

# Analytics Feature Description

Feature description and testing guide for the analytics and reporting module with 18 features

Version 1.1 | Updated 2026-04-11 | QA Team, Customer Success, Product Stakeholders

## [1. What Is the Analytics & Reporting System?](#)

The Analytics & Reporting system tracks, measures, and visualizes how readers interact with the Hyphen publishing platform. It combines two data sources:

1. **Google Analytics 4 (GA4)** — Tracks real-time reader behavior on the Reader Portal: page views, scroll depth, article reading time, paywall interactions, device types, geographic data, and traffic sources.
2. **Internal Platform Data (PostgreSQL/Prisma)** — Tracks subscription metrics, revenue, reader registrations, institutional usage, content moderation, and social media performance from the platform's own database.

Together, these provide a complete picture across the entire reader lifecycle: from first visit to content consumption to subscription conversion to long-term retention.

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## 2. Business Objectives & KPIs

### Primary KPIs Tracked

KPI Category	Metrics	Data Source	Update Frequency
Traffic	Page Views, Unique Visitors, Sessions, Avg. Session Duration, Bounce Rate	GA4	Near real-time
Content Engagement	Scroll Depth (25/50/75/100%), Read Completion Rate, Avg. Time on Article, Top Articles	GA4	Near real-time
Subscription Health	Total Subscribers, New Subscribers, Churn Rate, MRR, ARR, ARPU, LTV	Prisma DB	Real-time
Revenue	Monthly Recurring Revenue, Annual Recurring Revenue, Revenue by Plan, Growth Rate	Prisma DB (Payment table)	Real-time
Conversion	Paywall View Rate, Paywall Click-Through Rate, Subscribe Start Rate, Subscribe Completion Rate	GA4 (custom events)	Near real-time
Registration	Visitor-to-Registration Rate, Email Verification Rate, Registration-to-Subscription Rate	GA4 + Prisma	Mixed
Audience	Desktop/Mobile/Tablet Split, Browser Distribution, Top Countries, Traffic Sources (Organic/Direct/Social/Referral/Email/Paid)	GA4	Near real-time
Institutional	Seat Utilization Rate, Active Users per Institution, Content Access Patterns	Prisma DB	Real-time
Social Media	Impressions, Reach, Engagement Rate, Follower Growth, Best Posting Times	Platform APIs (Meta, X)	Periodic sync
E-Commerce	Product Views, Add-to-Cart Rate, Checkout Start Rate	GA4 (custom events)	Near real-time
Newsletter	Newsletter Views, Scroll Depth, Read Completion, Share Rate	GA4 (custom events)	Near real-time

## [Business Questions the System Answers](#)

Question	Where to Find the Answer
"How many people are reading our content?"	Analytics Overview > Key Metrics Cards (Page Views, Unique Visitors)
"Which articles are most popular?"	Analytics Overview > Top Content section
"How are subscriptions growing?"	Analytics Overview > Subscription Metrics (MRR, New Subscribers, Churn)
"Where is our traffic coming from?"	Analytics Overview > Traffic Sources (Organic, Direct, Social, etc.)
"How well is the paywall converting?"	Analytics Overview > Paywall Funnel (view -> click -> start -> complete)
"What devices do our readers use?"	Analytics Overview > Device Breakdown (Desktop/Mobile/Tablet)
"Are institutional subscribers using their access?"	Analytics > Institutional Usage Reports
"How are our social posts performing?"	Social > Analytics (Impressions, Engagement, Best Times)
"How deep are readers reading articles?"	Analytics Overview > Scroll Depth (25/50/75/100% distribution)
"Which marketing channels drive the most conversions?"	GA4 > Acquisition > UTM attribution from conversion surfaces



## Data Source Mapping

Data Point	Source	How It Gets There
Page views	GA4	Automatic — gtag.js fires <code>page_view</code> on every navigation
Unique visitors	GA4	Automatic — GA4 deduplicates by client ID
Article scroll depth	GA4	Custom event — <code>observeScrollDepth()</code> in article templates fires at 25/50/75/100%
Article read complete	GA4	Custom event — fires when reader scrolls to 100%
Paywall views	GA4	Custom event — <code>trackPaywallView()</code> fires when PaywallOverlay renders
Subscribe button clicks	GA4	Custom event — <code>trackPaywallClickSubscribe()</code> fires on paywall CTA click
Subscription start	GA4	Custom event — <code>trackSubscribeStart()</code> fires when reader begins checkout
Subscription complete	GA4	Custom event — <code>trackSubscribeComplete()</code> fires after payment verification
Product views	GA4	Custom event — <code>trackProductView()</code> fires on shop product page
Add to cart	GA4	Custom event — <code>trackAddToCart()</code> fires on "Add to Cart" button click
Newsletter scroll depth	GA4	Custom event — <code>observeNewsletterScrollDepth()</code> fires at 25/50/75/100%
Conversion surface interactions	GA4 + Internal	Dual tracked — GA4 events + ConversionEvent table
MRR / ARR / Revenue	Prisma DB	Calculated from Payment + Subscription tables
Subscriber counts	Prisma DB	COUNT queries on Subscription table
Churn rate	Prisma DB	Cancelled subscriptions / total subscriptions
Institutional usage	Prisma DB	InstitutionUser activity data
Reading history	Prisma DB	ReadingTracker component POSTs progress data to admin API
Traffic sources	GA4 Data API	Server-side query via <code>ga4-data-client.ts</code>
Device breakdown	GA4 Data API	Server-side query for deviceCategory dimension

## 4. GA4 Event Catalog — Every Event the Platform Fires

### 4.1 Automatic Events (fired by gtag.js)

Event	When Fired	Parameters
page_view	Every page navigation	page_path , page_title

### 4.2 Article Engagement Events

Event	When Fired	Parameters	Trigger Location	Status
article_view	Reader opens an article page	article_slug , article_section , content_type	Article page templates	Pending wiring
article_scroll_depth	Reader scrolls past 25%, 50%, 75%, or 100% of article	article_slug , article_section , scroll_depth (25/50/75/100)	observeScrollDepth() in article templates	Wired
article_read_complete	Reader scrolls to 100% of article	article_slug , read_time_seconds	observeScrollDepth() at 100% milestone	Wired

### 4.3 Paywall Events

Event	When Fired	Parameters	Trigger Location	Status
paywall_view	PaywallOverlay or paywall gate renders on screen	article_slug , article_section	PaywallOverlay, ArticlePaywallGate components	Pending wiring
paywall_click_subscribe	Reader clicks "Subscribe" on a paywall	article_slug	PaywallOverlay CTA click handler	Pending wiring

### 4.4 Subscription Events

Event	When Fired	Parameters	Trigger Location	Status
subscribe_start	Reader begins subscription checkout	plan_name , plan_price	Checkout page on mount	Pending wiring
subscribe_complete	Payment verified and subscription activated	plan_name , payment_method	After payment verification success	Pending wiring

## 4.5 E-Commerce / Shop Events

Event	When Fired	Parameters	Trigger Location	Status
shop_product_view	Reader opens a product detail page	product_handle, product_name, price	Shop product page	Pending wiring
shop_add_to_cart	Reader clicks "Add to Cart"	product_handle, product_name, price, quantity	CartProvider addItem handler	Pending wiring
shop_checkout_start	Reader clicks "Checkout" in cart	cart_value, item_count	Cart checkout redirect	Pending wiring

## 4.6 Conversion Surface Events

Event	When Fired	Parameters	Trigger Location
conversion_surface_impression	Conversion surface is displayed to reader	surface_id, surface_name, surface_type, conversion_goal, page_url	ConversionSurfaceRenderer on trigger
conversion_surface_click	Reader clicks surface CTA	surface_id, surface_name, surface_type, conversion_goal, cta_type	ConversionSurfaceProvider trackClick
conversion_surface_dismiss	Reader dismisses surface	surface_id, surface_name, surface_type, conversion_goal	ConversionSurfaceProvider dismissSurface
conversion_surface_conversion	Reader completes desired action	surface_id, surface_name, conversion_goal, conversion_type	ConversionSurfaceProvider trackConversion
coupon_copied	Reader copies a coupon code	surface_id, coupon_code, discount_percent, discount_amount	Surface component copy handler

## 4.7 Newsletter Events

Event	When Fired	Parameters	Trigger Location
<code>newsletter_view</code>	Reader opens a newsletter edition page	<code>newsletter_slug</code> , <code>edition_number</code> , <code>topic</code>	Newsletter edition page
<code>newsletter_scroll_depth</code>	Reader scrolls newsletter at 25/50/75/100%	<code>newsletter_slug</code> , <code>scroll_depth</code>	<code>observeNewsletterScrollDepth()</code>
<code>newsletter_read_complete</code>	Reader reaches 100% of newsletter	<code>newsletter_slug</code> , <code>read_time_seconds</code>	At 100% milestone
<code>newsletter_share</code>	Reader shares a newsletter	<code>newsletter_slug</code> , <code>platform</code>	SocialShare on newsletter page
<code>newsletter_list_view</code>	Reader views newsletter archive list	<code>topic</code>	Newsletter listing page
<code>newsletter_signup</code>	Reader subscribes to newsletter	<code>source</code> , <code>surface_id</code>	Newsletter form submit

## 4.8 Registration Events

Event	When Fired	Parameters	Trigger Location	Status
<code>registration_start</code>	Reader begins registration flow	<code>source</code> , <code>surface_id</code>	Registration page or conversion surface CTA	Pending wiring

## Event Flow Summary

### Reader Journey:

```

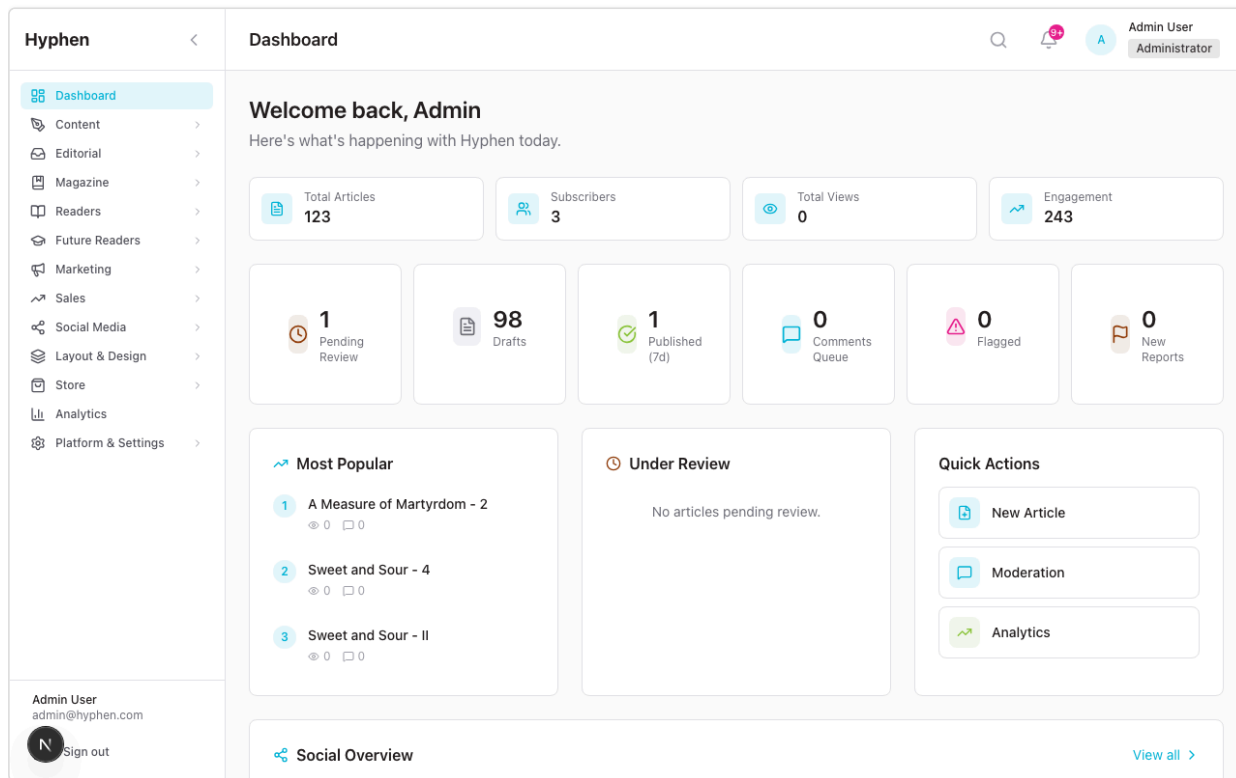
Visit site -----> page_view (automatic)
Browse article -> article_view
Scroll reading -> article_scroll_depth (25%, 50%, 75%)
Finish article -> article_scroll_depth (100%) + article_read_complete
Hit paywall ----> paywall_view
Click Subscribe > paywall_click_subscribe
Start checkout -> subscribe_start
Complete payment> subscribe_complete

Browse shop ----> shop_product_view
Add to cart ----> shop_add_to_cart
Checkout -----> shop_checkout_start

See promo modal > conversion_surface_impression
Click CTA -----> conversion_surface_click
Copy coupon ----> coupon_copied
Complete action > conversion_surface_conversion

```

## 5. Admin Dashboard — Quick Daily Snapshot



The admin dashboard provides a quick daily snapshot of key platform metrics.

### Location

Admin Console > Dashboard (landing page after login)

### What It Shows

4 Primary Stat Cards:

Card	Source	Description
Total Articles	Prisma DB	All articles across all statuses
Subscribers	Prisma DB	Active subscriber count + "+X this month"
Total Views	Prisma DB / GA4	Total article view count
Engagement	Prisma DB	Comments + shares combined

6 Status Cards:

Card	Source	Clickable?
Pending Review	Prisma DB (Article.status = pending_review)	Yes -- opens filtered content page
Drafts	Prisma DB (Article.status = draft)	Yes -- opens filtered content page
Published (7d)	Prisma DB	No
Comments Queue	Prisma DB (Comment.status = pending)	Yes -- opens moderation page
Flagged	Prisma DB (Comment.status = flagged)	Yes -- opens moderation page
New Reports	Prisma DB (ContentReport.status = open)	Yes -- opens moderation page

### 3-Column Section:

- Most Popular articles (by view count)
- Under Review articles (pending editorial review)
- Quick Actions (New Article, Moderation, Analytics)

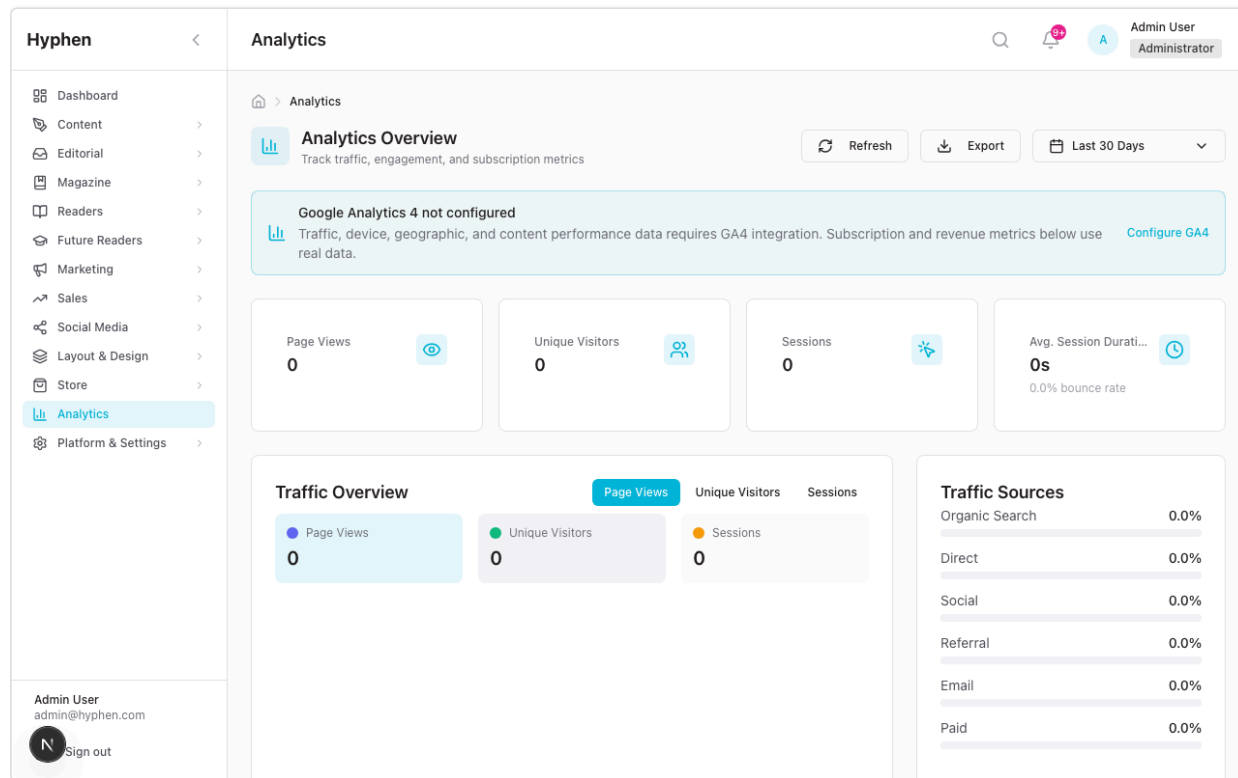
### Social Overview Widget:

- Scheduled Today / This Week / Failed post counts
- Quick links to Compose Post and Social Analytics

### Recently Published:

- Last 6 published articles with views, comments, shares

## 6. Analytics Overview Page — Deep Metrics



The analytics overview page with detailed traffic, subscription, content, and geographic metrics.

### Location

Admin Console > Analytics

### Controls

- **Date Range Picker:** 7d, 30d (default), 90d, 12m, Custom
- **Refresh Button:** Reloads all data
- **Export Button:** Downloads CSV report (requires ANALYTICS\_EXPORT permission)

## Section Layout

Section	Position	Data Source	Description
Key Metrics Cards	Top row	GA4	Page Views, Unique Visitors, Sessions, Avg. Session Duration -- each with % change vs previous period
Traffic Chart	Left 2/3	GA4	Time-series line chart with toggleable lines (Page Views, Unique Visitors, Sessions)
Traffic Sources	Right 1/3	GA4	Channel breakdown bars (Organic, Direct, Social, Referral, Email, Paid)
Subscription Metrics	Left half	Prisma	Total Subscribers, New Subscribers, Churn Rate, MRR, plan breakdown, subscriber trend sparkline, Conversion Rate, ARPU, LTV
Top Content	Right half	GA4	Table: Rank, Title, Page Views, Time on Page, Shares, Comments
Paywall Conversion Funnel	Left half	GA4	4-stage funnel: Paywall Viewed -> Clicked Subscribe -> Subscription Started -> Subscription Completed
Scroll Depth Distribution	Right half	GA4	Estimated distribution at 25%, 50%, 75%, 100% thresholds
Device Breakdown	Left 1/3	GA4	Desktop / Mobile / Tablet percentages
Top Countries	Right 1/3	GA4	Top 5 countries with flag icons and percentage
GA4 Link Banner	Bottom	--	"Need more detailed analytics?" link to Google Analytics

## [7. Paywall Conversion Funnel](#)

### [What It Tracks](#)

The paywall funnel measures the step-by-step conversion journey from seeing a paywall to completing a paid subscription.

Stage	GA4 Event	Description	Example Count
Paywall Viewed	paywall_view	Reader saw a paywall overlay or gate	10,000
Clicked Subscribe	paywall_click_subscribe	Reader clicked the "Subscribe" CTA on a paywall	2,500 (25% of stage 1)
Subscription Started	subscribe_start	Reader began the checkout process	1,200 (12% of stage 1)
Subscription Completed	subscribe_complete	Reader completed payment and subscription activated	450 (4.5% of stage 1)

### [How to Read the Funnel](#)

- The conversion rate shown at each stage is relative to the top of the funnel (stage 1)
- A healthy paywall funnel converts 2-5% of paywall views to completed subscriptions
- Large drop-offs between stages indicate friction points:
  - Big drop between "Viewed" and "Clicked Subscribe" = paywall messaging isn't compelling
  - Big drop between "Started" and "Completed" = checkout friction (price, payment method, UX)

### [Data Source](#)

GA4 Data API -- server-side query aggregating custom event counts over the selected date range.

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## [8. Registration Funnel](#)

### [What It Tracks](#)

The registration funnel measures how effectively the platform converts anonymous visitors to active subscribers.

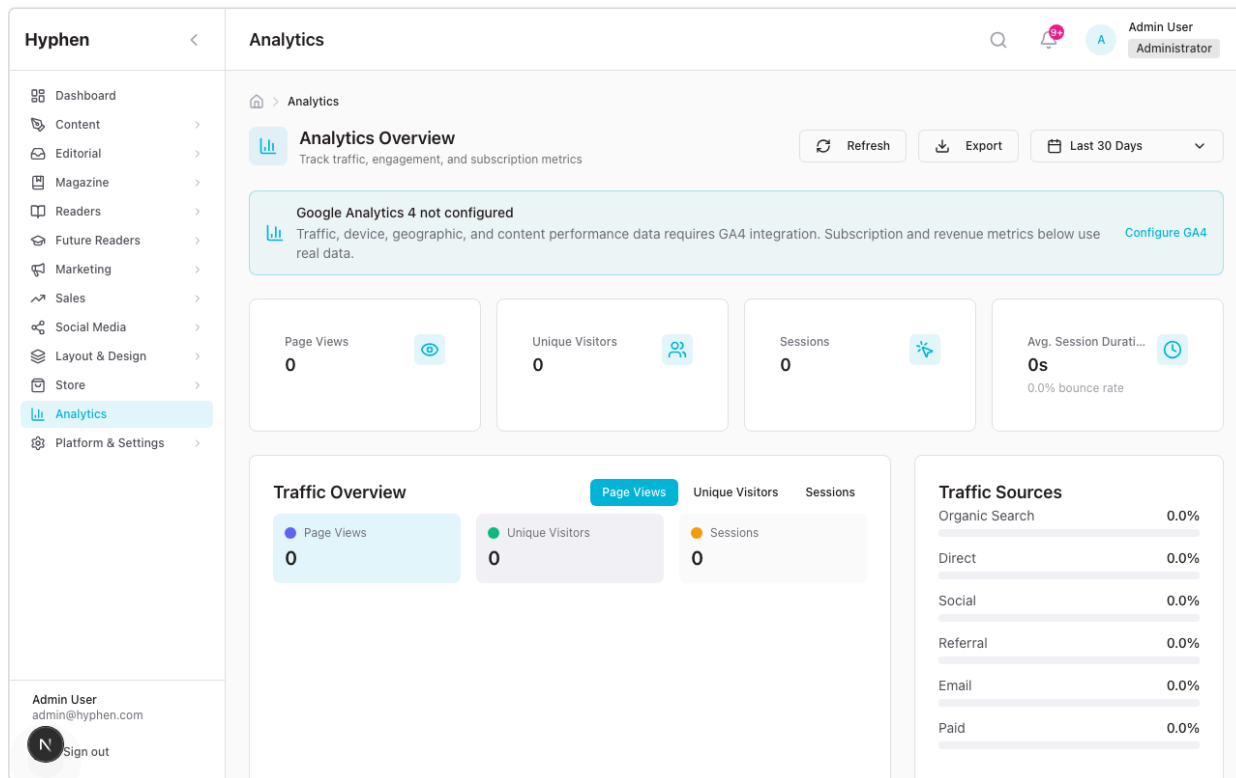
Stage	Data Source	Description
Total Visitors	GA4	Unique visitors in the period
Registered	Prisma DB	Readers who created an account
Verified	Prisma DB	Readers who verified their email
Active Subscribers	Prisma DB	Readers with active paid subscriptions

### [API Endpoint](#)

```
GET /api/analytics/registration-funnel?days=30
```

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## 9. Subscription & Revenue Metrics



Track active subscribers, MRR, churn rate, and conversion funnel metrics.

### Metrics Displayed

Metric	Definition	Source
Total Subscribers	Active + recently cancelled subscribers	Prisma: Subscription table
Active Subscribers	Currently paying subscribers	Prisma: Subscription.status = ACTIVE
New Subscribers	Subscriptions created in the current month	Prisma: Subscription.createdAt within month
Cancelled Subscribers	Subscriptions cancelled in the period	Prisma: Subscription.status = CANCELED
Churn Rate	(Cancelled / Total) as percentage	Calculated
MRR (Monthly Recurring Revenue)	Sum of monthly subscription payments	Prisma: Payment table aggregation
ARR (Annual Recurring Revenue)	MRR x 12	Calculated
ARPU (Avg Revenue Per User)	MRR / Active Subscribers	Calculated
LTV (Lifetime Value)	ARPU / Monthly Churn Rate	Calculated (estimated)
Conversion Rate	Trial-to-paid conversion percentage	Prisma: Subscription.status transitions

### Revenue by Plan Breakdown

Shows subscriber distribution and revenue contribution per plan (e.g., "Digital Only: 45%, Print+Digital: 30%, Annual: 25%").

## [Revenue Trend](#)

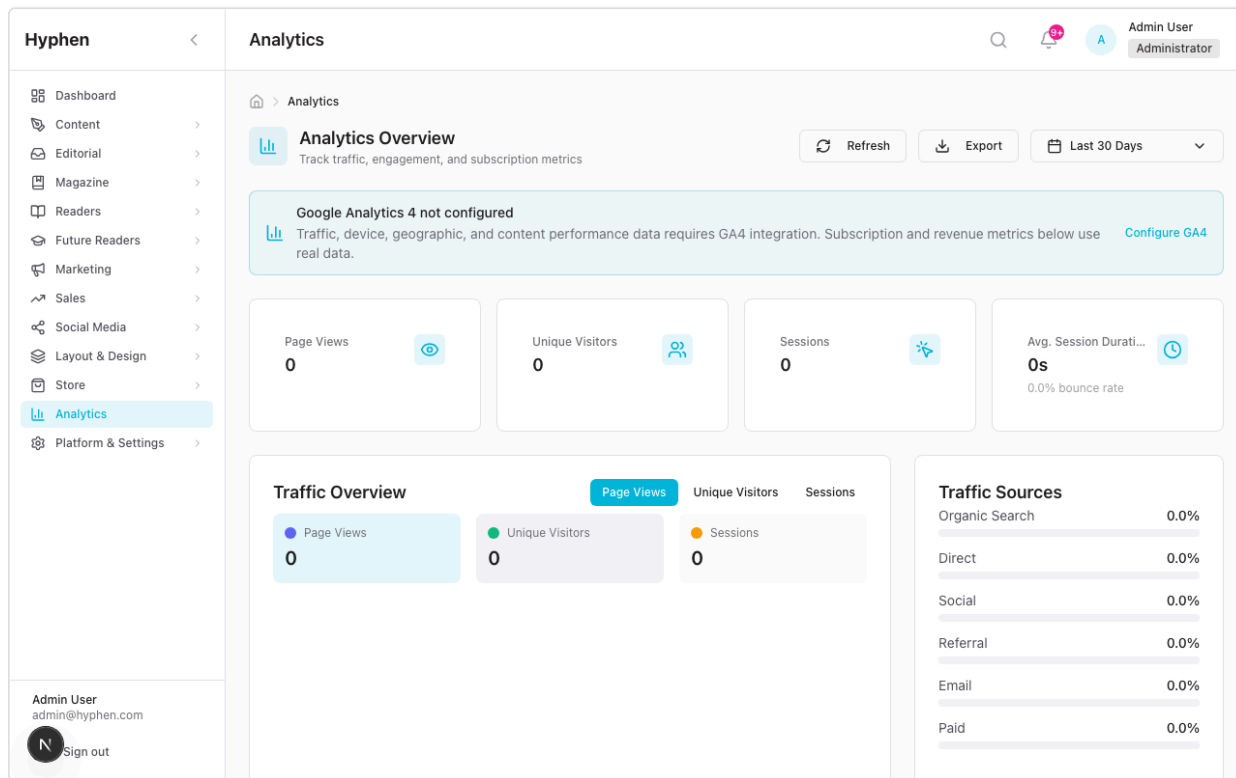
Monthly time-series chart of revenue, showing growth trajectory.

## [API Endpoint](#)

```
GET /api/analytics/subscription-metrics
```

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## 10. Content Performance Analytics



View per-article metrics including pageviews, read time, engagement rate, and social shares.

### Metrics Per Article

Metric	Source	Description
Page Views	GA4	Total times the article was loaded
Active Users	GA4	Unique readers who viewed the article
Avg. Engagement Time	GA4	Average time spent reading
Scroll Depth	GA4	Distribution at 25/50/75/100% thresholds

### Top Content Table

Ranked list showing the highest-performing articles by page views, with time-on-page, shares, and comments.

### Author Statistics

GET /api/analytics/author-stats — Per-author metrics for editorial performance review.

### API Endpoint

GET /api/analytics/content-performance



## [11. Traffic Source Analysis](#)

### [Channels Tracked](#)

Channel	How It's Identified	Example
Organic Search	Visitors from search engines (Google, Bing)	google / organic
Direct	Visitors who typed URL or used bookmark	(direct) / (none)
Social	Visitors from social media links	facebook / social, twitter / social
Referral	Visitors from other websites linking to you	blog.example.com / referral
Email	Visitors from email links (UTM tagged)	newsletter / email
Paid	Visitors from paid advertising	google / cpc, facebook / paid

### [UTM Attribution from Conversion Surfaces](#)

When readers click a conversion surface CTA, the URL is automatically tagged with:

- `utm_source=conversion_surface`
- `utm_medium=promo`
- `utm_campaign=cs_{goal}_{surfaceId}`

This appears in GA4 traffic source reports, allowing you to measure the direct impact of conversion surfaces on subscriptions.

### [API Endpoint](#)

`GET /api/analytics/traffic-sources`

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## 12. Device & Browser Analytics

### Device Categories

- **Desktop** (screen > 1024px)
- **Mobile** (screen < 768px)
- **Tablet** (768-1024px)

### Browser Distribution

Top browsers by usage (Chrome, Safari, Firefox, Edge, etc.)

### Operating Systems

Distribution across Windows, macOS, iOS, Android, Linux.

### API Endpoint

```
GET /api/analytics/device-browser
```

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## [13. Institutional Usage Reporting](#)

### [What It Tracks](#)

For each institution with an active subscription:

Metric	Description
Seats Used / Total	How many assigned seats are actively logging in
Utilization Rate	(Active users / Total seats) as percentage
Active Users	Users who logged in during the period
Content Accessed	Number of articles/issues accessed

### [Use Case](#)

Sales and customer success teams use this data to:

- Identify underutilized institutional accounts for engagement outreach
- Prepare usage reports for institutional renewal conversations
- Upsell additional seats to institutions with high utilization

### [API Endpoint](#)

```
GET /api/analytics/institutional-usage
```

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## 14. Social Media Analytics

### Location

Admin Console > Social > Analytics

### Tabs

1. **Performance** -- Impressions, Reach, Engagements, Engagement Rate, Posts Published, Likes, Comments, Clicks
2. **Content** -- Per-post performance breakdown
3. **Growth** -- Follower growth trends
4. **Best Times** -- Optimal posting time recommendations based on engagement data
5. **Executive** -- Summary view for leadership (requires SOCIAL\_EXECUTIVE\_READ permission)

### Metrics

Metric	Description
Total Impressions	Times posts were displayed
Total Reach	Unique people who saw posts
Total Engagements	Likes + comments + shares + clicks
Avg. Engagement Rate	Engagements / Impressions
Posts Published	Number of posts in the period
Follower Growth	Net new followers

## [15. Data Export & Reporting](#)

### [Export Formats](#)

- **CSV** -- Comma-separated values for spreadsheet analysis
- **JSON** -- Machine-readable format for programmatic use

### [Available Exports](#)

Export	Contents
Traffic	Page views, visitors, sessions by date
Subscriptions	Subscriber counts, MRR, churn by month
Revenue	Revenue by month and by plan
Content	Top articles with page views, engagement time

### [How to Export](#)

1. Navigate to **Analytics** page
2. Set the desired date range
3. Click the **Export** button (top-right)
4. CSV file downloads automatically

### [Permission Required](#)

`ANALYTICS_EXPORT` permission

### [API Endpoint](#)

```
GET /api/analytics/export?type=subscriptions&format=csv&days=30
```

## 16. Cookie Consent & Privacy

### How It Works

1. **GoogleAnalytics** component loads with `analytics_storage: denied` by default
2. **CookieConsent** component shows a banner asking the reader to accept cookies
3. If reader accepts, consent is stored in `localStorage` as `hyphen_cookie_consent: accepted`
4. On subsequent visits, `analytics_storage` is set to `granted` based on stored consent
5. If reader does not accept, GA4 events are still queued but not sent to Google

### Impact on Analytics

- Readers who decline cookies will NOT generate GA4 data
- This means page views, scroll depth, and all custom events from those readers are invisible
- Internal platform data (subscriptions, reading history, bookmarks) is NOT affected by cookie consent -- it's recorded via authenticated API calls

### Privacy Compliance

- Cookie consent follows GDPR principles
  - No tracking cookies set before consent
  - Consent status persisted only in `localStorage` (not server-side)
-

## [17. Scroll Depth & Reading Engagement Tracking](#)

### [How Scroll Tracking Works](#)

The `observeScrollDepth()` function in the Reader Portal:

1. Attaches a passive scroll event listener when an article page mounts
2. Calculates scroll percentage: `(window.scrollY / (scrollHeight - windowHeight)) * 100`
3. Fires `article_scroll_depth` at each milestone (25%, 50%, 75%, 100%)
4. Each milestone fires exactly once per page load
5. At 100%, also fires `article_read_complete` with total read time in seconds

### [What the Admin Sees](#)

In the Analytics Overview page, the **Scroll Depth Distribution** section shows estimated percentages:

- % of readers who scrolled to 25%
- % of readers who scrolled to 50%
- % of readers who scrolled to 75%
- % of readers who scrolled to 100% (completed reading)

### [Reading Progress \(Internal Tracking\)](#)

Separately from GA4, the `ReadingTracker` component:

- POSTs reading progress to `/api/account/history/[articleId]` at milestones (0/25/50/75/100%)
  - Tracks `progress`, `scrollTop`, `timeSpentSec`
  - Records `startedAt`, `lastReadAt`, `completedAt` in the ReadingHistory table
  - This powers the reader's **Reading History** page and the **Implicit Preference Learning** system
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## 18. Conversion Surface Analytics

See the dedicated [Conversion Surfaces Feature Description](#) for full details.

Summary of analytics integration:

- **5 GA4 events:** impression, click, dismiss, conversion, coupon\_copied
  - **Internal ConversionEvent table:** every interaction recorded with reader context
  - **Denormalized counters** on each surface: impressionCount, clickCount, dismissCount, conversionCount
  - **Admin stats dashboard:** totals, rates, time-series, device breakdown, top pages, UTM source breakdown
  - **UTM attribution:** all CTA URLs auto-tagged for GA4 campaign tracking
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## 19. User Stories

### For Editors

ID	As a...	I want to...	So that...
US-01	Editor	See which articles are most read this week	I can commission similar content
US-02	Editor	Know what percentage of readers finish articles	I can assess if article length is appropriate
US-03	Editor	See which sections have the most traffic	I can allocate editorial resources accordingly

### For Product Managers

ID	As a...	I want to...	So that...
US-04	Product Manager	Track the paywall conversion funnel end-to-end	I can identify and fix friction points
US-05	Product Manager	Monitor MRR and subscriber growth monthly	I can report business health to stakeholders
US-06	Product Manager	See the registration-to-subscription conversion rate	I can measure the effectiveness of the onboarding flow
US-07	Product Manager	Compare traffic between date ranges	I can measure the impact of marketing campaigns

### For Marketing

ID	As a...	I want to...	So that...
US-08	Marketing Manager	See which traffic sources drive the most subscribers	I can allocate budget to the best channels
US-09	Marketing Manager	Track conversion surface performance (impressions, clicks, conversions)	I can optimize promotional overlays
US-10	Marketing Manager	Know what percentage of traffic comes from social media	I can justify social media investment
US-11	Marketing Manager	Export analytics data as CSV	I can create custom reports for stakeholders

### For Sales / Customer Success

ID	As a...	I want to...	So that...
US-12	Sales Manager	See institutional subscription utilization rates	I can identify accounts at risk of churn
US-13	Customer Success	Generate usage reports per institution	I can share data during renewal conversations

[For QA](#)

ID	As a...	I want to...	So that...
US-14	QA Engineer	Verify GA4 events fire correctly on the Reader Portal	I can confirm the analytics pipeline is working
US-15	QA Engineer	Confirm the Admin Console displays real data when GA4 is configured	I can validate the full data flow
US-16	QA Engineer	Verify that declining cookie consent suppresses GA4 tracking	I can confirm privacy compliance

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## 20. Use Cases & Scenarios

### Scenario 1: Monitoring a New Issue Launch

**Context:** New magazine issue published this week. Editor wants to measure reader response.

**Steps:**

1. Open **Dashboard** -- check "Published (7d)" card for the new issue's articles
2. Open **Analytics** -- set date range to "7d"
3. Check **Key Metrics** -- expect a spike in Page Views and Unique Visitors
4. Check **Top Content** -- new issue's articles should appear in the top 10
5. Check **Scroll Depth** -- look for high completion rates (75-100%) indicating engaged readers
6. Check **Paywall Funnel** -- if issue articles are premium, expect funnel activity

### Scenario 2: Evaluating a Marketing Campaign

**Context:** Marketing ran a Facebook campaign to drive subscriptions.

**Steps:**

1. Open **Analytics** -- set date range to cover the campaign period
2. Check **Traffic Sources** -- "Social" percentage should be higher than baseline
3. Open GA4 directly -- filter by `utm_source=facebook` to see campaign-specific metrics
4. Check **Subscription Metrics** -- look for a spike in "New Subscribers"
5. If conversion surfaces were used, check their stats for UTM attribution (`utm_campaign=cs_subscribe_paid_*`)

### Scenario 3: Institutional Renewal Preparation

**Context:** Sales team preparing for an institutional subscription renewal meeting.

**Steps:**

1. Open **Analytics > Institutional Usage**
2. Find the institution by name
3. Note: seats used vs total, utilization rate, most active users
4. **Export** the data as CSV for the renewal proposal
5. If utilization is low, recommend engagement strategies; if high, propose additional seats

## Scenario 4: Diagnosing a Conversion Drop

**Context:** MRR has dropped this month. Need to diagnose why.

**Steps:**

1. Open **Analytics** -- compare 30d vs previous 30d
  2. Check **Subscription Metrics** -- is churn rate up, or are new subscribers down?
  3. Check **Paywall Funnel** -- are fewer people seeing paywalls (traffic drop)? Or is the funnel leaking?
  4. Check **Traffic Sources** -- has any channel dropped significantly?
  5. Check **Top Content** -- is popular content shifting away from premium articles?
  6. Check **Device Breakdown** -- is a mobile issue causing bounce rate increases?
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## 21. QA Test Scenarios — Comprehensive Checklist

### A. GA4 Event Tracking (Reader Portal)

#	Scenario	Steps	Expected Result	Priority
A1	page_view fires on navigation	Open any page on Reader Portal, check GA4 debug	page_view event with page_path	P0
A2	article_view fires	Open an article page	article_view with article_slug, article_section	P0
A3	article_scroll_depth 25%	Scroll to 25% of article	article_scroll_depth with scroll_depth: 25	P0
A4	article_scroll_depth 50%	Scroll to 50%	scroll_depth: 50	P1
A5	article_scroll_depth 75%	Scroll to 75%	scroll_depth: 75	P1
A6	article_scroll_depth 100% + read_complete	Scroll to bottom	Both article_scroll_depth (100) and article_read_complete with read_time_seconds	P0
A7	paywall_view fires	Visit premium article as anonymous	paywall_view with article_slug	P0
A8	paywall_click_subscribe fires	Click "Subscribe" on paywall	paywall_click_subscribe with article_slug	P0
A9	subscribe_start fires	Begin checkout	subscribe_start with plan_name, plan_price	P1
A10	subscribe_complete fires	Complete payment	subscribe_complete with plan_name, payment_method	P1
A11	shop_product_view fires	Open shop product page	shop_product_view with product details	P1
A12	shop_add_to_cart fires	Click Add to Cart	shop_add_to_cart with product and quantity	P1
A13	shop_checkout_start fires	Click Checkout	shop_checkout_start with cart value	P1
A14	newsletter_view fires	Open newsletter edition	newsletter_view with slug	P2
A15	newsletter_scroll_depth fires	Scroll newsletter to 50%	newsletter_scroll_depth with depth	P2
A16	Conversion surface events	Trigger a conversion surface	impression, click, dismiss, conversion events all fire	P1
A17	coupon_copied fires	Copy coupon code from surface	coupon_copied with code	P2
A18	Scroll milestones fire once only	Scroll article up and down repeatedly	Each milestone (25/50/75/100) fires exactly once	P1

## B. Cookie Consent & Privacy

#	Scenario	Steps	Expected Result	Priority
B1	Cookie banner appears	Visit Reader Portal in incognito	Cookie consent banner visible	P0
B2	Accept cookies	Click "Accept" on cookie banner	<code>hyphen_cookie_consent: accepted</code> in localStorage, GA4 events fire	P0
B3	Decline cookies	Click "Decline" (if available)	GA4 events NOT sent to Google	P1
B4	Consent persists	Accept cookies, close tab, reopen	Banner does not reappear, GA4 tracking active	P1
B5	GA4 script present	Check page source	gtag.js loaded with correct Measurement ID	P0

## C. Admin Dashboard

#	Scenario	Steps	Expected Result	Priority
C1	Dashboard loads	Login to Admin Console	Welcome card + 4 stat cards + status cards	P0
C2	Stats show real data	Verify articles, subscribers, views, engagement	Numbers match database counts	P1
C3	Clickable cards navigate	Click "Pending Review" card	Opens Content page filtered to pending_review	P1
C4	Most Popular shows articles	Check Most Popular column	Top articles by view count displayed	P1
C5	Social overview shows	Check Social Overview widget	Scheduled/This Week/Failed counts	P2

## D. Analytics Overview Page

#	Scenario	Steps	Expected Result	Priority
D1	Analytics page loads	Click Analytics in sidebar	Page renders with all sections	P0
D2	Date range: 7d	Select 7d in date picker	All metrics update for last 7 days	P0
D3	Date range: 30d	Select 30d (default)	All metrics for last 30 days	P0
D4	Date range: custom	Select custom dates	Metrics update for selected range	P1
D5	Key metrics cards show data	Check 4 top cards	Page Views, Unique Visitors, Sessions, Avg Duration with % change arrows	P0
D6	Traffic chart renders	Check line chart	Time-series with toggleable lines	P1
D7	Traffic sources show	Check Traffic Sources card	Percentage bars for each channel	P1
D8	Subscription metrics	Check Subscription section	Total, New, Churn Rate, MRR visible	P0
D9	Plan breakdown	Check By Plan section	Subscriber distribution across plans	P1
D10	Top content table	Check Top Content	Ranked articles with views, time, shares, comments	P1
D11	Paywall funnel renders	Check Paywall Conversion Funnel	4 stages with counts and conversion rates	P1
D12	Scroll depth section	Check Content Engagement	25/50/75/100% distribution bars	P1
D13	Device breakdown	Check Device Breakdown	Desktop/Mobile/Tablet percentages	P1
D14	Top countries	Check Top Countries	Country list with flags and percentages	P2
D15	Refresh button	Click Refresh icon	All data reloads, icon spins during loading	P2

## E. Data Export

#	Scenario	Steps	Expected Result	Priority
E1	CSV export works	Click Export on Analytics page	CSV file downloads with traffic + subscription data	P1
E2	Export with date range	Set 7d, then export	CSV contains only last 7 days of data	P1
E3	Export permission required	Login as user without ANALYTICS_EXPORT	Export button not visible	P2

## F. GA4 Connection & Configuration

#	Scenario	Steps	Expected Result	Priority
F1	GA4 not configured	No GA4 env vars set	Analytics page shows placeholder/empty data, no errors	P0
F2	GA4 configured	GA4 env vars set correctly	Real data appears from GA4	P0
F3	GA4 connection error	Set invalid GA4 credentials	Graceful fallback to empty data, no crash	P1
F4	Subscription data always works	GA4 down or unconfigured	Subscription metrics still show (from Prisma DB)	P0

## G. Permission Controls

#	Scenario	Steps	Expected Result	Priority
G1	No analytics permission	Login as user without analytics:read	"Access Restricted" with lock icon	P1
G2	Read-only permission	Login with analytics:read only	Page visible, Export button hidden	P1
G3	Full permission	Login as admin	All features accessible including export	P1
G4	Social analytics permission	Login without social:analytics:read	Social Analytics page shows access denied	P2

## H. Institutional Usage

#	Scenario	Steps	Expected Result	Priority
H1	Institutional metrics load	Navigate to Institutional Usage	List of institutions with utilization data	P1
H2	Usage reflects real data	Check seat counts and active users	Matches database records	P2

## I. Edge Cases

#	Scenario	Steps	Expected Result	Priority
I1	Empty state (no data)	Fresh install with no readers or content	All sections show empty/zero state, no errors	P1
I2	Large date range (12m)	Select 12 months	Charts render without performance issues	P2
I3	GA4 partial data	GA4 has traffic data but not scroll events	Available data shows, missing data shows "No data"	P2
I4	Multiple browser tabs	Open Analytics in 2 tabs simultaneously	Both tabs load correctly	P2

## 22. Known Limitations

Limitation	Description	Impact
GA4 data delay	GA4 Data API can have 24-48 hour lag for some metrics	Recent data may not reflect the very latest activity
No real-time traffic dashboard	Real-time monitoring shows placeholder data	Use GA4 real-time view directly for live monitoring
Cookie consent reduces data	Readers who decline cookies are invisible to GA4	Traffic numbers may undercount actual visitors
Traffic trend chart not fully wired	<code>fetchTrafficTrend()</code> returns empty array	Time-series chart may show flat or no data
Geo data not fully wired	<code>fetchGeoData()</code> returns empty array	Top Countries may show limited data
PDF export is placeholder	<code>generatePDFReport()</code> returns placeholder data	Only CSV export is functional
No A/B test analytics	No built-in A/B testing framework	Use GA4's built-in experiments for A/B testing
Scroll depth is page-level	Scroll tracking measures page scroll, not article content scroll	For very long pages with headers/footers, 100% may not mean "finished article"
Social analytics depends on API connections	Social data only appears when Meta/X APIs are connected	Must configure social integrations first
Some GA4 events not yet wired to all call sites	See section 22.1 below for details	Certain GA4 events will not fire until wiring is completed

### 22.1 GA4 Event Wiring Status

All GA4 tracking functions are defined in `reader-portal/src/lib/analytics.ts`. However, not all functions are called from every relevant component. The table below shows current wiring status:

Event	Function Defined	Wired to Components	Status
article_scroll_depth	Yes	Yes -- <code>observeScrollDepth()</code> used in article templates	Fully wired
article_read_complete	Yes	Yes -- fires at 100% scroll milestone	Fully wired
newsletter_view	Yes	Yes -- <code>NewsletterEditionDetail</code> <code>useEffect</code>	Fully wired
newsletter_scroll_depth	Yes	Yes -- <code>observeNewsletterScrollDepth()</code> in <code>NewsletterEditionDetail</code>	Fully wired
newsletter_read_complete	Yes	Yes -- fires at 100% newsletter scroll	Fully wired
newsletter_share	Yes	Yes -- <code>NewsletterEditionDetail</code> share handler	Fully wired
newsletter_list_view	Yes	Yes -- <code>NewsletterEditionGrid</code> <code>useEffect</code>	Fully wired
conversion_surface_impression	Yes	Yes -- <code>ConversionSurfaceRenderer</code> + <code>InlineEmbedSurface</code>	Fully wired
conversion_surface_click	Yes	Yes -- <code>ConversionSurfaceProvider</code>	Fully wired
conversion_surface_dismiss	Yes	Yes -- <code>ConversionSurfaceProvider</code>	Fully wired
conversion_surface_conversion	Yes	Yes -- <code>ConversionSurfaceProvider</code>	Fully wired
coupon_copied	Yes	Yes -- all 5 surface components	Fully wired
article_view	Yes	Not yet wired to article page templates	Pending
paywall_view	Yes	Not yet wired to <code>PaywallOverlay/ArticlePaywallGate</code>	Pending
paywall_click_subscribe	Yes	Not yet wired to paywall CTA handlers	Pending
subscribe_start	Yes	Not yet wired to checkout page mount	Pending
subscribe_complete	Yes	Not yet wired to payment verification success	Pending
registration_start	Yes	Not yet wired to register page	Pending
newsletter_signup	Yes	Not yet wired to newsletter form submissions	Pending
shop_product_view	Yes	Not yet wired to shop product page	Pending
shop_add_to_cart	Yes	Not yet wired to <code>CartProvider</code> <code>addItem</code>	Pending
shop_checkout_start	Yes	Not yet wired to cart checkout redirect	Pending

### Impact on admin analytics:

- The Paywall Conversion Funnel (Section 7) depends on `paywall_view`, `paywall_click_subscribe`, `subscribe_start`, and `subscribe_complete` events. Until these are wired, the funnel will show zero counts.
- Content Performance scroll depth data works correctly (fully wired via `observeScrollDepth()`).

- **Newsletter analytics** are fully functional.
- **Conversion surface analytics** are fully functional.
- **Shop/e-commerce analytics** will not populate until shop events are wired.

**Note for QA:** When testing the Paywall Funnel and subscription events, expect zero data until the pending events are wired. This is a known implementation gap, not a bug. The tracking functions exist and are correct — they just need to be called from the appropriate component lifecycle hooks.

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## 23. Glossary

Term	Definition
ARR	Annual Recurring Revenue (MRR x 12)
ARPU	Average Revenue Per User (MRR / active subscribers)
Bounce Rate	% of visitors who leave after viewing only one page
Channel	Traffic source category (Organic, Direct, Social, Referral, Email, Paid)
Churn Rate	% of subscribers who cancel in a period
Conversion Rate	% of visitors who complete a desired action
CTR	Click-Through Rate (clicks / impressions x 100)
GA4	Google Analytics 4 -- Google's analytics platform
GA4 Data API	Server-side API for querying GA4 data programmatically
gtag.js	Google's JavaScript tracking library loaded on the Reader Portal
KPI	Key Performance Indicator -- a measurable value showing effectiveness
LTV	Lifetime Value -- estimated total revenue from one subscriber
Measurement ID	GA4 property identifier (format: G-XXXXXXXXXX)
MRR	Monthly Recurring Revenue -- predictable monthly subscription income
Scroll Depth	How far down a reader scrolled (measured at 25/50/75/100%)
Session	A group of interactions in a single visit (ends after 30min inactivity)
UTM	Urchin Tracking Module -- URL parameters for campaign tracking
Utilization Rate	For institutions: active users / total seats

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