next* (August). https://digitalcontentnext.org/blog/2018/08/15/post-gdpr-are-data-clean-rooms-the-answer-to-accessing-walled-gardens

Neff, Jack (2018), "Google Disables Most Outside ROI Tracking, Will Likely Ace It's Own Tests." *AdAge*, (June 11th) https://adage.com/article/digital/google-shuts-roi-tracking-analysis/313836

O'Reilly, Lara (2018), "The Future of Digital Marketing in a Data-Privacy World," *The Wall Street Journal*, (June 18th). https://www.wsj.com/articles/the-future-of-digital-marketing-in-a-data-privacy-world-1529341496

Saleh, Khalid (2018), "US Digital Ad Spending – Statistics and Trends," *Invespcro.com*. https://www.invespcro.com/blog/us-digital-display-ad-spending-statistics-and-trends-infographic

Schiff Allison, (2017), "Facebook Shares More Audience Data Via Carefully Controlled 'Clean Rooms'." *AdExchanger*, (July 18th), https://adexchanger.com/platforms/facebook-shares-audience-data-via-carefully-controlled-clean-rooms

Visual IQ (2017), "Increasing Your Marketing ROI by Up to 35% with Attribution." https://bit.ly/2JtBGGF

Weissbrot, Alison (2018), "Google Sharply Limits DoubleClick ID Use, Citing GDPR." *AdExchanger* (April 27th). https://adexchanger.com/platforms/google-sharply-limits-doubleclick-id-use-citing-gdpr

Westgard, Kristy (2018), "In Europe They're Giving Users Control of Their Online Data." *Bloomberg Businessweek* (March 20th). https://www.bloomberg.com/news/articles/2018-03-20/how-europe-s-gdpr-will-mean-your-data-belongs-to-you-quicktake

A/B tests: Also known as split testing or bucket testing, an A/B test is an experimental method of comparing any number of advertising variations and measuring their success. A company can set up different campaigns to accurately record click-throughs, sign-ups and sales by determining the page a customer needs to get to for the transaction to be qualified.

Ads hubs: Ads hubs allow advertisers, agencies, and third-party vendors to input their data along with event-level ad campaign data and still maintain end-user privacy.

Agent-based modelling (ABM): ABM investigates aggregate phenomena by simulating the behavior of individual "agents," such as consumers or organizations.

DoubleClick Campaign Manager (DCM): DCM is the third-party ad server that allows marketers to plan, execute and measure their display campaigns through DoubleClick by Google. It is where advertisers and agencies make ad placements, create floodlight tags and push to Google Tag Manager (GTM), and complete trafficking tasks. Recently, DoubleClick Ad Exchange and DoubleClick for Publishers have become one brand, called Google Ad Manager.

DoubleClick ID: These ID allows marketers to pull together data from DCM for measurement and analysis.

Effective Cost Per Acquisition (eCPA): This is a calculated metric that tells a marketer what the CPA (the actual price for each action or acquisition) would have been if the marketer had bought actions or acquisitions instead of impressions, clicks and so on.

General Data Protection Regulation (GDPR): GDPR is a legal framework that requires businesses to protect the personal data and privacy of European Union (EU) citizens for transactions that occur within EU member states.

Last touch attribution method: This measurement method assigns 100% credit for sales and conversions to the final touchpoint (i.e., a click) that immediately precedes a sale or conversion.

Logfiles: Logfiles are data that gets stored in files by applications such as a web server. Each time a request is made to the server, details of the request are recorded

Marketing Mix Modeling (MMM): MMM is a technique which helps in quantifying the impact of several marketing inputs on moving sales or market share. It uses regression modeling of causal and outcome variables at an aggregated level by month, by region and so forth and does not use user-level data. The reason for using MMM is to understand how much each marketing input contributes to sales, and how much to spend on each marketing input.

Measure of productivity: This is a key performance indicator that measures the productivity of a marketing effort and the success of its strategies.

Moat viewability tags: These are the viewability tags, used by Moat, to help advertisers and publishers measure whether people see online ads consistent with the standards of the Media Rating Council (MRC). (The mission of the MRC is to secure for the media industry and related users audience measurement that is valid, reliable, and effective.) Moat, an analytics and measurement company, was founded in 2010 and acquired by Oracle in 2017. While Moat is believed to be used predominantly, others such as Comscore also offer viewability measurement.

Modeled integration: This model integrates knowledge from two or more domains into a single framework.

Multichannel: This is the practice by which companies interact with customers via multiple channels, both direct and indirect, in order to sell them goods and services.

Pixel: This is a graphic with a dimension of 1x1 pixels that is loaded when a user visits a website or opens an email. It is used to track certain user activities, allowing advertisers to acquire data for online marketing, web analysis or email marketing.

Programmatic bidding: This is the algorithmic purchase and sale of advertising space in real time, using software to automate the buying, placement, and optimization of media inventory via a bidding system.

Saturation curve: A saturation curve shows the diminishing effect of each additional incremental amount of advertising on demand.

Stock and flow models: These are models that distinguish between quantities that are stocks and those that are flows. Stocks are measured at one specific time while a flow is measured over an interval of time. It's a useful way to talk about different content types and how one can use them in their marketing.

Tagging system: This is a user-friendly solution to managing the tags -- or snippets of JavaScript -- that send information to third parties on a company's website or mobile app. Instead of updating code on the website, the company can use the interface to decide what page or action needs to fire. The system then adds the appropriate tracking to the site to make sure it all works.

Third party verification: This is the verification of data, conducted by an independent source, measuring media buys.

Uber model: This is a model that combines the characteristics of MMM and fractional attribution all at once.

Unifying ID: A Unifying ID lets a marketer associate a persistent ID for a single user with that user's engagement data from one or more sessions initiated from one or more devices, allowing the marketer to collect data about an individual user across devices, browsers, and other online activity. The Unifying ID is also used to match to other data such as Smart TV data and frequent shopper data. When a marketer sends an ID to analytics along with related data from multiple sessions, the report tells a more unified, holistic story about a user's relationship with the marketer's business.

User-level data: This data shows how a user interacts and behaves online.