

AWS Mobile Web Day

24th March 2016

Hosted by AWS Technical Evangelists, Danilo Poccia & Ian Massingham

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Analyze Mobile App Data and Build Predictive Applications

Sandeep Atluri, Data Scientist, AWS Mobile

“If you can’t measure it ,you can’t improve it”

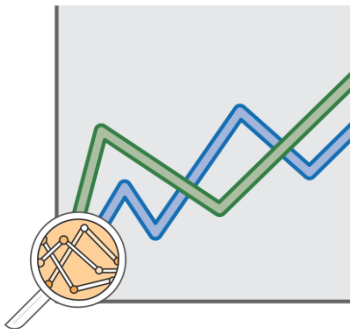
-Lord Kelvin

Three Types of Data Driven Development



Retrospective

reporting to analyze trends and to know what's happening in the business



Inquisitive

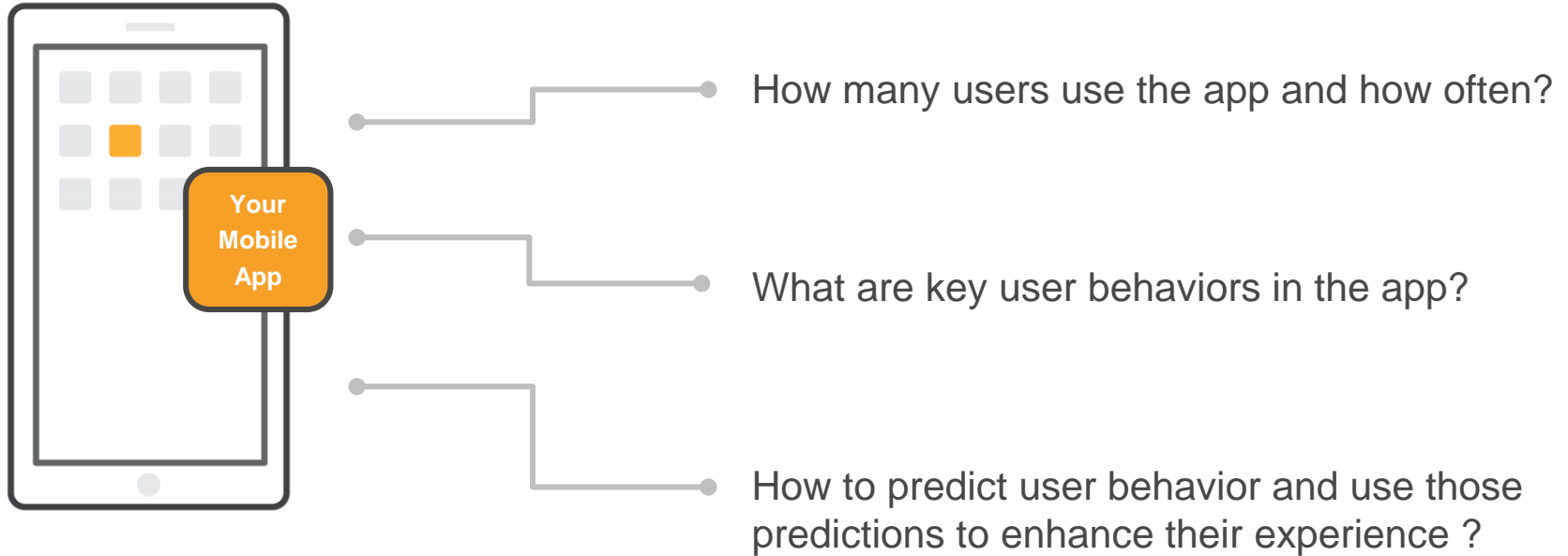
pattern finding to discover latent user behavior and to frame strategies accordingly



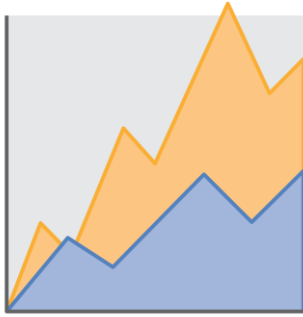
Predictive

applications to anticipate user behavior and to enhance experience

In the Context of a Mobile App

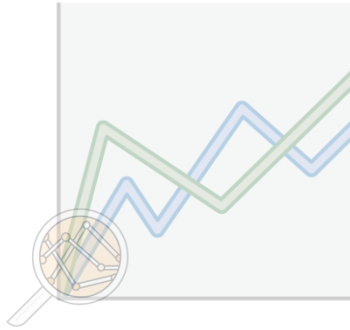


THREE TYPES OF DATA DRIVEN DEVELOPMENT



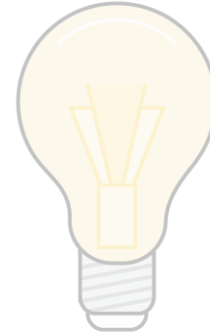
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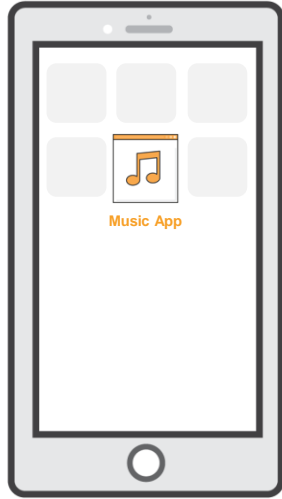
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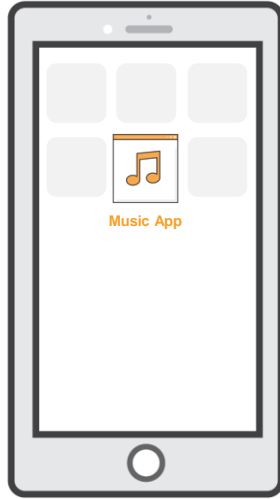


Predictive

applications to anticipate user behavior and to enhance experience



Let's just say you have built a music app



Let's just say you have built a music app

What are some of the questions that would help you analyze trends in the app?

Few Key Questions to Analyze Trends in the App

1

Engagement

How many users use the app daily to listen music ?

How many new users have been acquired to the app ?

How many times users open the app to listen music in a day?

2

Monetization

How many paying users does the app have ?

How much does a average paying user pay ?

3

Retention

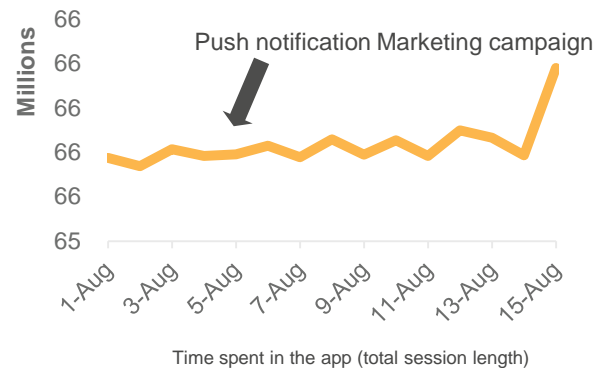
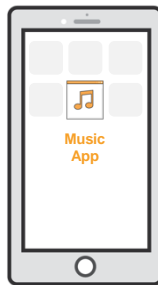
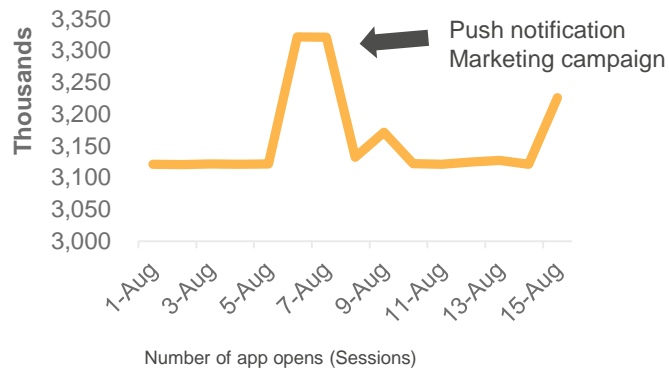
How many people returned to listen music in the first 7 days after they have installed the app ?

4

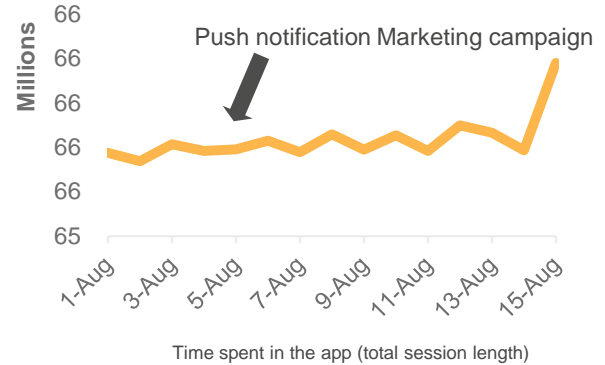
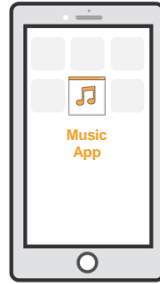
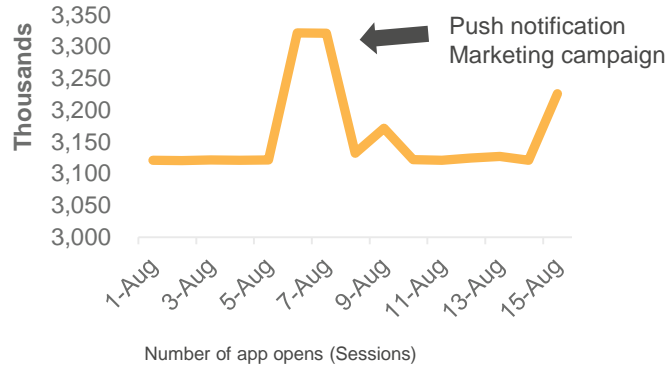
Behavioral

How many users shared or liked a particular artist ?

1 Engagement

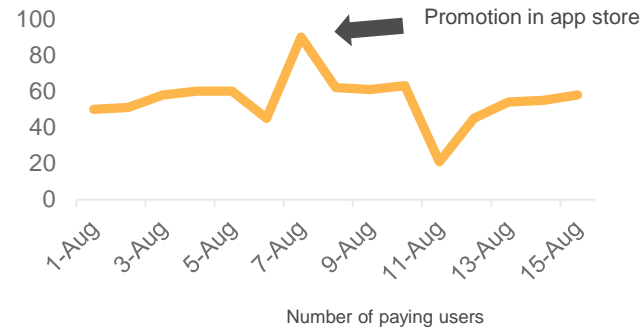
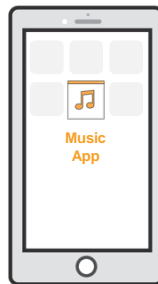
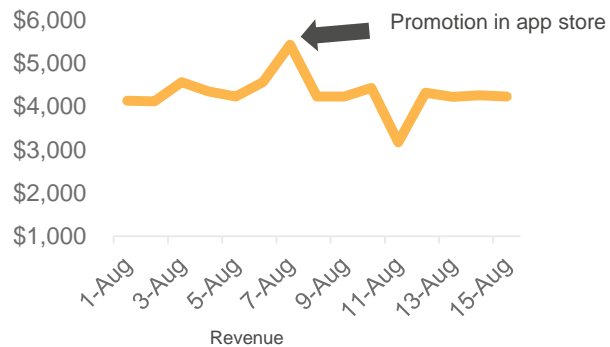


1 Engagement

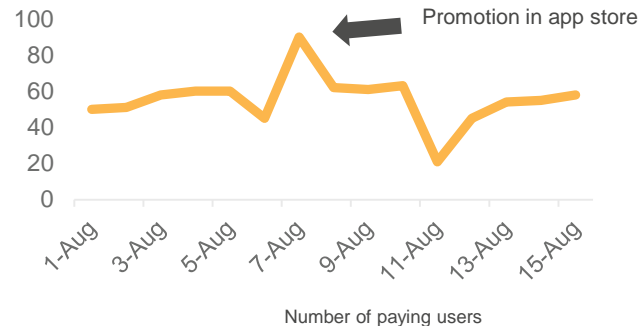
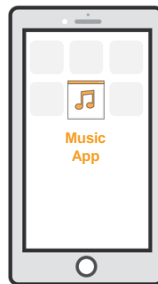
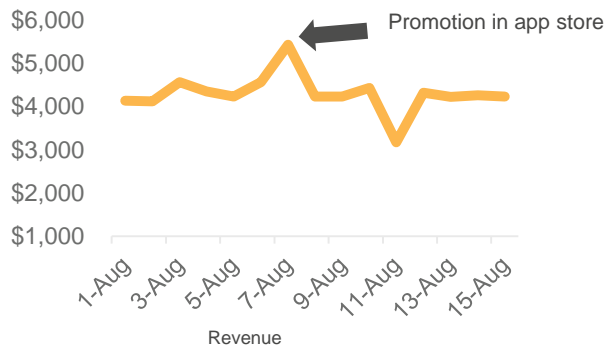


Marketing campaign did successfully improve app opens but did not result in users spending more time in the app

2 Monetization

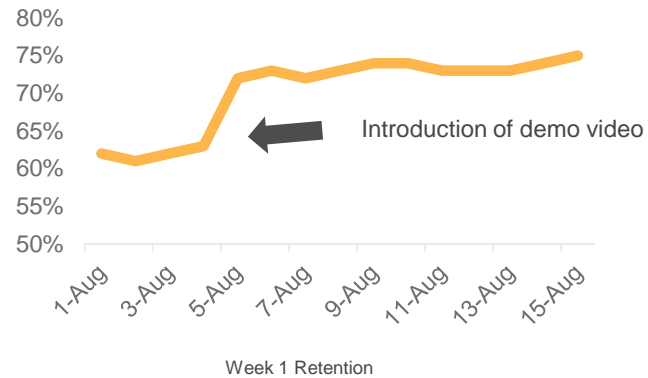
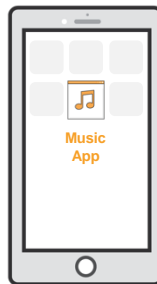
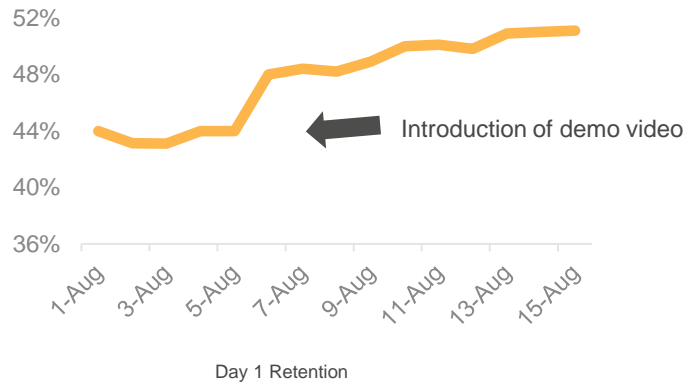


2 Monetization

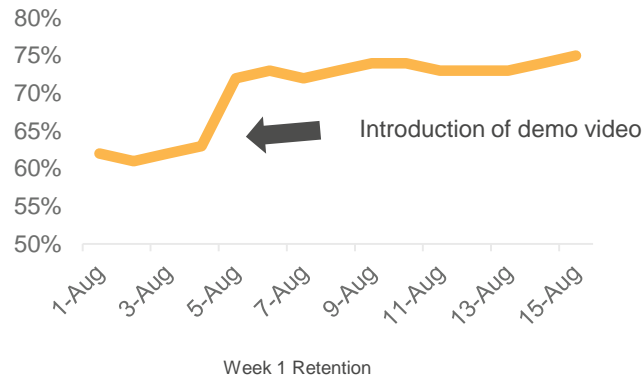
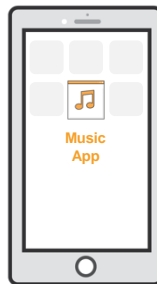
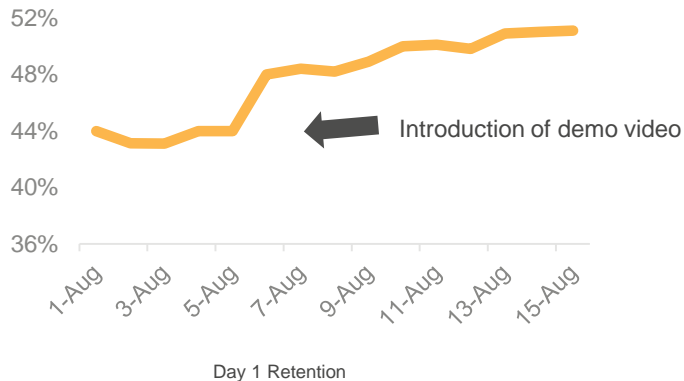


Promotion in the app store increased the over all revenue and more importantly the number of paying users as well

3 Retention

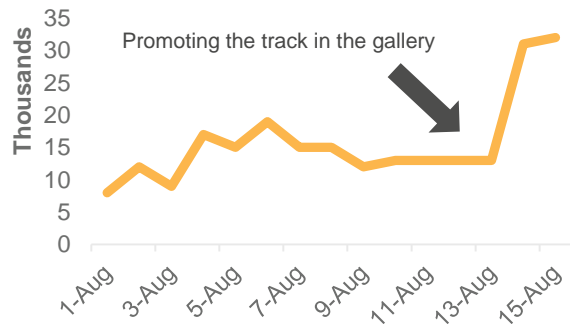


3 Retention

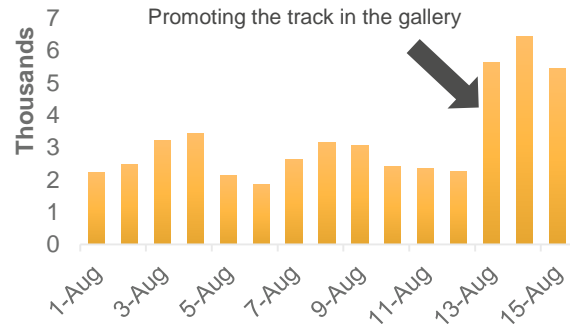
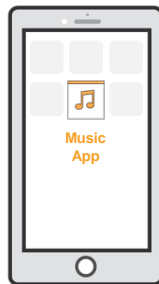


Changing the first time experience in the app has significantly improved retention in the app

4 Behavioral

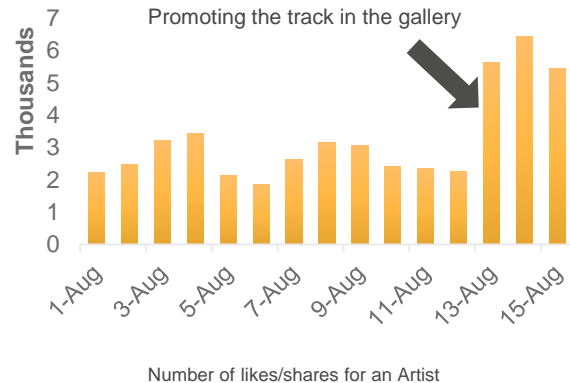
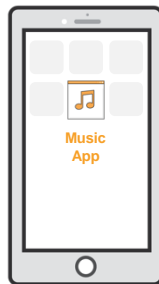
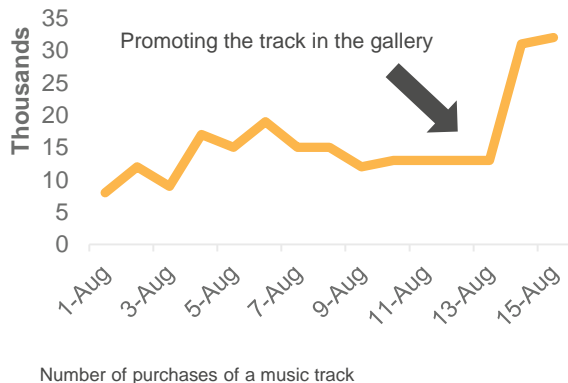


Number of purchases of a music track



Number of likes/shares for an Artist

4 Behavioral



Promoting the track has not only increased purchases for the track but has also increased the number of shares for the artist

Is there a easy way to track all these metrics automatically as soon as users start to use your app ?

Amazon Mobile Analytics

“Collect, visualize and export your app usage data at scale”

1

Fast



Focus on metrics that matter. Usage reports available within 60 minutes of receiving data from an app

2

Scalable and
Generous Free Tier



Scale to billions of events per day from millions of users.

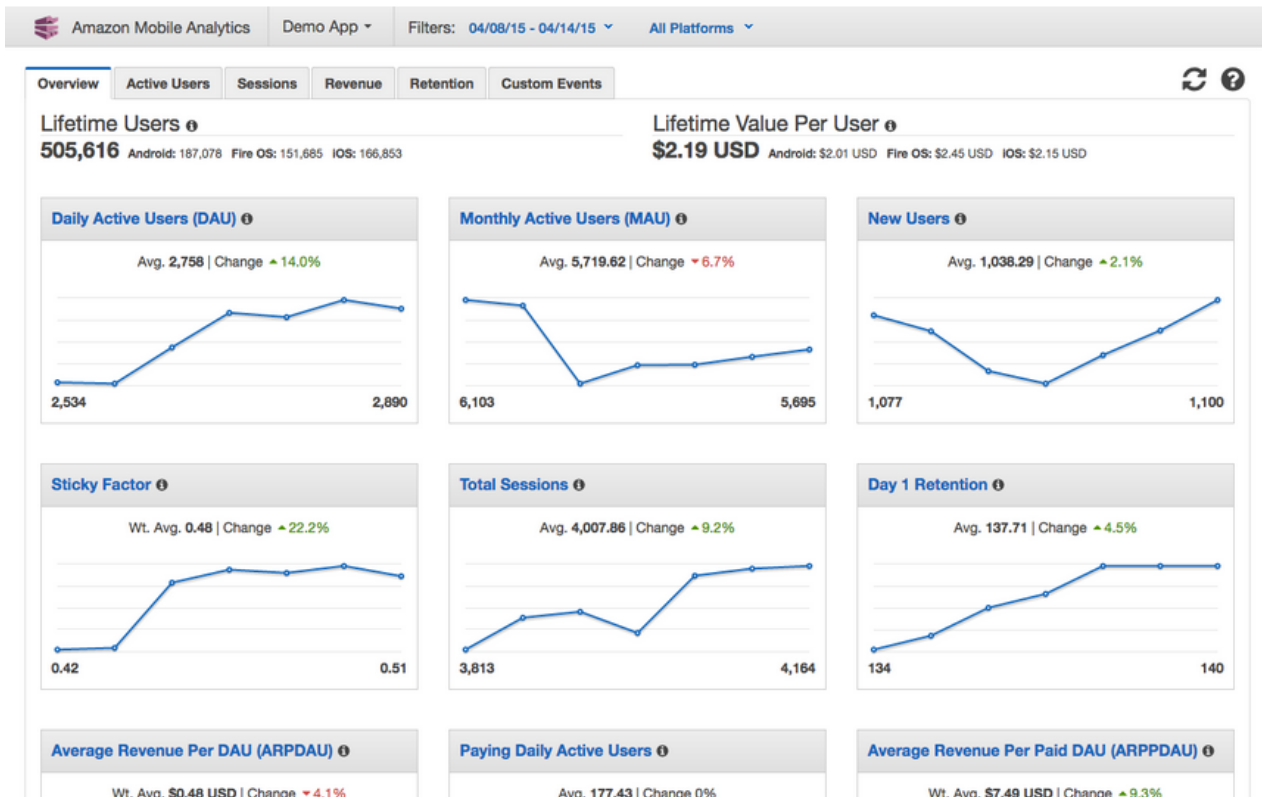
3

Own Your Data



Data collected are not shared, aggregated, or reused

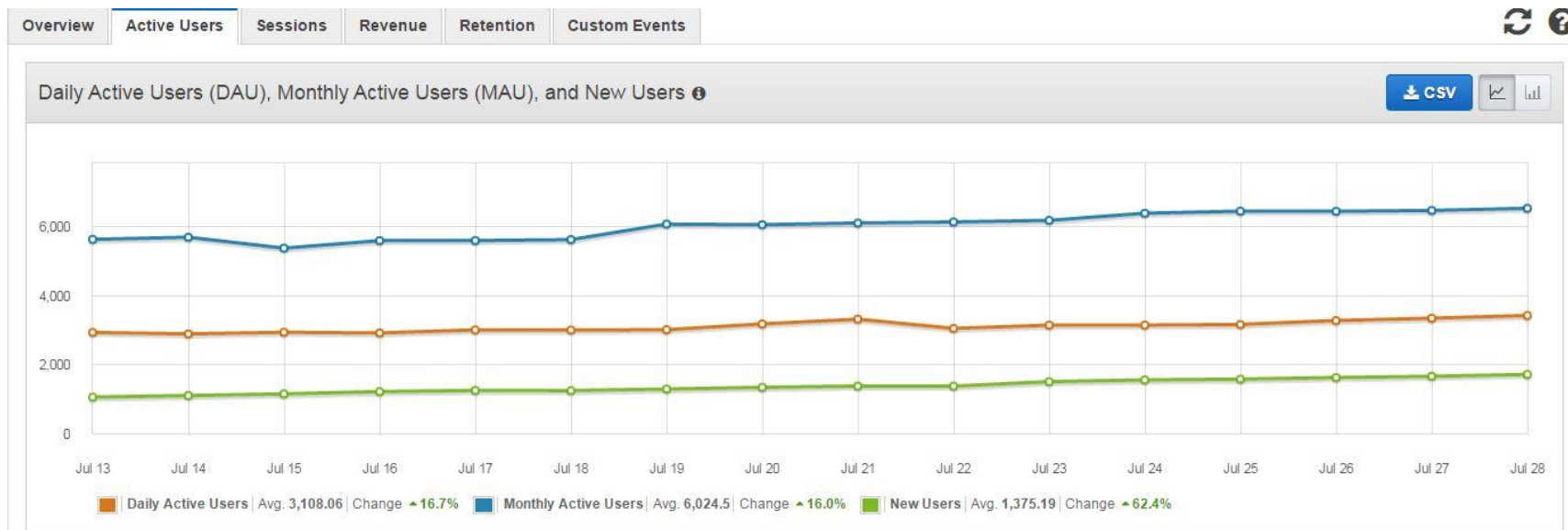
Get Metrics Important for Your App in a Single View



Key Business Metrics

1. Monthly Active Users (MAU)
2. Daily Active Users (DAU)
3. New Users,
4. Daily Sessions
5. Sticky Factor
6. 1-Day Retention
7. Avg. Revenue per DAU
8. Daily Paying Users
9. Avg. Paying DAU

Get a Detailed View of Each Business Metric



Track Unique Behavior to Your App Using Custom Events



Amazon Mobile Analytics

App Name: Demo App ▾

📅 07/19/15 - 08/17/15 ▾

Platforms: All ▾

Overview

Active Users

Sessions

Revenue

Retention

Custom Events



Custom Event Name:

Item_Purchased ▾

Attributes and Metrics:

All ▾

Lifetime Event Occurrences ⓘ

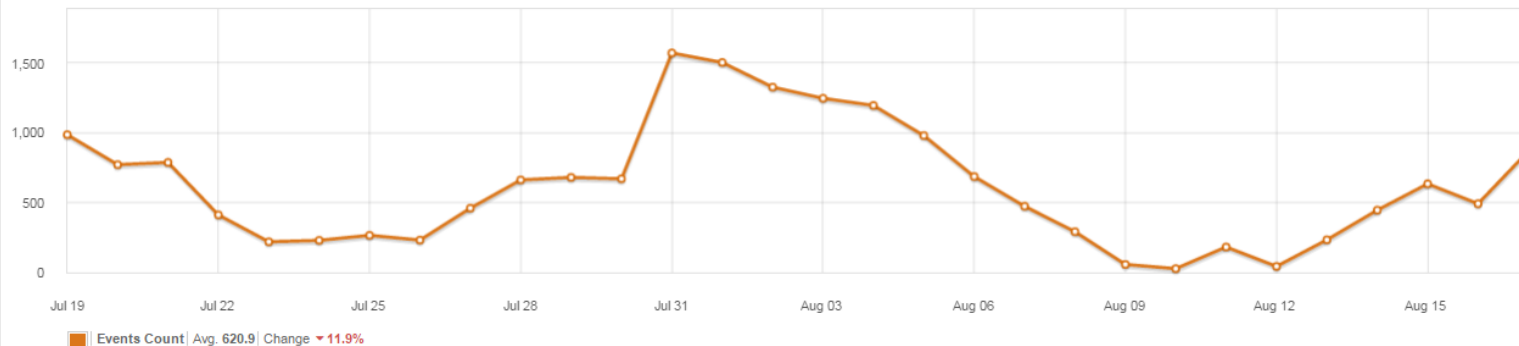
263,429 iOS: 35,433 Android: 213,219 Fire OS: 14,777

Lifetime Event Occurrences Per Session ⓘ

218 iOS: 312.4 Android: 187 Fire OS: 24.2

Events Count ⓘ

📄 CSV



Three Types of Data Driven Development



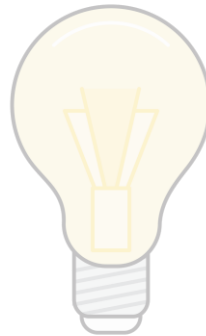
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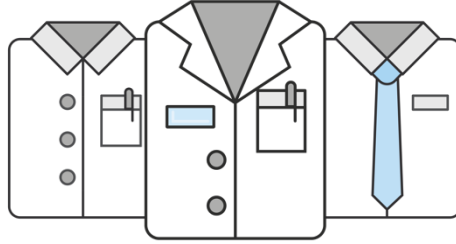
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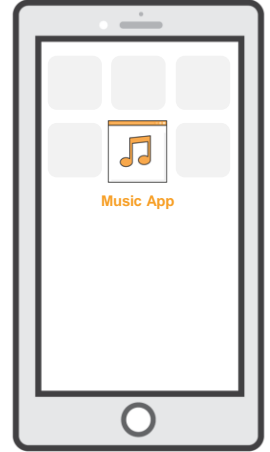
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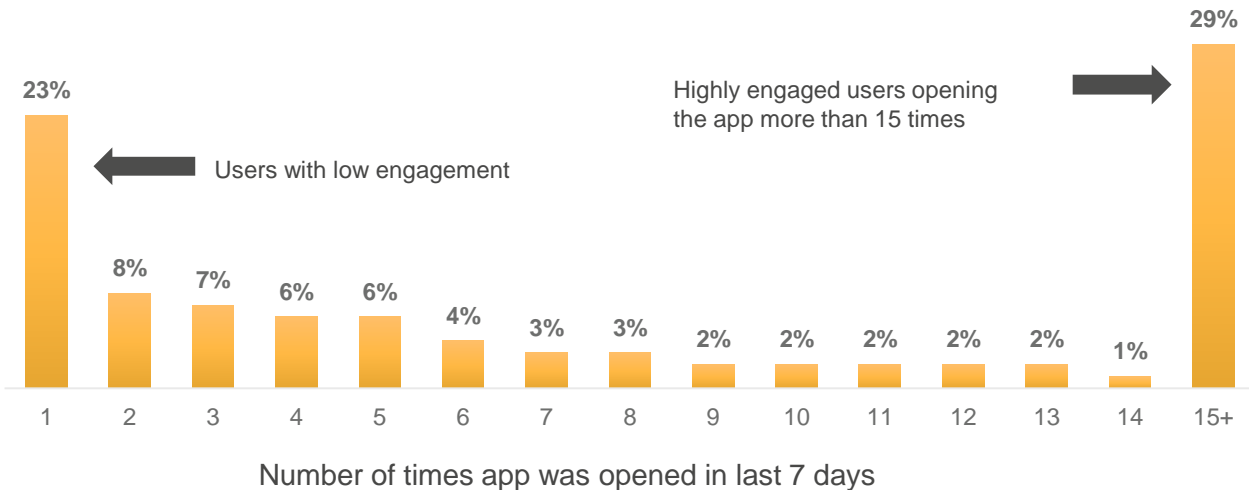
Going beyond standard metrics will give
you more insight in to user behavior

Few Questions that Will Help you Understand your Users Better

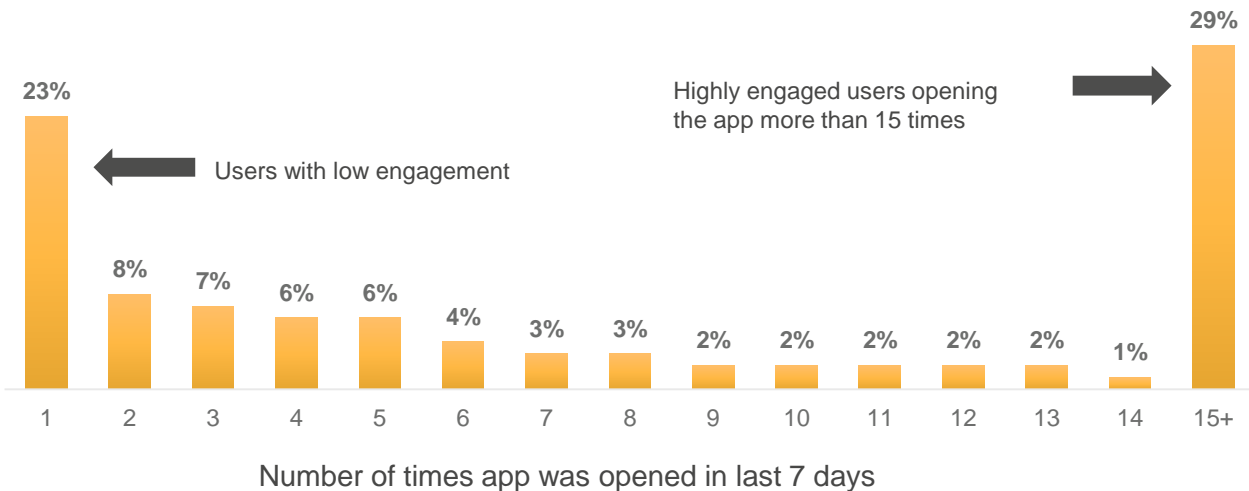
- 1 Who are the most engaged users and what are their usage patterns ?
- 2 How does usage pattern vary for users with different demographic profiles?
- 3 How does user population distribute across countries and platform ?
- 4 How much time does it takes for a user to convert to a paying user ?



1 Who are the Most Engaged Users and What are their Usage Patterns?

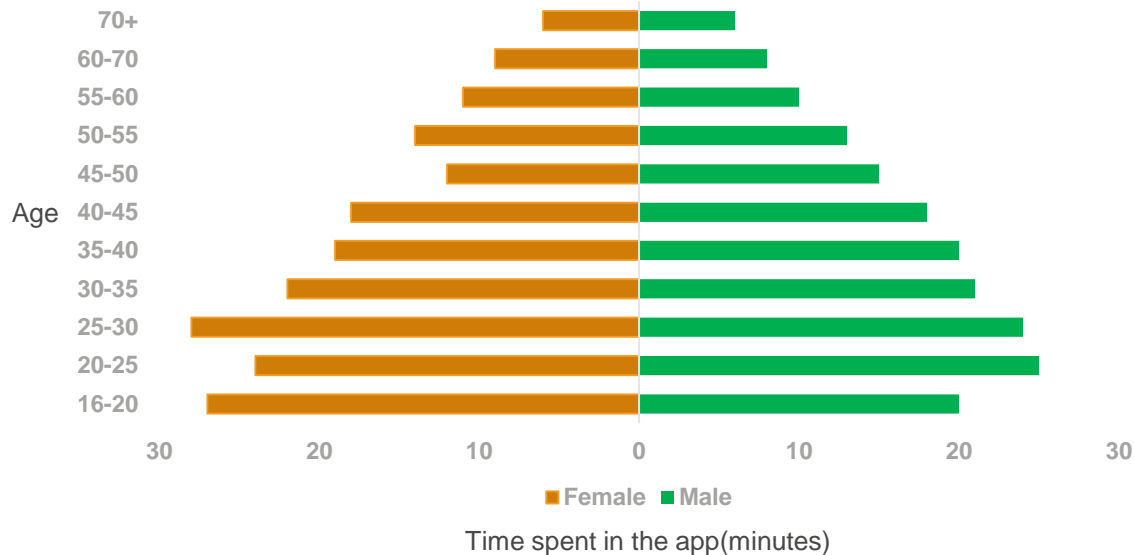


1 Who are the Most Engaged Users and What are their Usage Patterns?

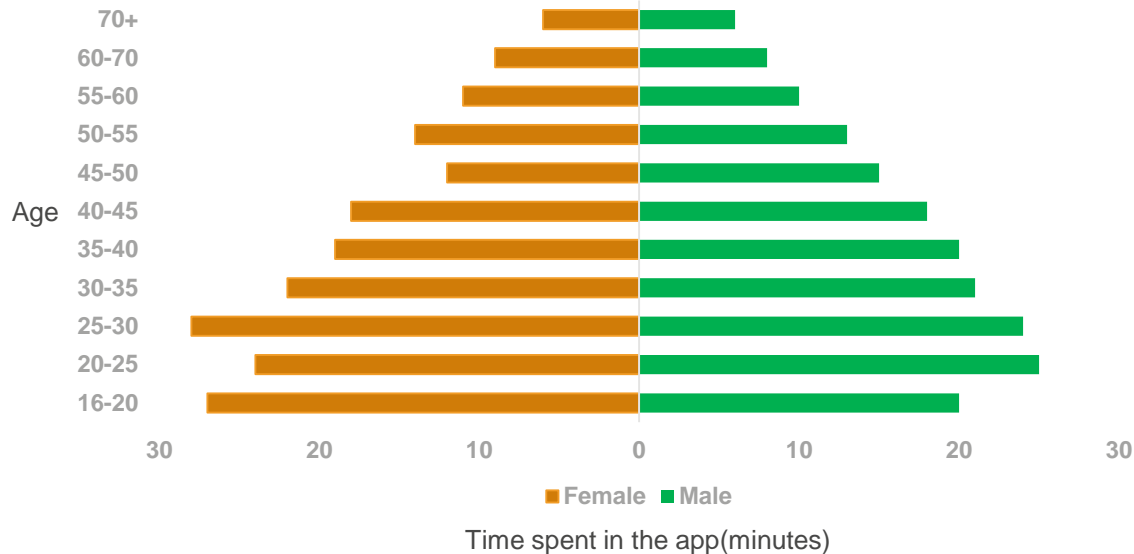


Design strategies to influence users with low engagement and convert them to highly engaged users

2 How Does Usage Pattern Vary for Users with Different Demographic Profiles?

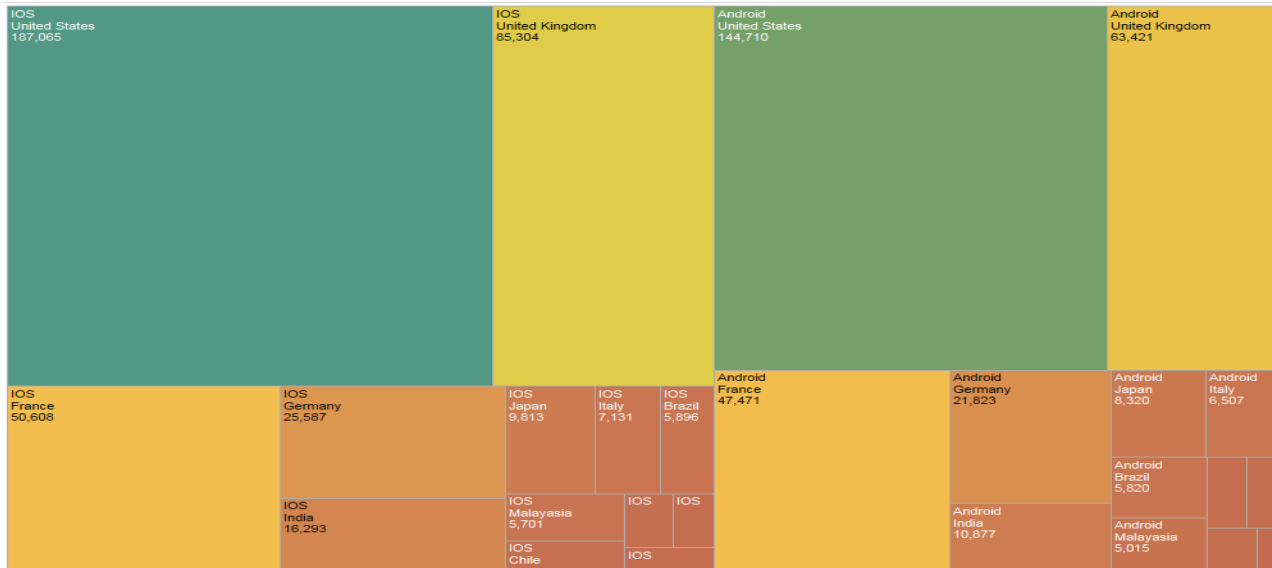


2 How Does Usage Pattern Vary for Users with Different Demographic Profiles?

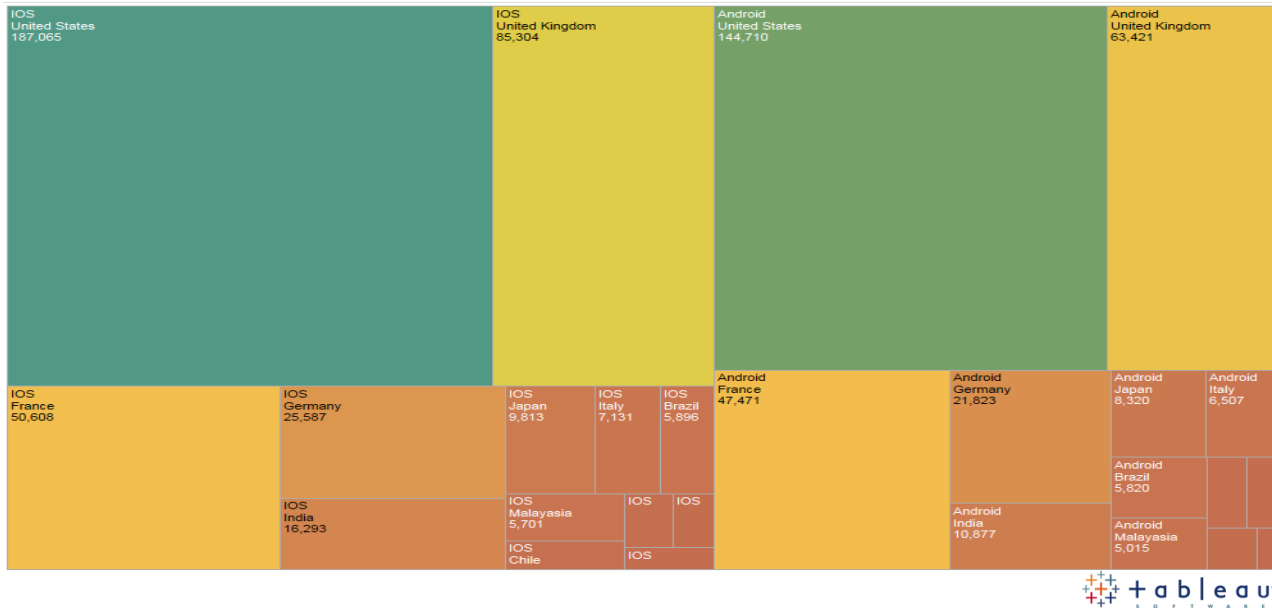


Understand your core user demographic profile and deliver relevant content to them

3 How Does User Population Distribute Across Countries and Platform?

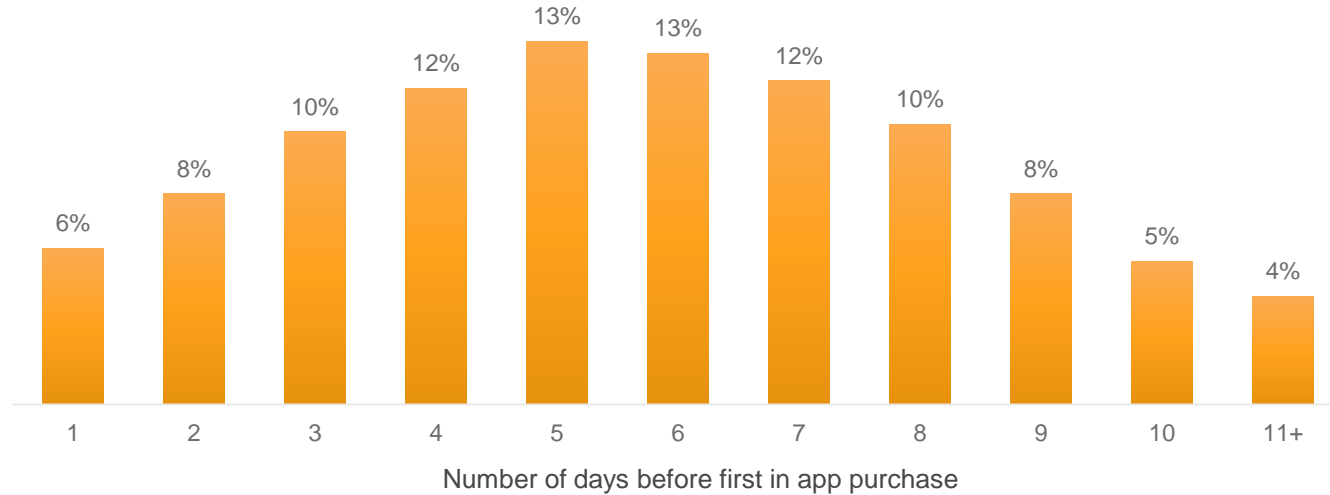


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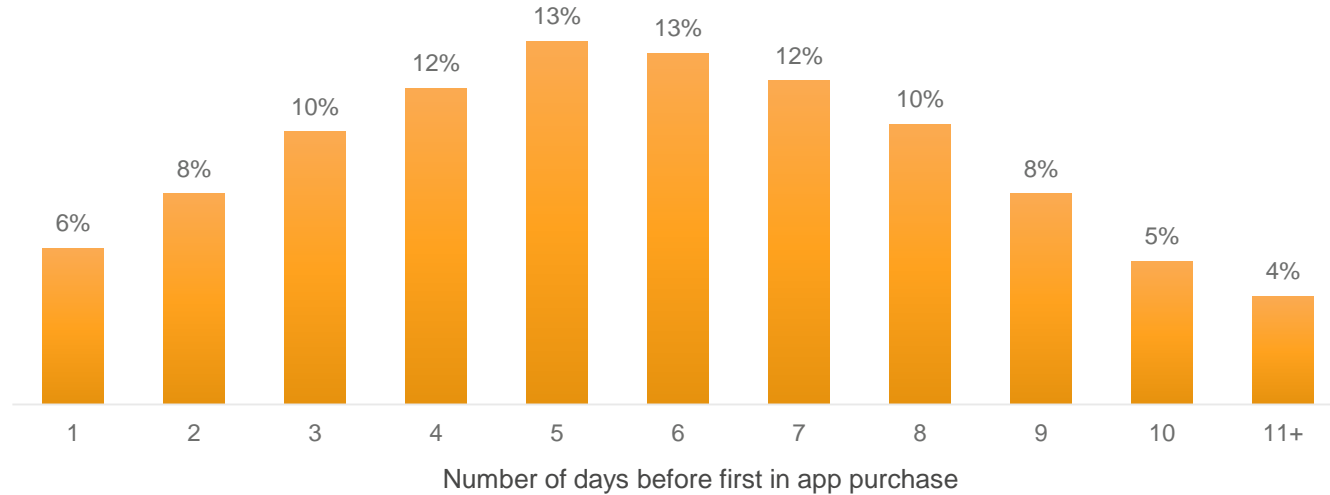


Formulate new user acquisition plans in countries that the app has low penetration

4 How Many Days Does it Take for a First Time User to Convert to a Paying User?



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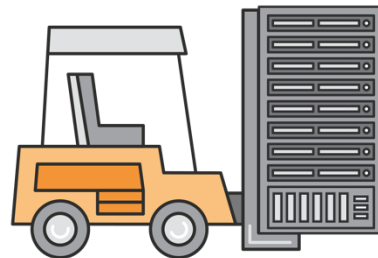


Target users who have spent more than 8 days in the app and are yet to purchase

Auto Export to Amazon Redshift



Amazon Mobile
Analytics



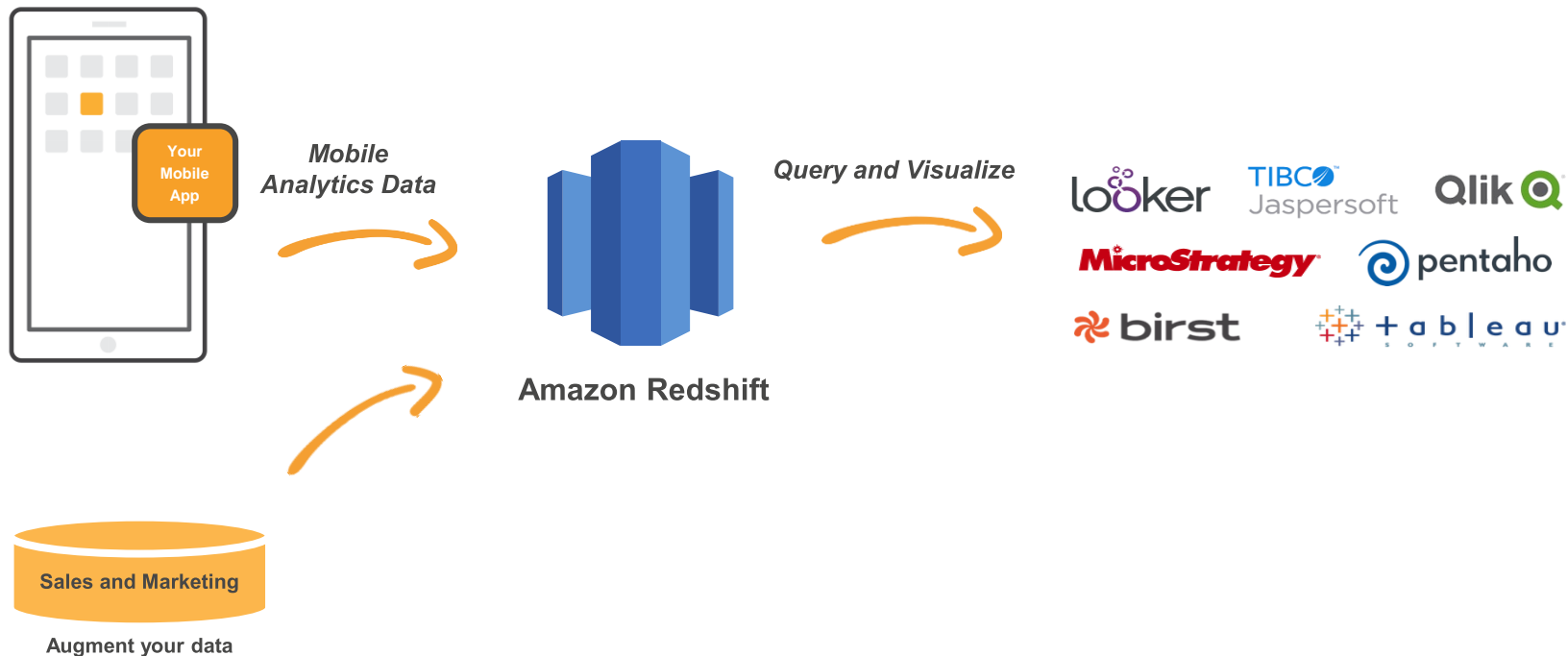
Amazon S3 &
Amazon Redshift

Schema for Your App's Event Data

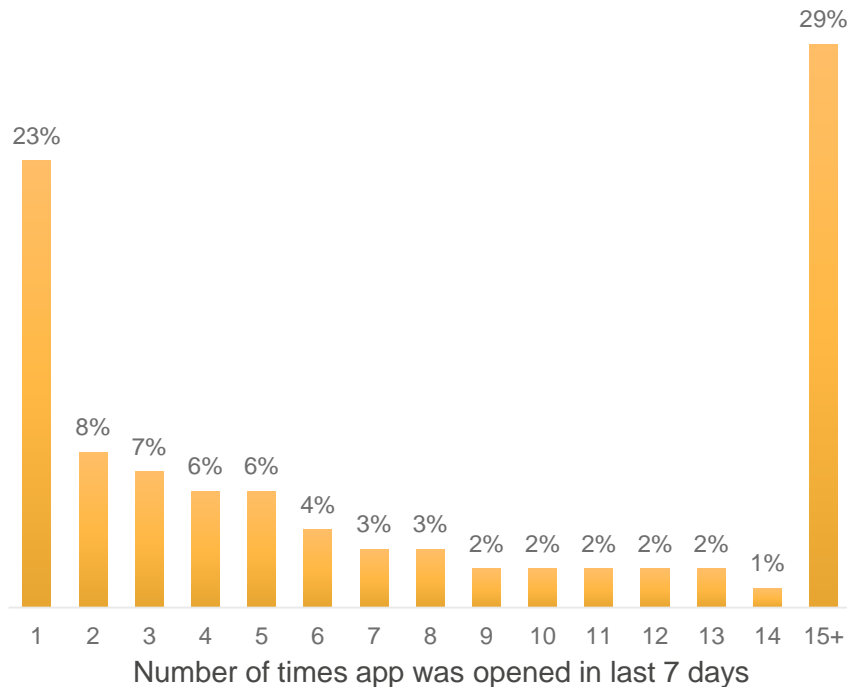
- 1 Simple & intuitive
- 2 Automatically collect common attributes
- 3 Integrate with existing data models

event_timestamp	arrival_timestamp	Standard Fields
application_key	account_id	
app_title	event_type	
unique_id	model	
make	platform	
platform_version	locale	
app_package_name	app_version_name	
sdk_name	sdk_version	
a_genre	attributes (string)	Custom Defined Fields
a_promo_code		
m_songtime_played	metrics (float)	
m_rating		

Now Easy to Query and Visualize



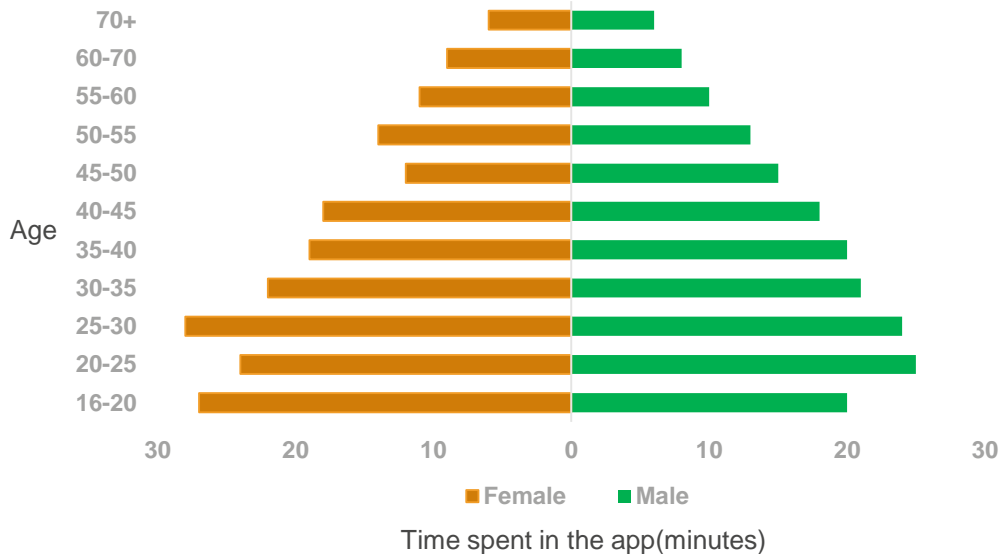
1 Who are the Most Engaged Users and What are their Usage Patterns?



SQL Query

```
select "app opens",  
       count(users) as "frequency"  
  from (  
select  
       client_cognito_id as "users"  
       ,count(*) as "app opens"  
  From  
       AWSMA.v_event  
  Where  
       event_type='_session.start'  
  And  event_timestamp between  
       getdate()-7 and getdate()+1  
  Group by client_cognito_id  
 )  
  Group by "app opens"
```

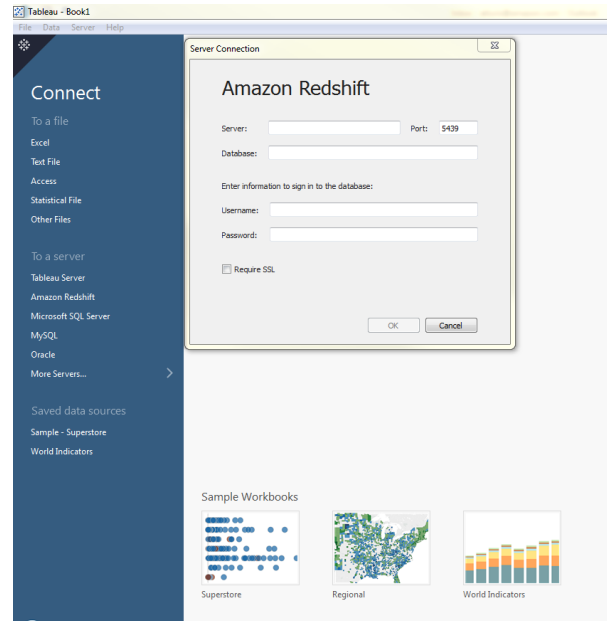
2 How Does Usage Pattern Vary for Users with Different Demographic Profiles?



SQL Query

```
select
    a_age as "age"
    ,a_gender as "gender"
    ,avg(m_session_length) as "time spent"
From
    AWSMA.v_event
where
    event_type='a_session.duration'
And event_timestamp between
    getdate()-90 and getdate()+1
Group by
    m_age
    ,m_gender
```

3 How Does User Population Distribute Across Countries and Platform?

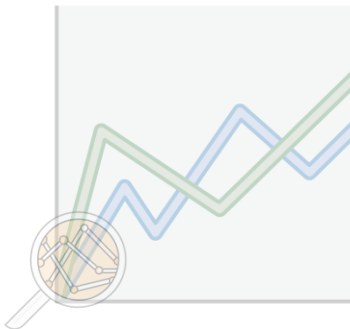


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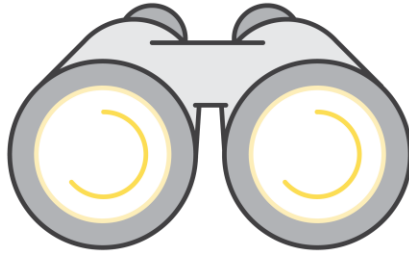
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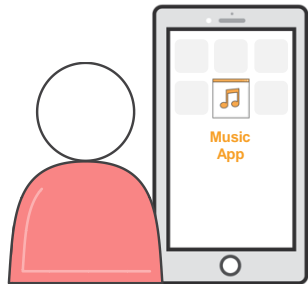
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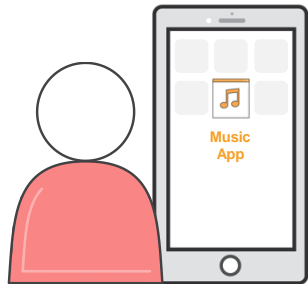
**Predicting user behavior will help
you deliver personalized
experience for users**

Predictive Application by Example



Susan has been using the app for more than 6 months now but she hasn't opened the music app in the last ten days

Predictive Application by Example



Susan has been using the app for more than 6 months now but she hasn't opened the music app in the last ten days

What would you do to bring her back to the app again ?

Predictive Application by Example

Push Notification



“Susan, you haven’t listened to your favorite artists in a while. Want to check them out? ”

Predictive Application by Example

Push Notification



“Susan, you haven’t listened to your favorite artists in a while. Want to check them out? ”

But what’s the best time to send her this push notification ?

One Way To Do is...

```
SELECT e.time_stamp  
  
FROM   events e  
  
WHERE  customer ='SUSAN'  
  
AND    event_type = '_push_notification_open'  
  
HAVING e.date> GETDATE() - 30
```

You can start by looking at all the different time slots she has opened a push notification in the last 30 days

One Way To Do is...

```
SELECT e.time_stamp  
  
FROM   events e  
  
WHERE  customer ='SUSAN'  
  
AND    event_type = '_push_notification_open'  
  
AND    date_part (dow,e.date ) in (6,7)  
  
HAVING e.date> GETDATE() - 30
```

But her usage pattern changes
on weekends.

You can edit the query to filter
for weekends only

One Way To Do is...

```
SELECT e.time_stamp  
  
FROM   events e  
  
WHERE  customer ='SUSAN'  
  
AND    event_type = '_push_notification_open'  
  
AND    date_part (dow,e.date ) in (6,7)  
  
HAVING e.date> GETDATE() - 60
```

Pattern is not clear as she opened in multiple time slots on different days.

You can go back in time to get a more clear pattern

One Way To Do is...

```
SELECT e.time_stamp  
FROM   events e  
WHERE  customer in ('SUSAN','JOE','BOB',.....)  
AND    event_type = '_push_notification_open'  
AND    date_part (dow,e.date ) in (6,7)  
HAVING e.date> GETDATE() - 60
```


but what about other users ?

tweak the query again

One Way To Do is...

```
SELECT e.time_stamp  
FROM   events e  
WHERE  customer in ('SUSAN','JOE','BOB',.....)  
AND    event_type = '_push_notification_open'  
AND    date_part (dow,e.date ) in (6,7)  
HAVING e.date> GETDATE() - 120
```

....and again



```
SELECT ...mp
FROM ...events e
WHERE cust... in ('S...SAN','JOE','BOB',.....)
ID ...nt_type = '_...h_notification_open'
AND ...date_part (d...date ) in (6,7)
HAVING ...ETDATE() - 120
```

Use machine learning technology to
learn business rules from your data

Better Way To Do it is...



Best time to Send

4 PM



9 AM



2 PM

Machine learning automatically finds patterns in your data and uses them to make predictions

Better Way To Do it is...



Best time to Send

4 PM



9 AM



2 PM

Machine learning automatically finds patterns in your data and uses them to make predictions

Your data + machine learning
= personalization in the app

Why Aren't there More Machine Learning Applications Today?

1

Machine learning expertise is **rare**

2

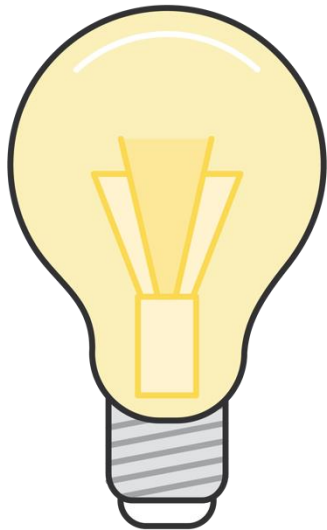
Building and scaling machine learning technology is **hard**

3

Closing the gap between models and applications is **time-consuming and expensive**

What if there were a better way?

Amazon Machine Learning



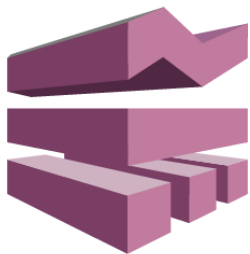
Easy to use, managed machine learning service built for developers

Robust, powerful machine learning technology based on Amazon's internal systems

Create models using your data already stored in the AWS cloud

Deploy models to production in seconds

Leverage Mobile App Data in Amazon Redshift to Build Predictive Applications Using Amazon ML



Amazon Mobile Analytics

+



Amazon Redshift



Amazon Machine Learning

Building Predictive Applications with Amazon ML

1

Train
model

2

Evaluate and
optimize

3

Retrieve
predictions

Building Predictive Applications with Amazon ML



- Create a Datasource object pointing to your mobile app data
- Explore and understand your data
- Transform data and train your model

Create a Datasource Object

The screenshot shows the 'Create datasource' wizard in the AWS Amazon Machine Learning console. The wizard is overlaid multiple times to show the progression from 'Input Data' to 'Review'.

1. Input Data

Locate the data you want to use.

Where is your data located?

Amazon ML scanner

Does the first line of the file contain the header information?

ACTION: Change

Machine learning v column that contains the target variable

Do you plan to use this data for training a machine learning model?

Select the row containing the target variable

You have selected

Search by attribute

Target

Name

☐ age

☐ campaign

☐ cons_cov

☐ cons_priv

☐ contact

☐ day_of_w

2. Schema

Target

Name

☒ y

3. Review

Review and make any changes, and then click Finish.

Input data

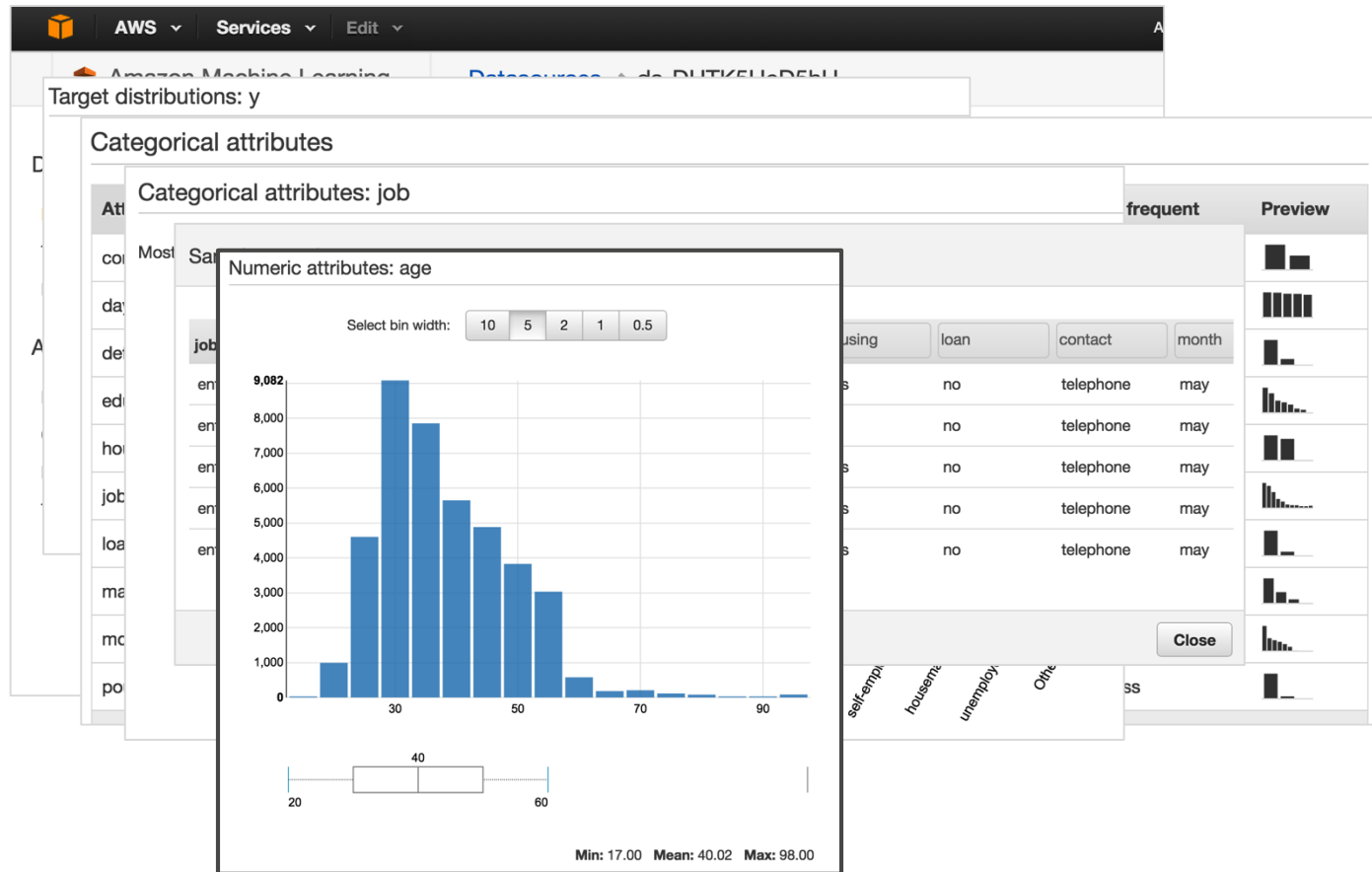
Datasource name	Banking.csv
S3 location	s3://ingerman-archie-walkthrough/banking.csv
Data format	CSV
Number of files	1
Total size	4.7 MB

Schema

Schema source	Auto generated (Column names are taken from the first row of the CSV file)
Data types	1 Binary Attribute 10 Categorical Attributes 10 Numeric Attributes

Target

Explore and Understand Your Data



Train Your Model

The screenshot displays the AWS ML console interface for creating a new ML model. The top navigation bar shows 'AWS' and 'Services'. The breadcrumb trail indicates the path: 'Amazon Machine Learning' > 'ML models' > 'Create ML model'. The left sidebar contains a table of contents with six steps: 1. Input data, 2. ML model settings, 3. Recipe, 4. Advanced settings, 5. Evaluation, and 6. Review (which is the active step). The main content area is titled 'Review' and includes a sub-header 'Input data'. Below this, a table lists the configuration details for the input data. The 'ML model settings' section is also visible, showing details for the model name, parameters, evaluation name, and evaluation data. At the bottom, there is a 'Recipe' section with a 'Show' link.

1. Input data 2. ML model settings 3. Recipe 4. Advanced settings 5. Evaluation 6. Review

Review

Review and make any changes, and then click Finish.

Input data

Datasource ID	ds-TDGk1Auzila
Datasource name	Banking dataset for regression
Created on	Mar 29, 2015 10:31:18 PM
Status	Completed

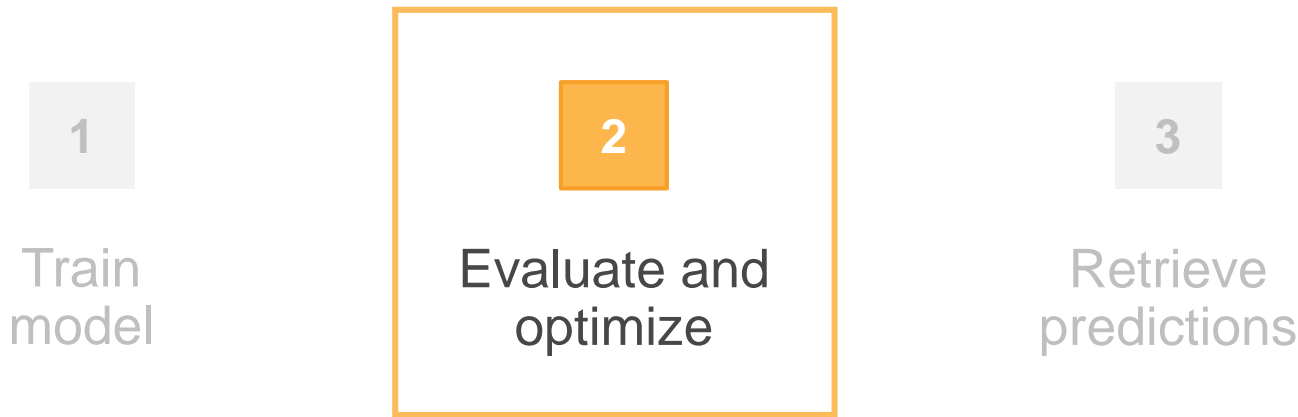
ML model settings

ML model Name	ML model: Banking dataset for regression
ML model parameters	Default (includes the ML model evaluation) - See Advanced settings below.
Evaluation name	Evaluation: ML model: Banking dataset for regression
Evaluation data	The default is 70 percent for training and 30 percent for evaluating the ML model

Recipe

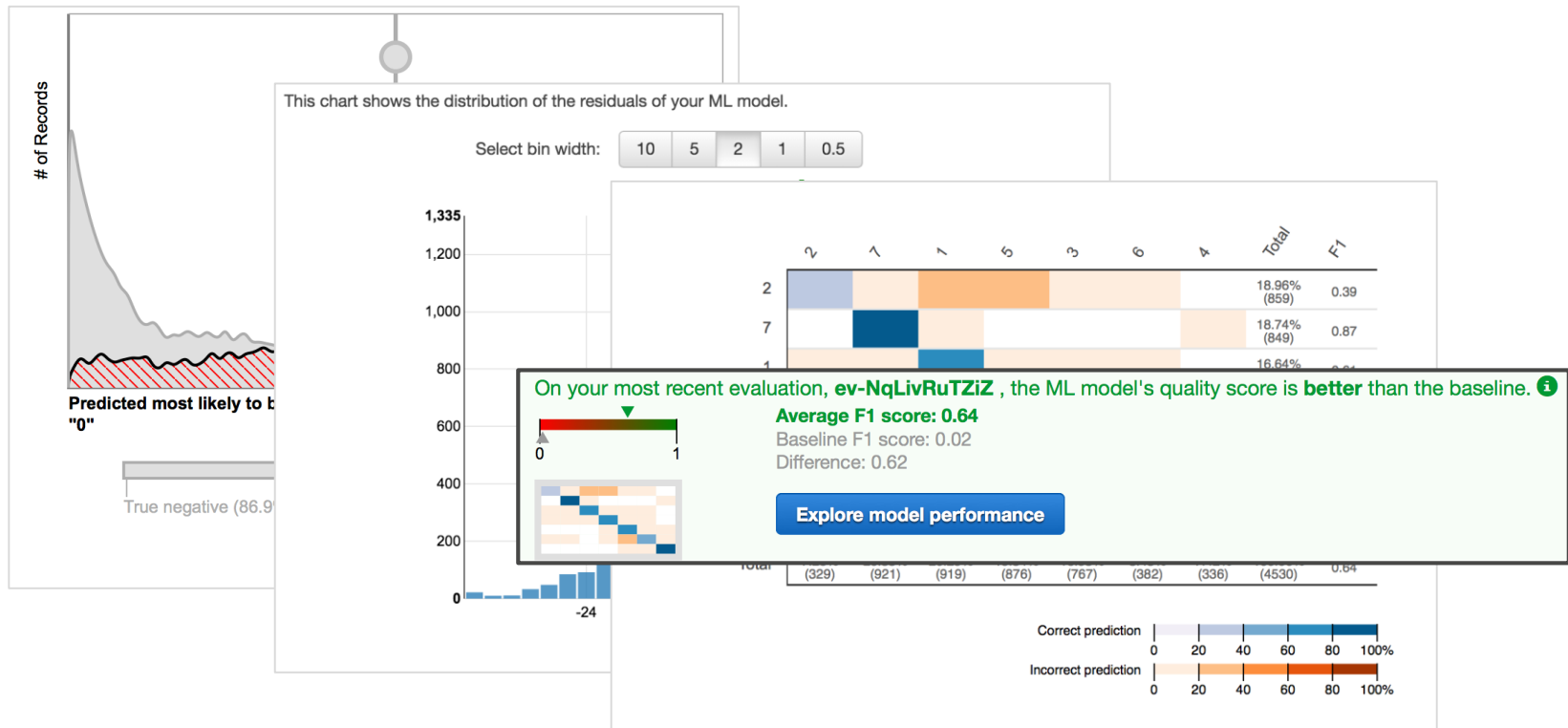
Recipe [Show](#)

Building Predictive Applications with Amazon ML



- Understand model quality
- Adjust model interpretation

Explore Model Quality



Building Predictive Applications with Amazon ML

1

Train
model

2

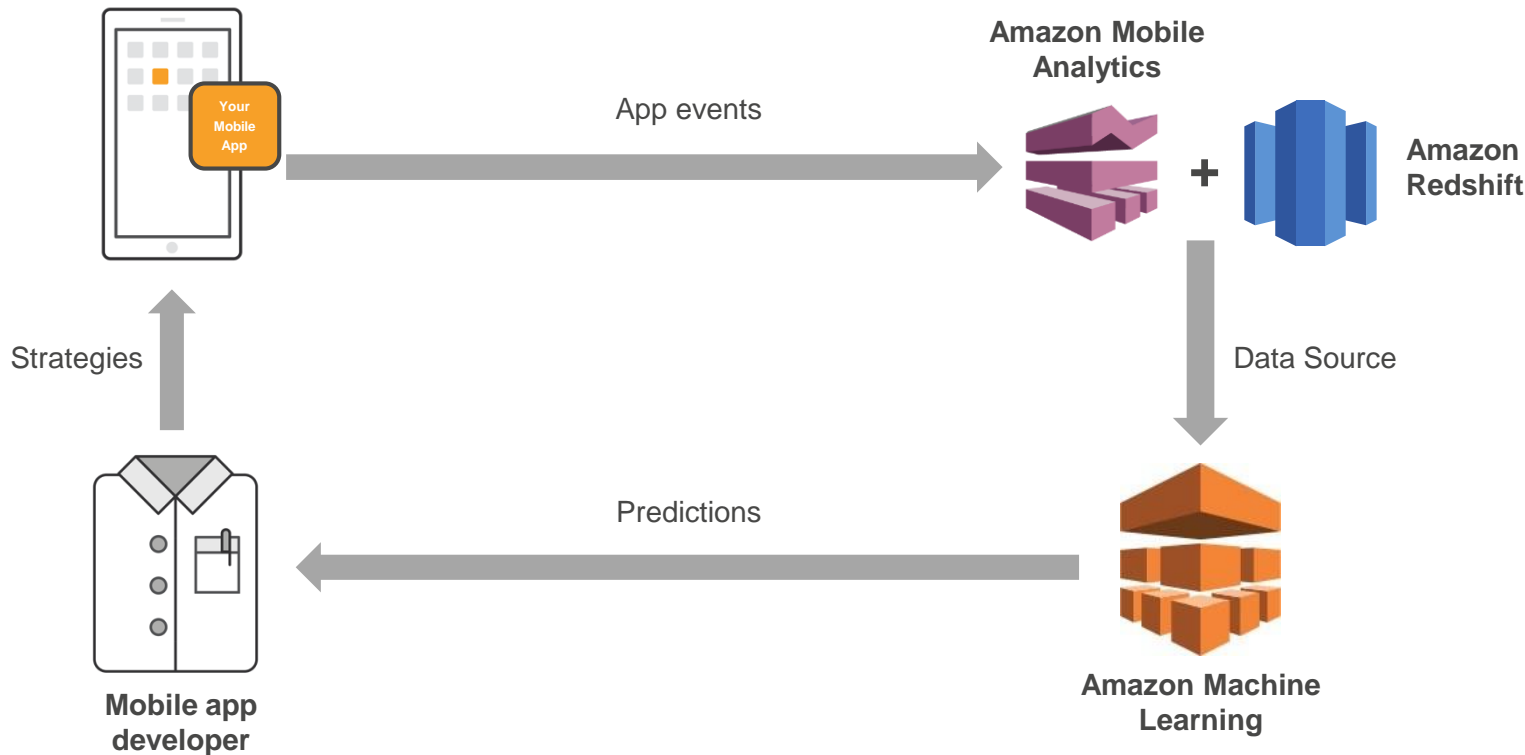
Evaluate and
optimize

3

Retrieve
predictions

- Batch predictions
- Real-time predictions

Now Build Predictive Applications Using Your Mobile App Data Easily



Few Strategies that can be Used Effectively via Machine Learning

- 1 Predict users with high probability to churn from the app and send push them notification to re-engage
- 2 Predict users with low probability to purchase in the app and send discount coupon via in-app notification
- 3 Identify users with high probability to share the app and reach out to them to do the same
- 4 Recommend relevant content to users based on similar user's behavioral patterns

Thank you !

For further questions please email us at
amazon-mobile-analytics@amazon.com