



Practical Google Analytics and Google Tag Manager for Developers

Jonathan Weber
and the Team at LunaMetrics

Foreword by Daniel Waisberg, Analytics Advocate, Google

Apress®

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To Robbin, whose determination to figure out Google Analytics in its earliest days led to all of this, and whose relentless pursuit of the very best people makes LunaMetrics an extraordinary place to work.

Contents at a Glance

Foreword	xv
About the Author	xvii
Acknowledgments	xix
Introduction	xxi
■ Part I: Implementing Google Analytics with Google Tag Manager	1
■ Chapter 1: Google Analytics Fundamentals	3
■ Chapter 2: Basic Google Analytics Measurement	11
■ Chapter 3: Introducing Google Tag Manager	19
■ Chapter 4: Testing Your Implementation	33
■ Part II: Enhancing Website Data with Google Tag Manager	43
■ Chapter 5: Tracking Interactions with Google Tag Manager	45
■ Chapter 6: Goals: Measuring Conversions	81
■ Chapter 7: Ecommerce: Tracking Products and Purchases	103
■ Chapter 8: Cleaning Up and Enriching Data	133
■ Chapter 9: Measuring Campaigns and Troubleshooting Traffic Sources	173
■ Chapter 10: Tracking Users Across Devices	189
■ Chapter 11: Providing Additional Data About Users	195

- **Part III: Collecting Data from Other Sources 209**
- **Chapter 12: Importing Data into Google Analytics 211**
- **Chapter 13: Collecting Data from Mobile Apps..... 221**
- **Chapter 14: Sending Data from Other Sources Using GA's
Measurement Protocol 231**
- **Chapter 15: Using Google Analytics with BigQuery for Big Data Analysis 237**
- **Appendix A: Google Tag Manager and Google Analytics APIs 257**
- Index..... 265**

Contents

- Forewordxv
- About the Authorxvii
- Acknowledgmentsxix
- Introductionxxi
- Part I: Implementing Google Analytics with Google Tag Manager..... 1
- Chapter 1: Google Analytics Fundamentals..... 3
 - GA Account Structure and Administration 3
 - Getting a Google Login.....3
 - Google Analytics Structure4
 - Administration and Access Controls5
 - Google Analytics Premium Properties5
 - How Google Analytics Collects Data..... 6
 - Hits, Sessions, and Users6
 - Privacy Considerations7
 - Reports and Data Structures in GA..... 7
 - Dimensions and Metrics7
 - Pre-Aggregation and Sampling8
 - Tool Overlap and Reconciliation9
 - Google Analytics Documentation..... 10
 - Summary..... 10

- **Chapter 2: Basic Google Analytics Measurement..... 11**
 - Basic Google Analytics Tracking Code..... 11
 - How the Tracking Code Works 12
 - Getting the Code on the Page 14
 - Cookies and Domains..... 15
 - Choosing a Cookie Domain 15
 - Multiple Domains As One Site 17
 - Summary 18
- **Chapter 3: Introducing Google Tag Manager 19**
 - Why Use a Tag Manager? 19
 - How Does Google Tag Manager Work?..... 20
 - Creating a GTM Account 20
 - GTM Container Script..... 21
 - The Building Blocks of GTM 22
 - Tags 23
 - Triggers..... 23
 - Variables 24
 - Providing Data to GTM with a Data Layer..... 26
 - Structure of the Data Layer 27
 - Filling In the Data Layer 27
 - Implementing GA Basics with GTM 27
 - What Comes Next 31
 - Summary 32
- **Chapter 4: Testing Your Implementation 33**
 - Publishing in Google Tag Manager 33
 - Preview and Debug Mode..... 33
 - Publish Your Container 37
 - Version Management..... 37

Troubleshooting Tools for GA	38
Chrome Tag Assistant	38
Google Analytics Debug Mode	38
Other Browser Tools	40
Google Analytics Real-Time Reports.....	41
Summary.....	42
■ Part II: Enhancing Website Data with Google Tag Manager.....	43
■ Chapter 5: Tracking Interactions with Google Tag Manager.....	45
Tracking Interaction in Google Analytics	45
Design Patterns for Events in GTM.....	47
Design Pattern 1: GTM's Auto-Event Tracking.....	49
Design Pattern 2: Custom JavaScript in GTM	53
Design Pattern 3: Explicit Data Layer Events in Site Code.....	54
Applications of Interaction Tracking	57
Outbound Links.....	57
PDFs and Other Downloads	59
Mail and Phone Links	62
Tabs, Hover, Scroll, and Other Content Interactions.....	62
Social Interactions	71
Video.....	74
Summary	79
■ Chapter 6: Goals: Measuring Conversions.....	81
Creating and Organizing Goals	82
Deleting Goals.....	85
Destination Goals and Funnels.....	85
Setting Up a Funnel	87
Funnels Without Distinct URLs.....	93
Conversions That Span Sessions.....	100
Summary	101

- **Chapter 7: Ecommerce: Tracking Products and Purchases..... 103**
 - Basic Ecommerce Tracking 104
 - Ecommerce Data in the Data Layer 105
 - Create a Goal in GA for the Checkout Process..... 109
 - Enhanced Ecommerce Tracking 109
 - Enabling Enhanced Ecommerce 111
 - Ecommerce Data in the Data Layer Declaration 114
 - Ecommerce Data on User Interactions 124
 - Summary 131
- **Chapter 8: Cleaning Up and Enriching Data..... 133**
 - Tools for Cleaning Up Data 133
 - GTM: Blocking Triggers and Overriding Default Values 133
 - GA: Filters and Views 135
 - Partitioning Internal Traffic..... 140
 - Removing Internal Traffic..... 140
 - Separating Test and Production Environments..... 146
 - Cleaning Up and Grouping Content 149
 - Enforcing Case in URLs..... 150
 - Default URLs 151
 - Query Parameters..... 153
 - Capturing the URL Fragment 155
 - Viewing Hostnames for Subdomains and Cross Domains 156
 - Site Search 159
 - Grouping Content..... 163
 - Other Applications for Filters..... 169
 - Filtered Views vs. Segments..... 170
 - Summary..... 171

■ Chapter 9: Measuring Campaigns and Troubleshooting Traffic Sources	173
Traffic Sources in GA	173
Adding Organic Search Engines	174
Ignoring Certain Referrers	175
Campaign Tracking	175
Specifying Campaign Values with GTM	179
Channel Groupings in GA	180
Traffic Data Integrations	182
AdWords	182
DoubleClick Platforms	184
Google Search Console	185
Troubleshooting Traffic Sources	185
Redirects	185
Self-Referrals	187
Summary	188
■ Chapter 10: Tracking Users Across Devices	189
Set Up User ID in GA	191
Send User ID Data with GTM	193
Provide a User ID Value	193
Set Up GTM to Send User ID to GA	193
Summary	194
■ Chapter 11: Providing Additional Data About Users	195
Custom Dimensions and Metrics	195
Dimensions	196
Metrics	197
Accessing Custom Dimensions and Metrics in GA	199
Setting Up Custom Dimensions and Metrics	200
Creating a Custom Dimension or Metric in GA	201
Generating Custom Data	202
Sending Custom Information to GA	203

Additional Examples	205
Custom Dimensions from Form Input	205
Custom Metrics from Interactions	206
Summary	207
■ Part III: Collecting Data from Other Sources	209
■ Chapter 12: Importing Data into Google Analytics	211
Data Import Process	212
Creating a Data Set	212
Data Import Schema	214
Uploading Data	215
Updating Data Sets	215
Data Import Types	216
Hit Data Import	216
Extended Data Import	216
Summary Data Import	219
Summary	219
■ Chapter 13: Collecting Data from Mobile Apps	221
GA for Mobile Apps	222
App Properties and Views	222
Mobile App SDKs	224
Android and iOS	224
Unity	225
GTM Containers for Mobile Apps	225
Differences from Website Containers	225
The Data Layer in Mobile Apps	228
Deployment and Testing	229
Summary	230

■ Chapter 14: Sending Data from Other Sources Using GA's Measurement Protocol	231
Sending Data	232
HTTP Request	232
Payload Parameters.....	232
Validation	235
Data Processing in GA.....	236
Summary.....	236
■ Chapter 15: Using Google Analytics with BigQuery for Big Data Analysis	237
About BigQuery	238
What BigQuery Is Not.....	238
GA and BigQuery Integration	238
Accessing BigQuery	239
Web Interface	239
GA Data Schema in BigQuery	241
BigQuery's Query Language.....	242
Selecting Data from Tables.....	243
Grouping Fields.....	249
Finding Data Where a Condition Is Met.....	249
Further Google Analytics Examples	250
Joining Data.....	253
Strategies for Using GA and BigQuery in Big Data Analysis	254
Importing Data into BigQuery	254
Extracting Data for Use in Other Applications.....	255
Summary.....	255

- **Appendix A: Google Tag Manager and Google Analytics APIs 257**
 - Google API Basics..... 257
 - Google Tag Manager API..... 258
 - GTM Container JSON Format..... 258
 - Google Analytics APIs 259
 - Reporting APIs 259
 - Configuration APIs 262
- Index..... 265**

Foreword

A long, long time ago, some smart people understood that distributing water from a centralized place would provide more control and be faster. This was the beginning of irrigation, a more organized and effective way to bring water to plants.

Fast-forward a few thousand years, and some other smart people invented even more advanced ways to irrigate hundreds of millions of acres around the globe. Let's say you own a plantation with multiple crops: coffee (of course!), corn, and soya—each of those plants require a different amount of water and a different amount of fertilizers. Without irrigation, it would be impossible to create and maintain a constant and precise flow of those two essential resources (and others) to your crops in an effective and timely manner.

You are probably asking yourself by now: What is this guy talking about? Well, in the same way that irrigation is used to deliver resources to multiple crops, Google Tag Manager (GTM) is used to deliver different tags to different pages quickly and effectively. So, in our case, instead of crops, we have pages, instead of resources we have tags, and in both we have rules to define what to do in each case.

In the same way that irrigation powered farmers to manage their resources in a more scalable way, so does Google Tag Manager for developers. GTM is a powerful tool that enables multiple professionals from different departments and locations to work together to create and deploy solutions to digital challenges, such as agility and performance.

This is not to say that all problems will vanish and that in three steps you will be rocking the Web; no, GTM is not an Asterix magic potion. As you will learn in this book, creating a powerful GTM implementation requires discipline and hard work, but you will also learn that the hard work will pay for itself many times over.

As Jonathan and the LunaMetrics team accurately and comprehensively describe in the chapters to come, you can do wonders with Google Tag Manager, both when it comes to Google Analytics implementations and other types of data collection.

Now turn the page and put your hand to the plow!

—Daniel Waisberg
Analytics Advocate, Google

About the Author



Jonathan Weber is the data evangelist at LunaMetrics. He spreads the principles of analytics through training seminars on Google Analytics and Google Tag Manager, and works with clients on challenging strategic issues in measuring and interpreting analytics data. He holds a master's degree from the University of Pittsburgh School of Information Sciences. Away from the computer, you can find him out in the sunshine as a flower farmer and plant geek.

LunaMetrics is a cool Google Analytics Certified Partner and Authorized Premium Reseller, located in the heart of Pittsburgh, PA—one of the US's newly techie towns.

Jonathan and the rest of the team at LunaMetrics are constantly working to make themselves authorities in the area of GTM and GA. The team doesn't really act that nerdy, but they get excited by creating new GTM workarounds and celebrate by playing board games.

Acknowledgments

There's a reason the cover of this book reads "Jonathan Weber and the team at LunaMetrics", because it couldn't have happened without everyone here. It's a privilege to be able to just pop over to someone's desk and talk over an idea with some of the top folks working on Google Analytics and Google Tag Manager implementations anywhere. The breadth and depth of experience of the LunaMetrics team is the foundation of this book. Thanks especially to Robbin Steif and Jon Meck for their tireless reviews and feedback from front cover to back; again to Jon and to Jimmy Keener for assembling the first drafts of several chapters; to Sayf Sharif and Dan Wilkerson for reviewing technical issues; and to Alex Moore and his entire analytics team here for all of their support, encouragement, and feedback.

Beyond LunaMetrics, there's a larger community devoted to GA and GTM who come together to sharpen our practices and our collective wisdom on these tools, in the Google Analytics Certified Partner program, the Google+ GTM community, and elsewhere. Thanks especially to Simo Ahava for being as obsessed with GTM as we are, and for creating so much valuable writing about it on his blog.

None of this would be possible without the excellent teams at Google working on Analytics and Tag Manager, both past and present. Thanks especially to Paul Muret, who got all of this started way back when; Daniel Waisberg, who penned the foreword for us (and whose excellent book on GA integrations you should also check out); to Avinash Kaushik, for getting so many people excited about web analytics; and to Brian Kuhn and Lukas Bergstrom on the GTM team, who have tirelessly provided support for a new and rapidly developing tool.

And finally, eternal gratitude to Jimmy, who put up with a lot of days and nights of "clicky-clicky" in the quest to finish this book.

Introduction

Who Is This Book For?

“What is the use of a book,” thought Alice, “without pictures or conversations?”

—Lewis Carroll, *Alice’s Adventures in Wonderland*

Google Analytics is used on millions of websites to measure and understand user behavior. But for many of those sites, implementation of Google Analytics goes like this:

1. Sign up for an account.
2. Paste the tracking code into your site template according to the simple instructions.
3. View site data in reports.

That’s certainly better than no data at all! But stopping your planning there misses many of the most powerful features of Google Analytics (GA): those that customize the data to your organization, your website, and your audience. This book will show you how to measure special interactions, conversions, and other types of data, so that you have reports and analysis with real impact.

One of the hurdles in further implementation can be IT resources necessary to deploy and test tracking code tags on the pages of your website to make additional measurement possible. Google Tag Manager (GTM) helps you overcome this hurdle by managing and deploying those tags from a web-based tool.

GA and GTM go together like peanut butter and jelly. While you can certainly implement all the things in this book without GTM, GTM makes the process so much more streamlined and testable that it’s strongly recommended for all GA implementations. Throughout this book, GTM will be introduced alongside GA features, and you’ll learn about using GTM to implement them.

Do I Need to Be a Developer?

The title says “for Developers,” but what does that really mean?

Web analytics, by its nature, measures web pages. GA and GTM use JavaScript code to do that measurement. Because of that, you should be familiar with the basic technologies that make web pages work in your browser: HTML, CSS, and JavaScript.

But do you need to be able to sit down at a blank computer screen and code a fully functioning website from scratch? Certainly not. The majority of work you’ll do involves adding a few lines of code here and there to existing, functioning pages in order to measure some element of that page. If your job title is “Developer,” you’ll have no problems, but if you work in marketing, content creation, or some other role, as long as you have some basic HTML skills you should be able to follow along and implement the examples in this book.

How Should I Read This Book?

Especially if you're just getting started with GA & GTM, *Part I: Implementing Google Analytics with Google Tag Manager* covers the basics you need to know about your implementation and getting the foundations of your website measurement in place, along with the processes for deploying and testing. Even if you have an existing implementation, Part I may provide a good refresher of basics, especially Chapters 3 and 4 if GTM is new to you.

Part II: Enhancing Website Data with Google Tag Manager covers a whole variety of additional kinds of data you'll want to send to GA from your website, while *Part III: Collecting Data from Other Sources* provides information about sending GA data from mobile apps, back-end systems, and more. The chapters of Parts II and III are collections of topics for growing and enhancing your implementation that you can approach in any order you like. Pick out the topics that are most valuable or highest priority for you and tackle those first. Chapter 5 is a good starting point, as it covers a number of the most common kinds of additional tracking in GA, as well as general approaches to implementation in GA and GTM. From there, feel free to skip around as your interest or needs dictate.

The *Bonus Chapter: Using GA with BigQuery for Big Data Analysis* provides an overview of the newest way of getting at your GA data, through Google's BigQuery service, enabling deep statistical analysis and data mining techniques on your website data. The *Appendix* provides an overview of GA and GTM APIs for setting up and reporting on your data.

Links to Resources and Code Examples

Throughout this book you'll find references to the GA and GTM documentation and other resources, as well as numerous code examples. You can also find these, organized by chapter, at this book's web page: <http://www.lunametrics.com/gtm-book/>. This page includes a number of helpful resources, organized by chapter:

- Clickable links to resources referenced in the text.
- Code for example tags and variables in GTM that appear in this book, provided in GTM's import/export format to easily bring them into your own setup.
- Resources to learn more about ancillary topics touched on in GA and GTM, such as regular expressions.
- Links to further relevant examples, beyond those included in the text.

Summary

- This book teaches you best practices for Google Analytics and Google Tag Manager implementation.
- You don't need to be a developer. You should have a basic understanding of HTML and JavaScript.
- Read Part I for a strong foundation for your implementation, and then pick and choose from Part II and Part III depending on your interest and needs.

PART I



Implementing Google Analytics with Google Tag Manager

CHAPTER 1



Google Analytics Fundamentals

“What a funny watch!” she remarked. “It tells the day of the month, and doesn’t tell what o’clock it is!”

“Why should it?” muttered the Hatter.

—Lewis Carroll, *Alice’s Adventures in Wonderland*

Google Analytics (GA) is an easy-to-use tool to measure activity on a website. A basic setup might take as little as a few minutes, and many of the standard reports are quite accessible and understandable without any special training or prior knowledge of web analytics. Because of this, many users jump into GA without knowing much about its underpinnings—how the data is structured and gathered—and that’s fine for the basics. But eventually, users can outgrow this intuitive understanding of GA and its data, and need deeper insight into how it works and what it can do.

You may already be using GA, or just starting out. In either case, this chapter will help you get a handle on what’s in GA:

- How Google Analytics accounts are structured
- How your data gets into Google Analytics
- How reports are generated from that data

GA Account Structure and Administration

If you’re just creating your Google Analytics account from scratch, either because you are starting a new website or switching from another tool, congratulations! You have the opportunity to set everything up from the beginning.

On the other hand, if you’re like most users of GA, you’re inheriting some accounts that already exist, set up at some point in the dim past. There may or may not be any record, documentation, or organizational memory of what was set up and why.

To make sense of all this, let’s take a look at the structure of GA accounts, starting with the email address you use to log in.

Getting a Google Login

Whether starting from scratch or accessing an existing implementation of Google Analytics, you will need a way to log in. For GA (and all other Google-y tools, such as Tag Manager, AdWords, Search Console, Google+, and so on), this requires that you have a Google Account.

If you sign up for an email address through Gmail, that's automatically a Google Account. But you can sign up any email address (`alice@aliceswonderlandresorts.com`, for example) as a Google Account. Look no further than the "Sign in" option at the top right of pretty much anything Google, which will allow you to sign in with an existing account or create a new one. It will ask you a few security questions and allow you to choose a username for a new Gmail address or to use an existing email address.

■ **Tip** You're better off using company email addresses than Gmail addresses for official business using Google tools, since you have more control over your own email addresses (being able to reset the password with email verification if someone leaves your organization, for example).

You'll want anyone who needs a login to your organization's data and settings in Google Analytics (and later, Google Tag Manager) to create an account this way. You can have many different logins, with different levels of access to your GA data.

■ **Tip** You might wonder: "Should we share a single login?" Whether you want a shared login (e.g., `analytics@aliceswonderlandresorts.com`) or separate logins for different personnel (e.g., `alice@aliceswonderlandresorts.com`, `lewis@aliceswonderlandresorts.com`, etc.) depends on the structure of your organization's departments, business units, or teams, as well as your internal security policies. Think about whether multiple people sharing a password works. (For small organizations, maybe. For larger organizations, you're going to want more granularity, control, and accountability for individuals.)

Google Analytics Structure

Google Analytics organizes data into a three-level hierarchy: *accounts*, *properties*, and *views*. Each login (email address) can have access at any of these levels.

Account is the highest level, and generally corresponds to a single business or organization. In many cases, you may have access to just one GA account. But you might have multiple accounts for various reasons: you have a work account (for your employer's websites) and a personal account (for your blog on trends in the millinery industry); you might be an agency that works with multiple clients, each of whom has an account; or you might work for a large and complex organization that has multiple accounts (the North American division vs. the European division).

The **property** is the next level of organization. Each account may have multiple properties. The property corresponds to a website (or group of websites), mobile app, or other source of data. Your organization might have multiple websites (`aliceswonderlandresorts.com`, `madhatterheadwareinc.com`, etc.), and so your account might contain multiple web properties.

The **view** is the third and lowest level of organization. Each view is a specific set of data from the property from which the reports in GA are generated. By default, GA creates a view for each property that simply contains all the data for that property. You get to specify what data are included in each view, so you can create additional views for subsets of your site's content (just a particular section of the site, or just a particular marketing channel, for example).

On the Home tab for GA, you'll see a hierarchical listing of all the accounts, properties, and views to which your login has access, through which you can browse by collapsing and expanding the sections. Each view shows a short summary of metrics, and clicking on a view takes you to its reports.

Administration and Access Controls

The Admin tab of Google Analytics gives you access to all of GA's settings, and you'll find that it's organized in the same way, by account, property, and view (from left to right). Each of the three columns is a menu of settings for that level, and the drop-down menus at the top of each column control which account, property, or view you're seeing.

What you'll see in the Admin tab depends on which level of permissions your login has to GA. There are several levels of permissions that can be assigned to a login:

- **Read & Analyze** is the most basic level of permissions. This allows a user to view reporting data and create personal customizations, such as custom reports, alerts, dashboards, or segments.
- **Collaborate** is the next level. It includes everything that Read & Analyze can do, as well as the ability to share customizations with other users.
- **Edit** includes everything that Collaborate can do, with the addition of the ability to change settings in the Admin area.
- **Manage Users** is a separate permissions level from Read & Analyze, Collaborate, or Edit, and does *not* include those abilities (though it can be given in addition to them for a user). Manage Users gives the ability to add or remove permissions for other logins.

These permissions can be assigned at the account, property, or view level, which gives great flexibility. For example, Alice might be in charge of analytics across all company websites, so she could have Edit and Manage Users access at the account level. The Mad Hatter, who manages the ecommerce store portion of the website, may have Edit permissions to only that view.

If you have the Manage Users permission, you'll be able to see a Manage Users menu listed in the Admin tab. Clicking through shows a list of users and their permissions, as well as the ability to add a new user. Note that the login email needs to be a Google Account (see earlier) before you can add it to GA.

■ **Tip** Most commonly, you will probably use Collaborate permissions for the majority of users, at whatever account, property, or view is appropriate for them to use. Typically Edit and Manage Users are reserved for a limited number of administrators (again, at the account, property, or view level that's appropriate).

Further chapters explore the other settings in the Admin area. The property-level settings largely pertain to what data is collected by GA: the tracking code itself (Chapter 2), custom data (Chapter 11), and data import (Chapter 14). The view-level settings control what data shows up in reports, and you'll learn ways to use those to track conversions (Chapter 6) and clean up and organize your data (Chapter 8).

Google Analytics Premium Properties

Google Analytics is a free tool. People often ask, "Why does Google give it away for free?" Organizations with better data about their websites and marketing are more likely to spend money on advertising, which is where Google brings in the money.

As a free tool, however, it does have some limitations on how much data you can collect and process. Google also offers Google Analytics Premium, which is a paid subscription service that includes higher limits on data collection and processing, service-level and uptime guarantees, and customer support and training. GA Premium also offers some more processing-intensive reports and ways of retrieving data beyond what's available in the free tool, as well as early access to beta features.

GA Premium is activated at the property level in GA, and you'll see a flag next to any properties in your account list that are enabled for GA Premium.

Most of the features discussed in this book are available for everyone—Premium or standard. Differences will be called out so you'll know.

How Google Analytics Collects Data

Google Analytics captures a wide variety of data. Data is sent to GA by means of a tracking **hit**. Each hit is a bundle of data about some specific type of interaction (viewing a page, for example).

GA specifies the format for this hit data with a data collection specification called the Measurement Protocol. The Measurement Protocol is agnostic about the source of the data—as long as the hit is in the right format, the data will be collected into Google Analytics. This means that you can send data to GA from anywhere: a website, a mobile app on iOS or Android, or from your own custom applications. (You can learn more about the Measurement Protocol in Chapter 14.)

In most cases, you'll be sending data to GA from your website, and that's the focus of the bulk of this book. For websites, GA provides a JavaScript library that generates the tracking hits for you and automates much of the nitty-gritty of the data collection so that you don't have to worry about the details of the Measurement Protocol.

This JavaScript code is loaded in each page of your website (Chapter 2 has all the details). By default, this code captures the view of each page (and a slew of associated data) each time a page loads. By adding more code, you can track other interactions or occurrences, such as clicking a button, scrolling the page, and more.

For standard (non-Premium) GA, you are limited to collecting ten million tracking hits per month by the terms of service. If you exceed that limit, Google may contact you about purchasing a GA Premium subscription or reducing the amount of data you collect. (Premium accounts have higher hit limits, starting at one billion hits per month.)

Hits, Sessions, and Users

Each hit sent to Google Analytics represents one interaction. A collection of hits that occur together is called a **session**. For example, a user might come to your website and view several pages in succession—each page generates a hit, and all of the hits together comprise the session. The typical rule for grouping hits into sessions is that not more than 30 minutes pass until the next hit (although you have the ability to change this time window in the GA settings).

■ **Example** Alice visits a website and goes to pages A, B, and C. Then she follows a rabbit down a hole and returns an hour later, viewing pages D and E. Alice has two sessions: the first containing A, B, and C, and the second containing D and E. If only 29 minutes had passed between C and D, there would be a single session with all five pages.

Google Analytics also tracks the **user**, who may have multiple sessions. When the same user comes back to the site repeatedly, GA keeps track of how many times they've been there and how recently. (Chapter 2 discusses how GA tracks website users with cookies; Chapters 10 and 11 give more detail on how to track individual users and record additional information about them.)

Privacy Considerations

Of course, you are interested in tracking user activity to make your website better. But you have to remember that the users visiting your website are real human beings, not just a collection of data, and you need to be clear about what you're collecting and careful about what you do with it.

Google Analytics' Terms of Service for the United States¹ require the following:

- That you disclose that you are using Google Analytics to track the behavior of your website users (typically by linking to Google's description of how it collects data in your site's privacy policy).
- That you must not circumvent any methods that GA allows users to opt out of tracking.
- That you must not collect any **personally identifiable information** within GA (names, email addresses, or billing information).

The terms for other regions may be different, and you should also become familiar with the privacy regulations in the countries in which you operate to understand your obligations.

Reports and Data Structures in GA

Once the data is sent to Google Analytics, it will appear in all of the standard reports you can access in the Reports tab (or in Custom Reports in the Customization tab, if you've created any of those). Let's take a look at how this data is organized into those reports and how the numbers are calculated.

Dimensions and Metrics

Dimensions and metrics are the building blocks of every report in Google Analytics, and understanding the dimensions and metrics available and how they fit together will give you a deep understanding of how GA really works, and what you can do with the data.

Dimensions are labels that describe data. They typically appear as the rows of reports. Examples include:

- *URLs*: Hostname, Page, Landing Page, Exit Page, Previous Page, Next Page
- *Traffic sources*: Source, Medium, Campaign, Keyword, Referral Path, Social Network
- *Geography*: Country, Region, City, Metro

¹<http://www.google.com/analytics/terms/us.html>

Metrics are measurements. They are always numerical and typically appear as the columns of reports. Examples include:

- *User metrics*: Users, % New Sessions
- *Session behavior metrics*: Bounce Rate, Pages/Session, Avg. Session Duration, Conversion Rate
- *Campaign metrics*: Impressions, Clicks, CTR, CPC

Each report in GA—whether a standard report, a custom report, or even data extracted through the GA APIs—is a combination of dimensions and metrics that are extracted and calculated from the tracking hits received. Most standard reports have some sensible defaults, but allow you choices to show the data in different ways by changing the dimensions or metrics displayed. Custom reports allow you to select completely customized combinations of dimensions and metrics. Reports also allow filtering and segmentation of data based on dimensions and metrics. For example, you can say “Show me all the Pages with Bounce Rate greater than 50%” or “Show me the Campaigns only for users located in Florida”.

You’ll get a sense for the dimensions and metrics available simply by browsing through the standard reports in GA. A comprehensive reference to dimensions and metrics is available in the GA developer documentation,² which includes the labels used in the reporting interface as well as the programmatic identifiers used in the APIs. The dimensions and metrics reference also indicates which combinations are allowed—certain dimensions or metrics cannot be viewed in the same report, either because they are logically incompatible or because the underlying data on such a combination isn’t available in GA.

Pre-Aggregation and Sampling

For the combinations of dimensions and metrics in most of the standard reports, all of the report data is pre-aggregated by Google Analytics. This means that the metrics in these reports are calculated and ready to go when you request the report for any date range.

Row Limits

For this pre-aggregated data, there is a limit of 50,000 unique rows daily that are shown in the aggregated reports. Once you exceed this limit, the report will group additional values into a single row labeled (other). This is uncommon for most dimensions, but for dimensions like Page (URL) or Keyword, there may be large numbers of unique values. (Additional limits apply in multiday or multidimension reports, but exceeding the daily limit is the most common scenario. The limits are higher for GA Premium users.) You may be able to overcome these limits by cleaning up unnecessarily specific query parameters or other information in your URLs, as discussed in Chapter 8.

Sampling

If you request a report that is not drawn from GA’s pre-aggregated data—for example, by applying an additional dimension to a standard report, applying a segment, or creating a custom report—GA must calculate the metrics for the report on the fly by going back to the original tracking hit data.

²<https://developers.google.com/analytics/devguides/reporting/core/dimsmets>

For non-aggregated data, if the date range contains more than 500,000 visits, Google Analytics will employ *sampling* in calculating the metrics for the report. (Again, additional limits sometimes apply, but the session limit is the most common to trigger sampling. The limits are increased substantially for Google Analytics Premium users, who also have the ability to download completely unsampled reports.)

Sampling means that the totals are projected from a subset of the data. For example, if there were 1,000,000 sessions in your time period, Google Analytics might take 500,000 sessions to calculate the metrics, then multiply by 2 (1,000,000 / 500,000) for the totals.

GA will indicate when sampling occurred and what proportion of total traffic was used in calculating the report by a notification at the top right of the report. It also gives you the ability to select between “Slower response, greater precision” (which uses close to the limit of 500,000 sessions, but takes longer to calculate the report) or “Faster response, less precision” (which is quicker, but uses fewer sessions).

You can eliminate sampling if you can reduce the date range of your report to encompass fewer than 500,000 sessions. (In this scenario, you would have to add results back together for multiple date ranges to get totals for the entire time period of interest. You can also use the GA APIs to apply this technique programmatically.) However, this approach makes analysis in GA's reports cumbersome, and it does not make it possible to address user-level metrics (which cannot be simply totaled across time periods).

Tool Overlap and Reconciliation

If you're like most folks, you're using multiple tools for measuring web activity, and more than likely, some of those overlap with what Google Analytics is also measuring. Your content management system, social media plugins, ecommerce system, email marketing tools, and more may all have metrics about web activity.

To the extent possible, it's worth trying to consolidate as much as possible in a single system that is flexible enough to handle most of the data that's most important to you, for the simple ability to see and analyze all these data side-by-side without having to stitch them together in some other way. GA is a good candidate for bringing together as much of your online (and even offline) customer interaction as possible because of its flexibility. Much of this book will focus on bringing these different categories of data together. However, collecting data in GA may not be practical for you in all cases, so there are many facilities for exporting data as well (see the bonus Chapter 16 and Appendix).

Where you are using GA data alongside data from other sources, you should be aware that metrics will not always match exactly. This can happen for a whole variety of reasons. Metrics that *seem* like they should be the same are often defined in subtly different ways between tools, or are measured in different ways. Compare carefully, and don't assume that numbers between different tools are comparable unless you understand their definitions clearly and do some cross-checking of your own. Overall, though, you should expect metrics to agree directionally and proportionally between tools, and you shouldn't get bogged down in the minutiae of reconciling tools when you could better spend your time making decisions based on data that is *good enough*.

Google Analytics Documentation

Even with this excellent book in hand, you'll probably need to reference the documentation for Google Analytics at some point. There are actually two major documentation collections for GA:

- The Help Center,³ accessible from the top menu, provides information about the reporting and administration functions in Google Analytics. If there's a report or setting you don't quite understand, it should give you some context on what it's for and how it works.
- The Developer Center⁴ has all the documentation of the Google Analytics JavaScript tracking codes, APIs, and other technical information about GA. It makes a great supplement to this book, and some of its reference documentation and handy tools will be referred to for further background.

Summary

- Google Analytics has a three-level structure: accounts, properties, and views. Access to Google Analytics is through Google Accounts, which are logins based on a Gmail address or any other email address. Each login may have different levels of permission at any level in the GA account structure.
- Google Analytics collects data through tracking hits, packages of data about an interaction that are sent from your website using JavaScript, or from another source of data such as a mobile app. Hits are grouped together in sessions, and users are tracked over multiple sessions. There are privacy provisions for notifying your users about your data collection practices and restricting the data you can collect.
- Google Analytics data is based on dimensions (labels that describe data) and metrics (numeric measurements). All reports, including standard reports, custom reports, and APIs are based on GA's dimensions and metrics. Standard reports are pre-aggregated, meaning the numbers are precalculated. Non-pre-aggregated reports, such as a custom report or a standard report with an added segment, can be sampled, meaning that the numbers are calculated on the fly from a subset of the data if the dataset is large.

³<https://support.google.com/analytics/>

⁴<https://developers.google.com/analytics/>

CHAPTER 2



Basic Google Analytics Measurement

“Begin at the beginning,” the King said, very gravely, “and go on till you come to the end: then stop.”

—Lewis Carroll, *Alice’s Adventures in Wonderland*

Google Analytics’ measurement of your website is based on JavaScript tracking code installed on the site. Although for most of this book we’ll be using Google Tag Manager (GTM) to manage and install this code (beginning in Chapter 3), it’s instructive to understand the basics of the GA tracking code and how it is intended to work. Practically speaking, you probably won’t use this tracking code directly. However, having a basic understanding of it will help you to interpret the options in GA tags within GTM, as well as to decipher GA documentation and examples to set up GTM for your site.

Basic Google Analytics Tracking Code

When you first create a Google Analytics account, you supply some basic information, such as your site’s domain and time zone. Then, GA presents a snippet of JavaScript code with the instruction to “copy and paste this code into every web page you want to track” (see Figure 2-1).

This is your tracking code. Copy and paste it into the code of every page you want to track.

```
<script>
(function(i,s,o,g,r,a,m){i['GoogleAnalyticsObject']=r;i[r]=i[r]||function(){
(i[r].q=i[r].q||[]).push(arguments)},i[r].l=1*new Date();a=s.createElement(o),
m=s.getElementsByTagName(o)[0];a.async=1;a.src=g;m.parentNode.insertBefore(a,m)
})(window,document,'script','/www.google-analytics.com/analytics.js','ga');

ga('create', 'UA-XXXXX-YY', 'auto');
ga('send', 'pageview');

</script>
```

Figure 2-1. GA’s tracking code instructions

If you need to find this suggested code after the initial setup process, you can find it in the Admin settings in the Property column in the section Tracking Info ► Tracking Code.

How the Tracking Code Works

Let's break this code down and take a look at what it does. The first part looks like this:

```
(function(i,s,o,g,r,a,m){i['GoogleAnalyticsObject']=r;i[r]=i[r]||function(){
(i[r].q=i[r].q||[]).push(arguments)},i[r].l=1*new Date();a=s.createElement(o),
m=s.getElementsByTagName(o)[0];a.async=1;a.src=g;m.parentNode.insertBefore(a,m)
})(window,document,'script','//www.google-analytics.com/analytics.js','ga');
```

Don't even bother reformatting this piece of code to make it more readable, because it's the same for every site and you would almost never make changes to it. It fetches the GA tracking library (`analytics.js`) from a Google server and inserts it into the page. (The only part of this script you would possibly want to change is the very last bit: `'ga'` is the name that will be given to the GA tracking function. You can rename this function should you need to avoid a conflict with the name of an already existing object in your page.)

The second part is where you tell Google Analytics what to do. The default code includes two commands:

```
ga('create', 'UA-XXXX-YY', 'auto');
ga('send', 'pageview');
```

The `ga` function accepts a sequence of parameters, the first of which is the name of a GA command. Here you see two different commands: `create` and `send`.

Create the GA Tracker

The `create` command sets up the GA tracker. Each tracker sends data to a specific GA property, which is identified in the second parameter in this command, called the **property ID**. The property ID is of the form `UA-XXXX-YY`, where `XXXX` is a number that identifies your GA account, and `YY` is a number that identifies a property within the account. You can find the property ID listed next to each property in the Home screen of GA, or in the Admin settings in the Property column.

The last parameter, `auto`, is a configuration parameter for the tracker that relates to how it sets cookies for the site. (More about this later in the chapter.)

Send the Pageview

The second command, `send`, sends a tracking hit to GA.

The second parameter of this command is the **hit type**, which in this case is `pageview`. There are a number of different hit types, which collect different kinds of data and are reported in different ways in GA, such as the event hit type for user interactions (described in Chapter 5) or the `screenview` hit type for mobile applications (see Chapter 13).

Whenever a send command occurs, data is sent to Google Analytics. An HTTP request is generated to www.google-analytics.com/collect that includes a payload of data about the hit (the data from which the dimensions and metrics in GA will be populated).

Because the GA tracking code is included on every page of your site, each time a page loads, the command to send a pageview executes, recording that the page was viewed. It's that simple. The two commands represented here (`create` to create the tracker, `send` to send the pageview) are the bare-bones minimum for GA tracking to function on your site.

Now, this default code doesn't capture everything you might want—it's just recording pageviews each time a page loads. So what about an AJAX form, where the user completes several steps but the page doesn't reload? What about other interactions within pages, like playing an embedded video? These are going to require additional code (to execute *only* when some action is completed, like loading new AJAX content or playing the video). Chapter 5 provides both general approaches for this additional tracking (using GTM), as well as specific recipes for common scenarios.

THE GENERATIONS OF GA TRACKING CODE

This book focuses on the latest generation GA tracking library, `analytics.js`, which is part of GA's suite of upgrades and expanded features called Universal Analytics. There are other, older GA tracking libraries, such as `urchin.js` and `ga.js`. These worked in similar ways, but the specifics of syntax are different, and not all features described in this book are available with older libraries.

The `analytics.js` library has been the default code for new properties in Google Analytics since 2014, and an upgrade process is available for properties that predate the change. You will see a notification about the upgrade process in the Admin section if you haven't updated (and you'll be able to see the older code on your site). Although the older code will continue to work and gather data for some period of time, if you want to take advantage of any of the newer features of GA, you will want to upgrade as soon as possible (and eventually it will become mandatory).

The GA Developer Center contains documentation for the legacy code and an upgrade center to guide you through the process.¹

Multiple GA Trackers

One last important detail about creating a GA tracker: every tracker has a *name* that identifies it. (The default tracker's name is actually `t0`, although that's not indicated anywhere.) The name of the tracker is nothing to worry about if you're only using one, but in some cases, you might have multiple trackers running in parallel on a web page. If there are multiple trackers, each command must specify which tracker it is being called on. (It's not necessary to specify the name for the default tracker `t0`, however.)

Why might you want multiple trackers? In some cases, you might want to send data to more than one property in GA, which can happen for many reasons:

- Joint interest in a website by two distinct parties (your organization and its parent company, for example) with different GA accounts.
- Adding your tracking code to content provided by a third-party vendor or app that may have its own GA tracking already in place.
- In some situations, for testing upgrades to ensure your implementation is correct (see Chapter 4).

¹<https://developers.google.com/analytics/devguides/collection/upgrade/>

Here's an example of naming a tracker and then calling a command on it. The name can be any string; here you use `t1`.

```
ga('create', 'UA-XXXX-YY', 'auto');           // default tracker
ga('create', 'UA-XXXX-YY', 'auto', 't1');      // additional tracker named t1

ga('send', 'pageview');                        // sends pageview for default tracker
ga('t1.send', 'pageview');                     // send pageview for t1
```

The commands for named trackers are prefixed with the tracker name before the command name, separated by a dot: `t1.send`, for example.

Arguments and Field Names

Depending on the command, Google Analytics accepts values for additional fields that affect how it works or the data gathered. As you saw earlier, for example, the `create` command indicates the property ID, for example.

In many cases, there are two ways you can specify these values. For some, you can specify them as arguments directly in the `ga` function call:

```
ga('create', 'UA-XXXX-YY', 'auto');
```

This is the format you've already seen, and it is a convenient way to provide some of the most common field values. Since it uses function arguments, notice that the *order is important*, and the function expects the arguments to occur in a particular position.

There's an alternative syntax available as well, and it's the only way to specify some of the lesser-used fields, which do not have a parameter equivalent. This alternative syntax uses an object for the fields and values:

```
ga('create',
  {
    'trackingId': 'UA-XXXX-Y',
    'cookieDomain': 'auto'
  });
```

Since the object includes the name for each field, order doesn't matter. Both of these syntaxes are equivalent and work in the same way.

Getting the Code on the Page

So the instructions say “copy and paste this code into every web page you want to track,” but fortunately that's probably easier than it sounds. In this era, chances are that you have a content management system with some manageable number of page templates (rather than individual, distinct HTML files for each page of the site).

If that's the case, you just need to get the code into one or more templates so that it's automatically included in each page of the site. You do want to make sure that you get all the templates, because any missing pages will not be measured in GA. As far as GA is concerned, if there's no tracking code on the page, it's as if it doesn't exist.

Code Placement

The GA tracking code is *asynchronous*, meaning that the browser doesn't need to wait for the code to finish loading to continue rendering elements that come after it in the page. This means that you can safely put the code at or near the top of your pages. The recommendation is to put the code in the <head> section of the page, although the beginning of the <body> is fine as well if that is easier in your templates.

■ **Tip** You do want to try to include the code as high in the page as possible. If the code is toward the end of the page and the page takes a significant amount of time to load, it's possible that the user could navigate away (click a link or close the browser window) before the tracking code has loaded, meaning you would miss capturing data about that pageview.

The GA code executes asynchronously from the rest of the page, but the *commands provided to GA execute in the order they are called*. Because of this, it's important for the `create` command to come *before* the `send` command, for example.

Cookies and Domains

Google Analytics employs a cookie to store a *client ID*, a randomly generated identifier for a particular browser and device. It uses the client ID in its calculation of the number of users and in user behavior across sessions (such as recency, loyalty, and the multichannel funnel reports).

Your browser stores cookies assigned to a particular domain (for security reasons, so that unauthorized sites can't read cookies from other domains). GA uses first-party cookies, meaning that its cookie, named `_ga`, is assigned to your domain. That is, if I have GA tracking code on `aliceswonderlandresorts.com`, I have a `_ga` cookie for that site (not for `google.com` or `google-analytics.com`, for example, which would be a *third-party* cookie).

In many cases, GA's use of cookies is pretty invisible to you, and if you have only a single domain, or several domains that are all separate sites, it isn't something you need to worry about. However, if you have multiple domains or subdomains that operate as a single website, you may need to specify where the cookie is set and how domains share the client ID value.

Choosing a Cookie Domain

Google Analytics uses some default rules to decide the cookie domain, or you can explicitly specify which domain you'd like to use. There are three possible cases for the cookie domain:

- *Default:* `ga('create', 'UA-XXXX-YY')`
GA uses the **full domain** shown in the hostname of the URL, except that it ignores a `www.` prefix, if any. If subdomains of your main domain should be treated **separately**, this is the desired option.
- *Automatic Configuration:* `ga('create', 'UA-XXXX-YY', 'auto')`
GA uses the **highest-level domain** possible from the hostname of the URL. This is the suggested code when first installing GA. If subdomains of your main domain should be treated **together**, this is the desired option.

- *Manual Configuration:* `ga('create', 'UA-XXXX-YY', 'store.aliceswonderlandresorts.com')`
GA uses the **domain you specify**. The domain must be an ancestor of the domain in the hostname of the URL.

■ **Note** The `create` command can accept the cookie domain as the third argument, or you can use the field object. The following are equivalent:

```
ga('create', 'UA-XXXX-YY', 'store.aliceswonderlandresorts.com');
ga('create', 'UA-XXXX-YY', { 'cookieDomain': 'store.aliceswonderlandresorts.com' });
```

Table 2-1. Cookie Domains in GA Using Different Settings in the Create Command

If the URL hostname is...	And the cookie domain setting is...			
	default	'auto'	'example.com'	'store.example.com'
example.com	example.com	example.com	example.com	not allowed
www.example.com	example.com	example.com	example.com	not allowed
store.example.com	store.example.com	example.com	example.com	store.example.com

In most cases, you want to treat multiple subdomains (such as `www` and `store`) as a single site, with a single set of cookies, which the `auto` option does. If you wanted to treat subdomains as separate sites, you would want to specify the domains manually with separate cookies for each.

ALTERNATE COOKIES AND COOKIELESS SOLUTIONS

The default Google Analytics cookie is named `_ga`. Should you need to rename this cookie to prevent conflicts, you can do so with an additional field in your `create` command:

```
ga('create', 'UA-XXXX-YY', { 'cookieName': 'my_ga_cookie' });
```

It's also possible to use GA without any cookies at all. To do so, you must supply the Client ID from your own source to identify the device. This option can be useful for syndicated content where you want to avoid first-party cookies, or use a third-party cookie, or supply data from an application on a shared kiosk—for example:

```
ga('create', 'UA-XXXX-YY', {
  'storage': 'none',
  'clientId': '5aced0c9-1d2f-4da0-bbdf-5775d8ff7ad7' });
```

The `clientId` should be a universally unique identifier following the format of UUID Version 4.²

²www.ietf.org/rfc/rfc4122.txt

Multiple Domains As One Site

Sometimes, you need to treat multiple domains as a single site. This is most common with sites with third-party components, such as a shopping cart, donation site, or other application where some functionality is on a different domain. For example, your site might be `aliceswonderlandresorts.com`, but to book a hotel stay, users end up on `aliceswonderland.example.biz` instead, a third-party site.

If the regular GA tracking code were used on such a site, there would be a separate `_ga` cookie for `aliceswonderlandresorts.com` and `aliceswonderland.example.biz`. Since each site would have a different set of client IDs, GA won't connect behavior on one site with the other—for example, did someone who viewed a particular page on your site end up booking a hotel room on the third-party site? That's a question you would probably want to be able to answer, but to do so, you will have to coordinate the client IDs between the two sites (see Figure 2-2).

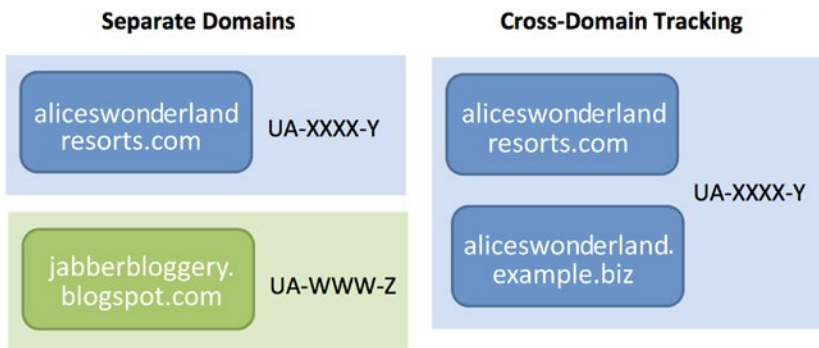


Figure 2-2. Multiple domains and Google Analytics

This is known as *cross-domain tracking* in GA. GA provides some functions to append a special parameter to the links or forms that take a user from one site to another that contains the client ID, so that the receiving site uses the same client ID. The links look like this:

http://aliceswonderland.example.biz/hotelbooking.php?_ga=1.1821195.1441315.1362115890410

The linker parameter `_ga` contains the client ID for the receiving site. Let's take a look at how to set this up.

Enabling Cross-Domain Tracking

First, in each site's create command, you have to turn on the cross-domain linker function:

```
ga('create', 'UA-XXXXX-YY', 'auto', {'allowLinker': true});
```

When `allowLinker` is set to `true`, GA will look in the URL of the page for the linker parameter containing the client ID. If it's present, it will use that value, rather than generating a new client ID for the cookie.

■ **Note** The cross-domain linker parameter also includes a timestamp, and the client ID will only be used by GA if the timestamp is within the last two minutes. This helps prevent a user from accidentally sharing a link with a linker parameter and causing multiple users to share the same client ID.

Decorating Links

Next, you have to append the linker parameter to links on either site that go to the other. This is known as “decorating” the links—like hanging a little ornament on the end.

GA provides several utility functions to do this in a plugin called linker. The simplest option is to use the `autoLink` command, which allows you to specify a list or pattern of domains to be included and automatically decorates links that appear on your web pages.

```
ga('require', 'linker');
ga('linker:autoLink', ['aliceswonderlandresorts.com', 'example.biz']);
```

The first line loads the linker plugin. The second calls the `autoLink` command and supplies an array of domains for which you want links to be decorated. The domain list uses a substring match against the destination of the link—notice you can list `example.biz` or `aliceswonderland.example.biz`, depending on how specific you want to be.

■ **Tip** Instead of a list of strings, you can also use a regular expression to match domains:

```
ga('linker:autoLink', [/^aliceswonderland(resorts\.com|\.example\.biz)$/]);
```

The `autoLink` command works well for automatically decorating links on most websites. Some pages may include scripts that prevent autolinking from functioning, so as with any JavaScript, you should test thoroughly before deploying on your site. If autolinking doesn’t work for your site, the linker plugin also provides a function `linker.decorate` for manually decorating your links. This function is useful in a number of situations aside from standard links:

- Decorating an HTML form that posts from one site to another.
- Decorating the destination of an `iFrame` of one site’s content within the other.
- Decorating links if the `autoLink` function doesn’t play nicely with existing scripts on your site.

Specific examples of these cases are available in the GA Developer Center.

Summary

- Google Analytics uses JavaScript tracking code to track users’ activity on a website. The `analytics.js` tracking library is included on each page of the site along with a `create` command (to set up the GA tracker) and a `send` command (to send pageview data to GA).
- Google Analytics uses a first-party cookie named `_ga` to store a client ID to identify a browser and device. With multiple subdomains or domains, there are options to specify the domain for the cookie.
- With multiple domains, Google Analytics provides cross-domain tracking to share client IDs between sites with different cookies via a parameter in links between the domains. The linker plugin provides the functionality to decorate links with this parameter.

CHAPTER 3



Introducing Google Tag Manager

At this moment the King, who had been for some time busily writing in his note-book, cackled out “Silence!” and read out from his book, “Rule Forty-two. All persons more than a mile high to leave the court.”

—Lewis Carroll, *Alice’s Adventures in Wonderland*

The basic Google Analytics code (see Chapter 2) isn’t very complicated. Put it in your template and you’re all set. Except... Well, there are still a bunch of chapters left in this book with additional types of data you might want to track with GA, many of which involve adding more code. A little piece here for PDF tracking, another little bit over there to track user logins, and so on. The more code you add, the harder it becomes to keep track of all the little pieces, and which of those pieces should be included and under what circumstances, and what happens when you make a change.

And that’s just GA. Chances are, you also have other little bits of JavaScript on your site for other tracking tools that capture other kinds of data that are useful—maybe other Google tools like conversion and remarketing tags for AdWords or DoubleClick, or maybe for third-party ad platforms and analytics tools. Sometimes you might have to measure the same pageview or click for two, or three, or four different tools to serve different purposes, and each one takes a JavaScript tag.

If all of that sounds like it could get a little messy, it’s because it can. That’s where a tag management tool steps in to organize and standardize all those tags.

Why Use a Tag Manager?

Just like your content management system manages the *content* of your website—by allowing you to insert text, headings, and images in a web-based interface—a tag management system manages the *tags*—allowing you to insert those bits of JavaScript, such as the Google Analytics tracking code. It offers a web-based interface to choose, edit, and manage those tags when they are included in your web pages.

This approach offers a number of advantages:

- There’s no need to make changes to the actual source code of the site or its templates when updating or adding tags.
- You can keep track of and organize tags to avoid duplication and mistakes.
- There are built-in debugging, testing, and preview tools.
- You can use version control to keep track of changes.
- There are multiple levels of permissions to view, edit, and publish tags.

Tag management tools separate the process of adding and updating tracking tags from the process of altering your site’s templates and code. There are a number of good tag management tools available, but this book focuses on Google Tag Manager (GTM), since it’s a free tool that works very well with GA. (And if you’re a GA Premium subscriber, GTM is also covered by the service-level agreement for GA Premium.)

How Does Google Tag Manager Work?

Google Tag Manager has two components that work together to include tags on your website:

- A web-based interface to set up tracking tags to be included on your site.
- A container script that is placed in your site’s template that loads the tags.

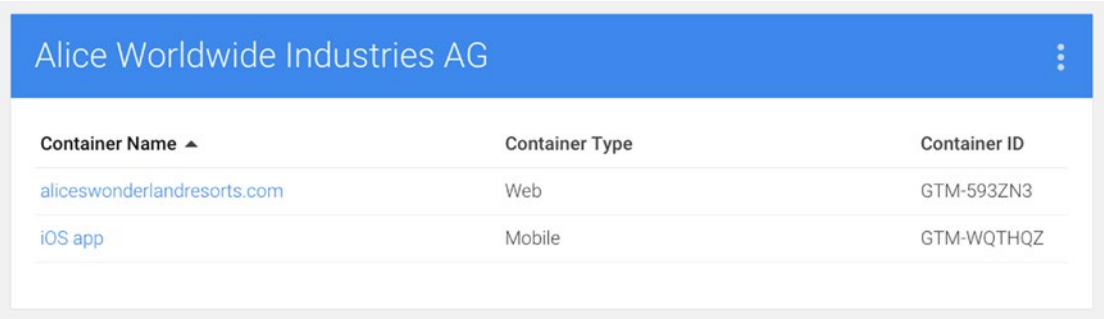
Let’s take a look at each of these pieces to get your GTM account set up.

Creating a GTM Account

Since GTM is another Google tool, you can use the same Google Account login you use for GA. You can be granted access to a previously existing GTM account or you can create a brand-new one. Just like GA, your login can have access to multiple GTM accounts.

GTM Account Structure

GTM accounts are organized into *containers*. Each container corresponds to a *container script* (see the upcoming “GTM Container Script” section) that is included on a website using GTM. When you sign up for a GTM account, it creates your first container, and you are able to create additional containers as needed. GTM shows an overview of your accounts and containers when you log in (see Figure 3-1).

The screenshot shows the Google Tag Manager interface for a user named 'Alice Worldwide Industries AG'. At the top, there is a blue header bar with the name and a three-dot menu icon. Below this is a table with three columns: 'Container Name', 'Container Type', and 'Container ID'. The table lists two containers: one for 'aliceswonderlandresorts.com' (Web) with ID 'GTM-593ZN3', and another for 'iOS app' (Mobile) with ID 'GTM-WQTHQZ'.

Container Name ▲	Container Type	Container ID
aliceswonderlandresorts.com	Web	GTM-593ZN3
iOS app	Mobile	GTM-WQTHQZ

Figure 3-1. GTM’s list of accounts and containers

In some ways, it seems that there is an obvious parallel between *accounts* and *properties* in GA and *accounts* and *containers* in GTM. At the account level, this analogy holds up well: an account usually represents a single organization or business, in either tool.

The GTM container can be a somewhat broader concept than the GA property, however. For example, while you might have separate GA properties for your development, test, and production websites, you might have a single GTM container to manage the tags across those sites, since you want very similar tags deployed across all of them. A general rule of thumb for GTM containers is that if the tags are mostly the same across websites, use a single container. If they differ greatly between websites, separate containers

might be more appropriate. (You'll see more of how these tags are set up over the next several chapters, so you may want to get a feel for how tags work in GTM before you make a final decision about how to structure your account.)

GTM Permissions

Just as in GA, logins in GTM can have different levels of permission at the account and container levels that give them different abilities. You can assign permissions in the User Management section of GTM's Admin area.

At the account level, there are two different levels of permissions:

- **View** allows the user to see the list of users and the account settings, but not to make any changes.
- **Manage** allows the user to add and remove other users and to edit the account settings.

At the container level, there are more detailed permissions:

- **View Only** allows the user to view the tags in the container, but not to make any changes.
- **View and Edit** allows the user to make changes to the tags in the container.
- **View, Edit, Delete, and Publish** allows the user to make changes to tags, delete them, and publish them to the live website.

Changes to your website don't take effect until they are published in GTM. By managing the container permissions, you can ensure that only the users who should be able to change tags or publish them to your website are able to. (The next chapter will take a look in greater detail at the publishing process in GTM.)

■ **Note** The GTM account settings additionally enable you to require two-step authentication for certain activities, such as modifying permissions or editing custom tags. Two-step authentication is an additional security measure for Google Account logins that sends a verification code to a phone or other device to verify the user's identity.

GTM Container Script

In order to include tags on your website, you have to add the GTM container script.

On the surface, the GTM container script is just another snippet of code you're adding to your website templates (just like GA or any other tracking code). But the GTM container script is meant to *replace all those other bits of code* as a single script that you won't need to update on your site; all updates will be made through GTM.

When you first create a container, GTM will provide you with the container script and instructions. Or, you can find the container script by selecting the Admin tab at the top and choosing Install GTM in the right-hand column.

The GTM container script looks something like this:

```
<!-- Google Tag Manager -->
<noscript><iframe src="//www.googletagmanager.com/ns.html?id=GTM-XXXXXX"
height="0" width="0" style="display:none;visibility:hidden"></iframe></noscript>
<script>(function(w,d,s,l,i){w[l]=w[l]||[];w[l].push({'gtm.start':
new Date().getTime(),event:'gtm.js'});var f=d.getElementsByTagName(s)[0],
j=d.createElement(s),dl=l!='dataLayer'?'&l='+l:'';j.async=true;j.src=
'//www.googletagmanager.com/gtm.js?id='+i+dl;j.parentNode.insertBefore(j,f);
})(window,document,'script','dataLayer','GTM-XXXXXX');</script>
<!-- End Google Tag Manager -->
```

This code contains your GTM container ID, which is an identifier of the form GTM-XXXXXX that uniquely identifies your container. This code loads a script called `gtm.js`, which includes all the tags you have set up in GTM.

Like the GA tracking script, the GTM script is asynchronous, so it should be placed as high in the page as possible. However, note that the GTM code contains two parts: a `<noscript>` tag and a `<script>` tag. The `<noscript>` portion allows GTM to include some types of tags even if JavaScript is not enabled in the client browser. These tags are included in an `<iframe>` element, which means that the GTM code must go in the body of the web page (iframe elements are not officially supported in the head section). Because of this, the recommendation for the location of the GTM code is at the beginning of the body, immediately after the opening `<body>` tag.

Once the GTM container code is included on your website, tags can be added and published through the GTM web interface.

The Building Blocks of GTM

Once you've created a container, you'll see it listed in GTM's list of accounts and containers. Selecting a container takes you to the container overview (see Figure 3-2). The container overview shows information about recent changes to the container, and prompts you to add your first tag (which we'll do in an upcoming section). In the top navigation, you'll notice tabs for Accounts (which takes us back to the list of accounts and containers), Container (this overview screen), Versions (past versions of the container, discussed in Chapter 4), and Admin (the account and container settings).

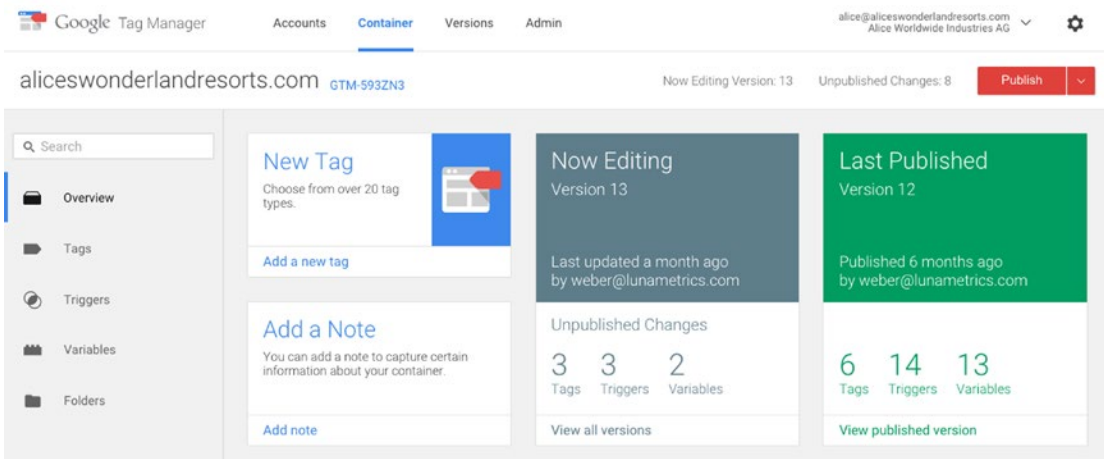


Figure 3-2. GTM's container overview