

DNSC 6290: Customer Analytics, Fall 2021

Lecture 1

Introduction to the course + Why Customer Analytics matters

Instructor: Ali Pilehvar, Ph.D.

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<https://gwu.webex.com/meet/alipilehvar>



Business

9/2/2021

About me



Ali Pilehvar

University of Maryland, College Park

Ph.D., Operations Management, May '13
M.Sc., Sys. Eng., May '07

LinkedIn: <https://www.linkedin.com/in/alipilehvar/>

Most recent experience (2015- present)

- **Realtor.com – Director of Product Analytics (June 2021- present)**
 - Overseeing the team of data access and strategy: KPI definition, KPI build /improvement/ reporting
 - Advanced analytics and funnel investigation
- **Wayfair – Advanced Analytics and Insights Manager (Oct 2019- June 2021)**
 - Lead the team of analysts to unlock web analytics insights and execute data-driven and high-ROI initiatives to grow \$70 million annual home service business (e.g., assembly, warranty)
- **Liquidity Services – Head of Marketing Analytics and Auction Marketing (April 2015- Oct 2019)**
 - Overseeing buyer journey funnel and marketing analytics execution across 4 marketplace with annual revenue of \$600MM
 - Data management, customer insights & segmentation
 - Marketing spend tracking and customer retention strategies

Agenda for today

- ▶ Going around room and introduce ourselves
- ▶ Review of the course/syllabus [\[Link\]](#)
- ▶ Customer Analytics: What it is and why it matters?
- ▶ Different sources of customer data
- ▶ What defines a good metric?
 - ▶ North Star Metrics
- ▶ In-class exercise

Customer Analytics: What it is and why it matters

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

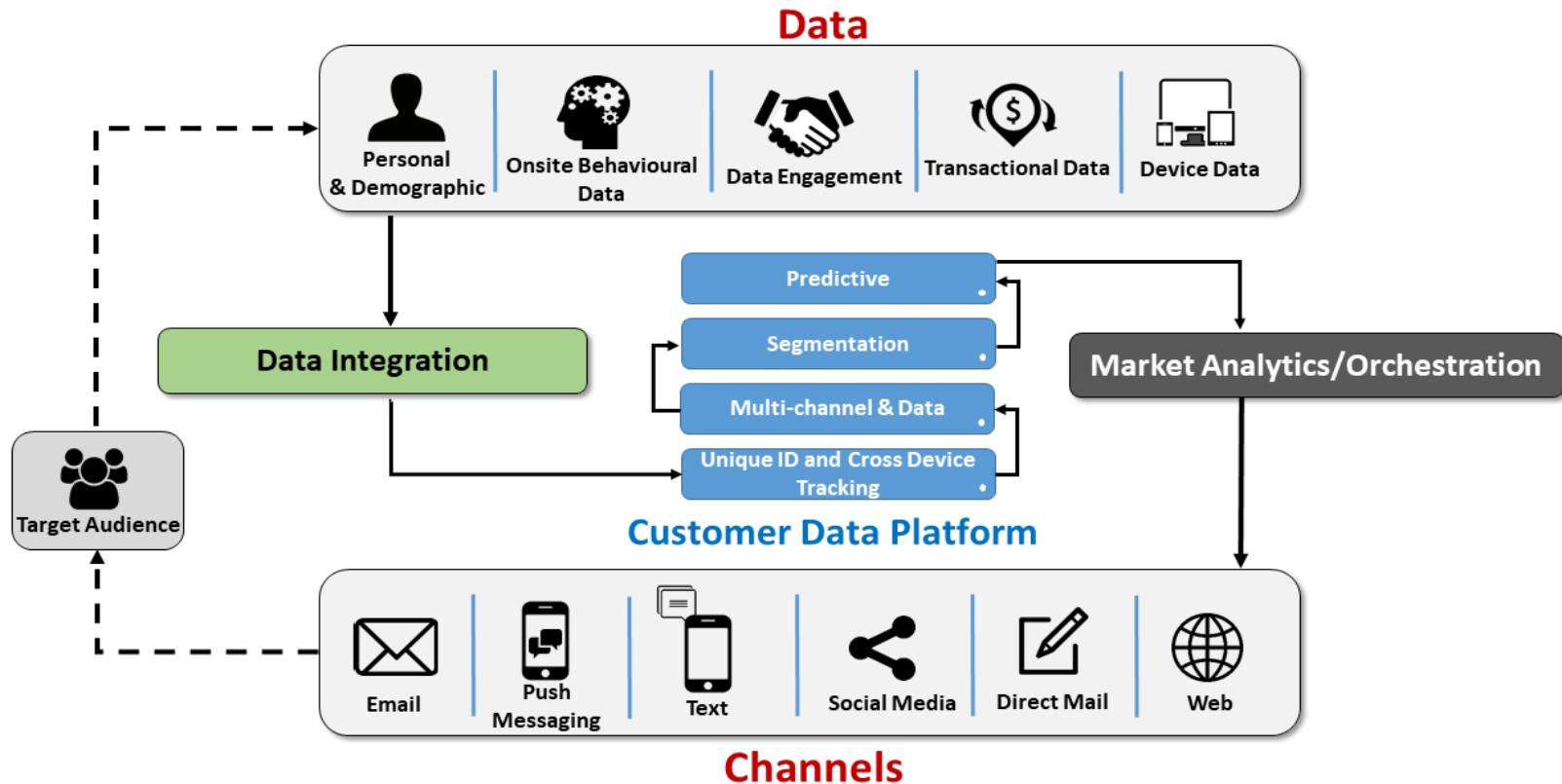
Peter Drucker

My definition of Customer Analytics

“Customer Analytics is simply all about the actionable measurements. It includes a rigorous process of identifying and measuring meaningful customer engagement and relevant metrics across customer journey, and mapping everything out to the company’s true north star metrics”

Customer Analytics at a glance

Customer Analytics refers to the processes and technologies that enables companies to learn about customer behavior by collecting data from different sources and stage of the customer journey.



Source: <https://vigoursoft.com/customer-analytics/>

Customer Analytics empowers companies to measure, learn, and optimize the customer behavior

- Companies leverage Customer Analytics to **grow their business** and **improve the customer experience.**
- Customer Analytics use techniques such as predictive modeling, data visualization, and segmentation to convert the customer data into the actionable intelligence.
- Where we need Customer Analytics:

Product	Marketing	Sales
<ul style="list-style-type: none">- Measure features, usage, and customer journeys- Test the product engagement	<ul style="list-style-type: none">- Create segments and look-alike audiences- Identify the best channels	<ul style="list-style-type: none">- Score and segment leads, prospects, and users.

What questions can Customer Analytics answer....?



Loyalty

Generate customer loyalty by discovering response patterns



Acquisition

Which channels bring the biggest number of new customers?



Retention

Increase the frequency of visit and purchased items from existing customer pool



Cross sell/upsell

Identify related products and interests to promote



Churn prevention

Identify dissatisfied customers & churn patterns



Engagement

How long and where customers spend most time on the site (app)?



ROI maximization

Increase the spend in most efficient marketing channels, lower the spend in weakest channels

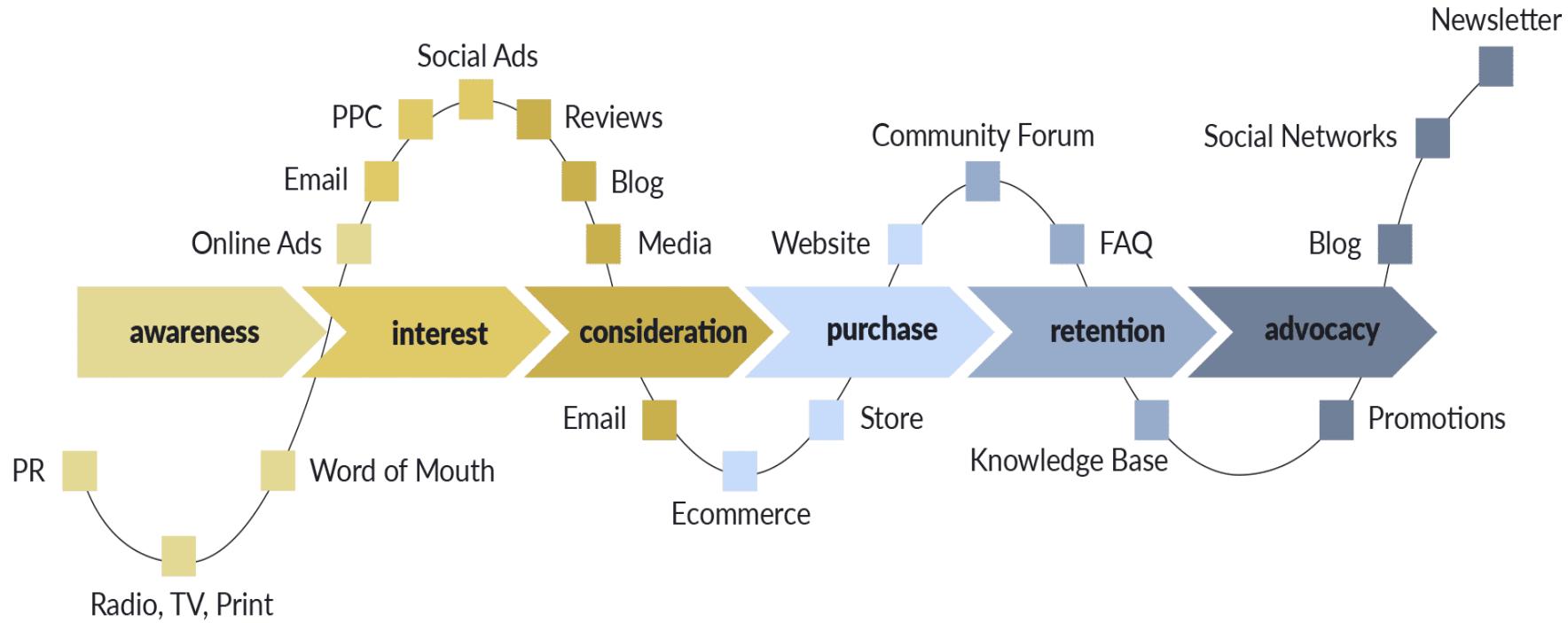


Segmentation

Identify different segment by predicting customer lifetime value (CLV)

Customer Analytics drive values for companies across all stages of customer journey

Across different stage of customer journey and at each customer touch point, companies could leverage customer data to eliminate the friction and increase conversion from each stage to the next one.



Source: <https://www.revelx.co/blog/customer-journey-optimization/>

Four core building blocks which define Customer Analytics process



Data Management

- Data sources/types
- Data preparation and tracking
- Data Warehouses
- Metric & variable preparation
- Data security and privacy



Analytics Production

- Data validation
- Data modeling
- Predictive, prescriptive, and descriptive analytics



Analytics Consumption

- Reporting
- Data Visualization
- A/B testing
- Business intelligence

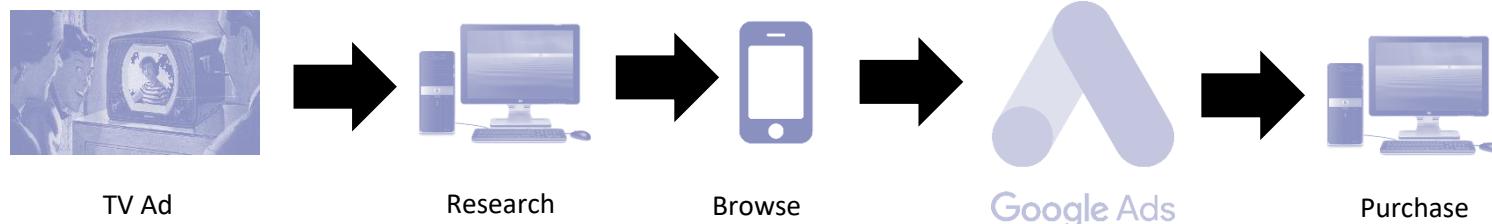


Analytics Activation

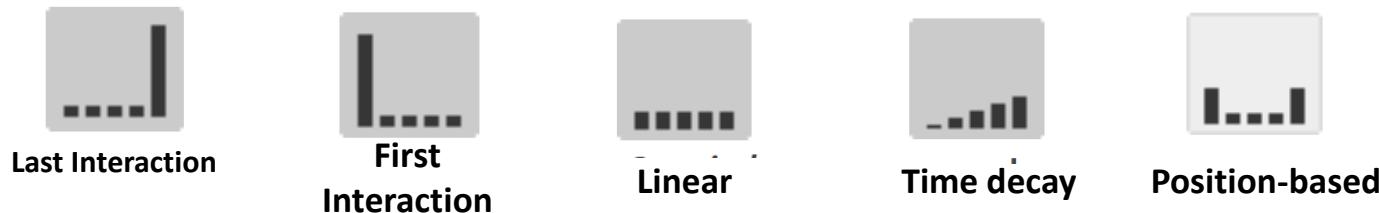
- Marketing planning & performance
- Product usage & optimization
- Customer experience

Cross-device customer journey make the customer analysis and ad measurement challenging

- **Problem with switching between devices:** finding the actual marketing influences and calculating the ad measurement/ROI on a purchase decision is not easy specifically for a larger and more complex buyer journey.



- Companies invest millions to track customer across different devices from login, sign ups, apps, email, CRM, cookies and link them together to explore how big is the issue.
- Different attribution models is used and built to deal with multi-touch cross-device journeys



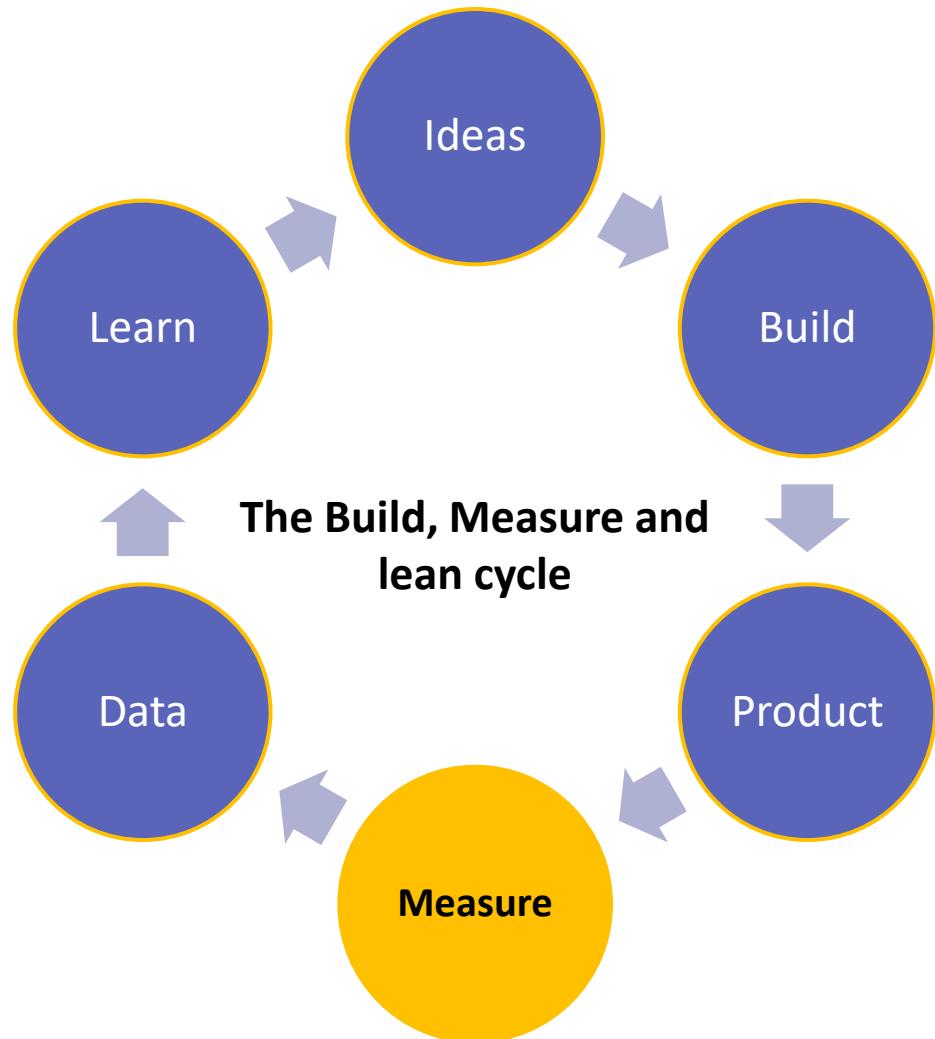
Customer analytics is one critical part of lean startup framework

- ▶ Eric Ries's core Lean Startup's concept is:

build -> measure -> Learn

- ▶ The process focus on doing everything from establishing an idea to developing the product, learning, testing, and iterating quickly and efficiently.

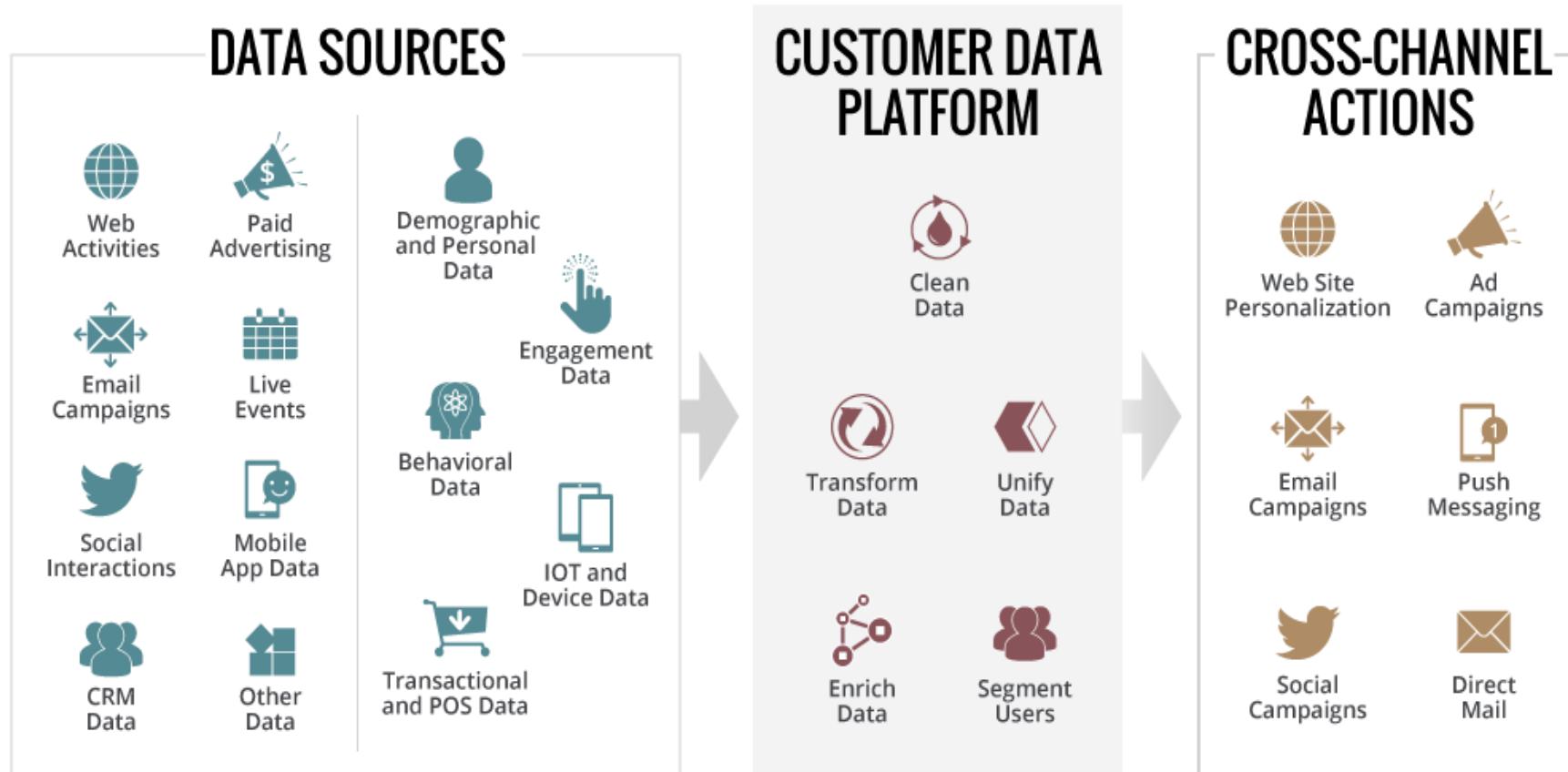
- ▶ Lean analytics focuses on **measure** stage and is the key in this iterative cycle.



Notes

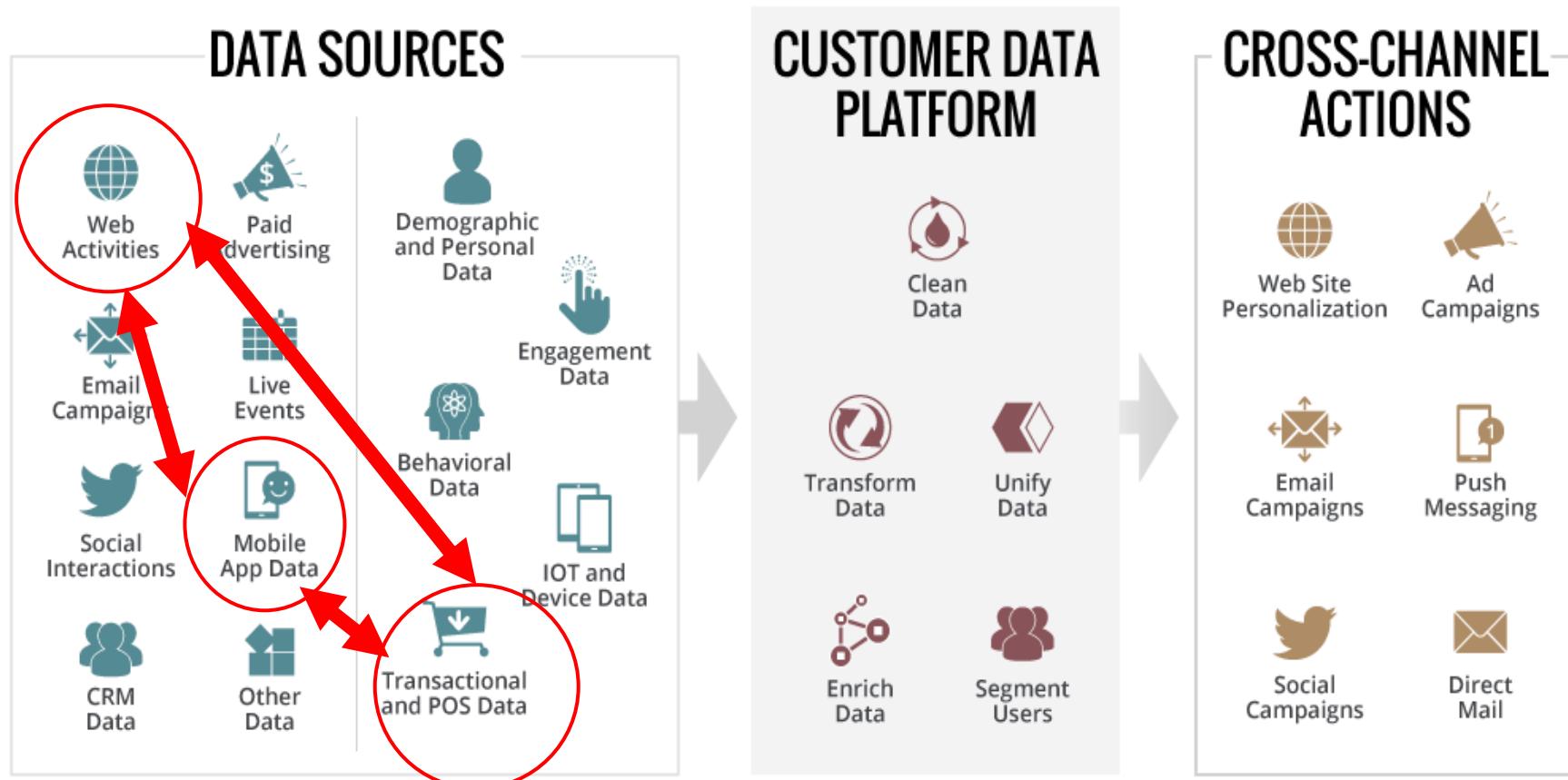
Different sources of customer data and acquisition channels

Different source of customer data is available and could feed Customer Analytics



Source: <https://www.columbiaroad.com/blog/customer-data-platform-a-revenue-engine-or-just-another-buzzword>

Linking the web and mobile analytics and transactional data at customer level is *critical* and a continuous process



Source: <https://www.columbiaroad.com/blog/customer-data-platform-a-revenue-engine-or-just-another-buzzword>

Customer can arrive from different type of acquisition channels at the web/mobile site/app

Organic Search (SEO)

Users find a website after using a search engine like Google or Bing, without referring by any other website.

Direct channel

Visitors who know about the brand come directly to the site

Social Media

Visitors come to the site via social medial pages and post (e.g., Facebook, Instagram)

Paid per click (PPC)

Google search
paid social (e.g., Facebook)
Display ad

Email Marketing

Visitors who are opted-in to receive emails will be targeted
[great opportunity for personalization]

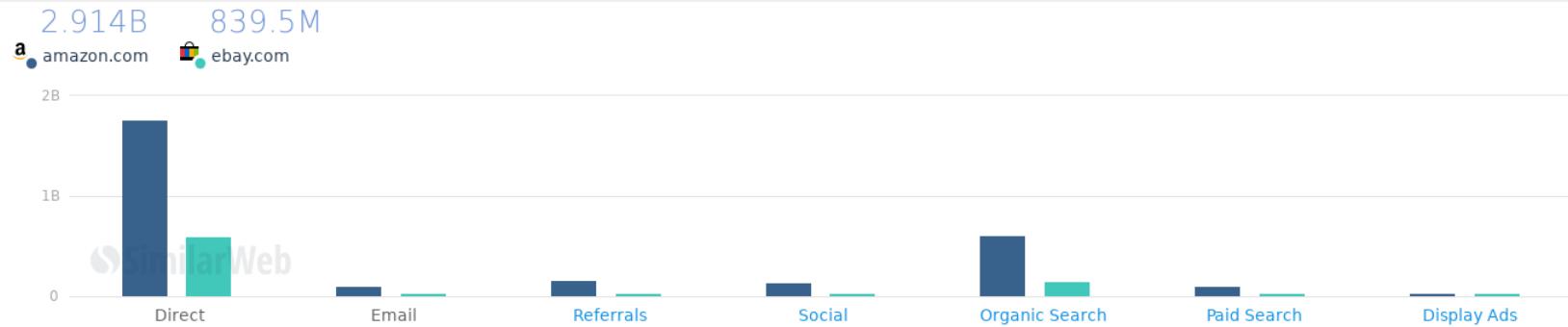
Referral/affiliate

Traffic coming other 3rd parties (e.g., articles on FT which talked about a brand with the site ink)

A glance into Amazon/ebay's acquisition channel breakdown (May-July 2019, Desktop, US only)

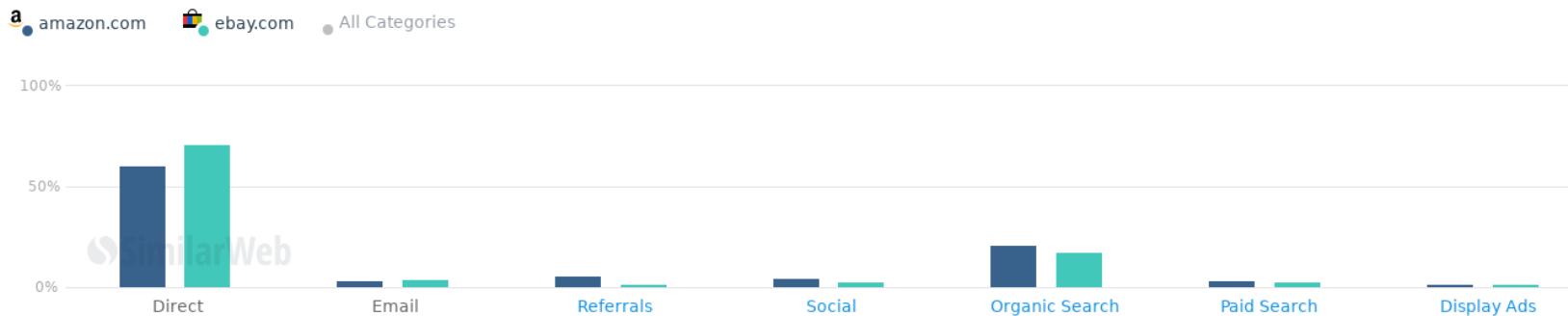
Channels Overview

| May 2019 - Jul 2019 | United States | Desktop Only



Channels Overview

| May 2019 - Jul 2019 | United States | Desktop Only



Source: SimilarWeb

Transactional data can track all interactions between users and brand since they get acquired

- ▶ Example from an Amazon-like ecommerce site

Buyer journey: Sign up>Browse>View>Add to cart>Purchase>Post Purchase

customer id	1153	1153	3146	3146
Acquisition Date	2/15/2011	2/15/2011	7/1/2010	7/1/2010
Acquisition Channel	0	0	Search - Paid	Search - Paid
Acquisition Device	Desktop	Desktop	Desktop	Desktop
year	2018	2018	2017	2018
month	7	6	11	3
Category Name	X	Y	X	Z
skus viewed	1	6	4	2
skus added to cart	1	2	1	1
skus purchased	1	1	1	1
Revenue generated	\$257	\$69	\$327	\$59

Notes

What defines a good metric?

What makes a good and relevant metric?

- ▶ **A good metric is comparative**

E.g., purchase conversion increase 5% MOM

- ▶ **A good metric is understandable**

If people cannot remember it, cannot discuss it!

- ▶ **A good metric is a ratio and rate**

Ratios are easier to act on, they are comparative,

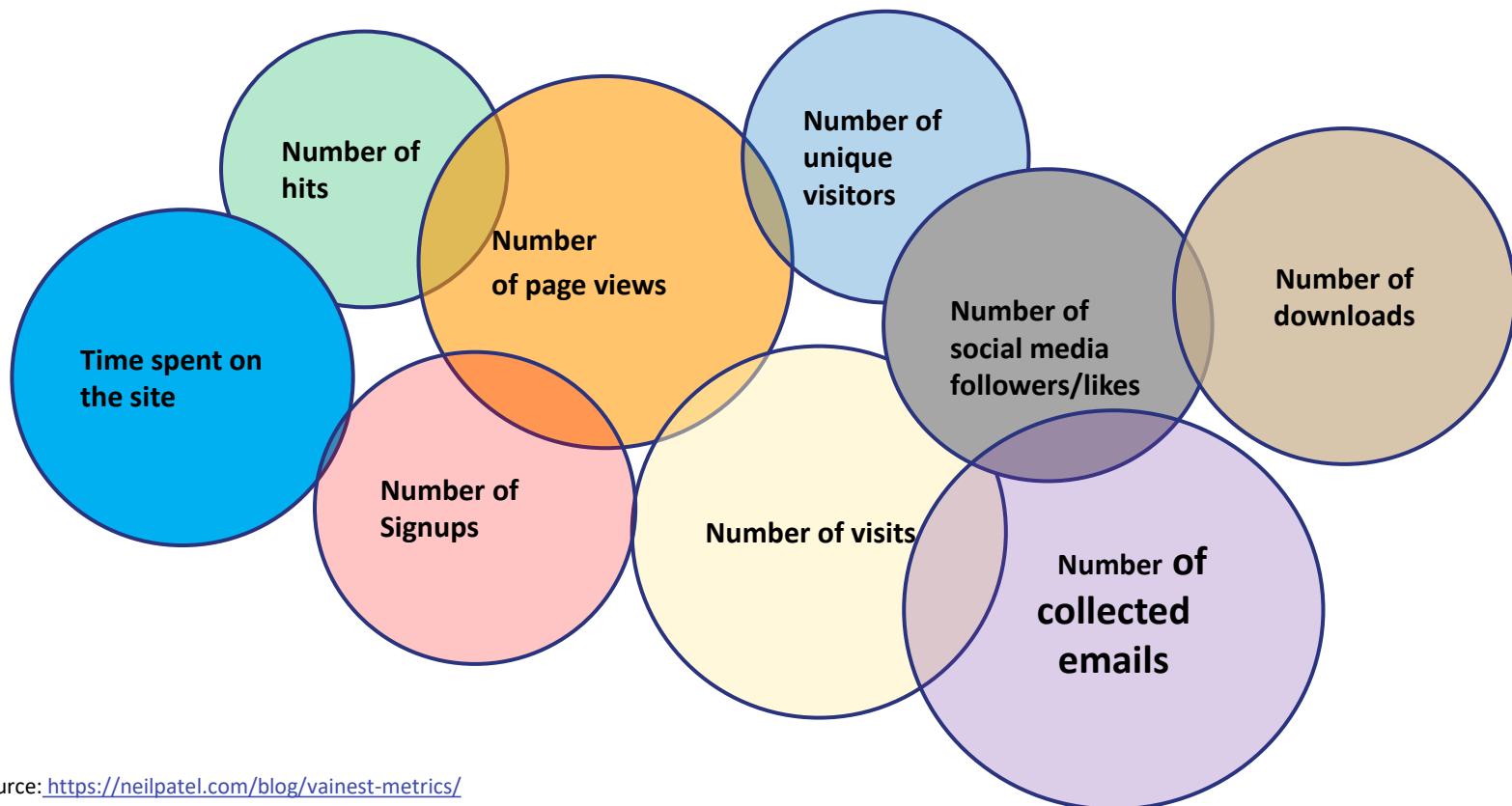
- ▶ **A good metric should be actionable (not vanity)**

A real metric should be able to define an action and change your behavior

e.g., “*total signups*” could be a **vanity metric** versus “% of active users” which is more actionable

Some vanity metrics to watch out for

- **Vanity metrics** are all those data points that make us feel good if they go up but don't help us make decisions:
 - They still have value, but their performance is not a leading indicator of how your business is doing.

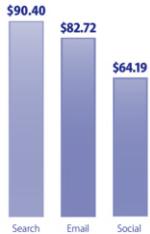


Source: <https://neilpatel.com/blog/vainest-metrics/>

The most important e-commerce metrics to track



Customer Lifetime Value



Revenue Per Traffic Sources



Cart Abandonment Rate



Email Conversion Rate



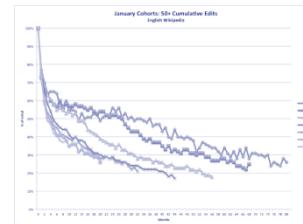
Social Media Conversion Rate



Average Order Value



Sales Conversion Rate



Returning Customer Percentage

The relationship between Metrics and KPIs

The set of specific metrics which are most closely aligned with your **critical business objectives** (e.g., revenue growth, user engagement) called **KPIs** (key performance indicators)



Metrics

Example: Monthly site traffic to Wayfair

- Quantifiable measures used to gauge performance or progress
- Monitor it to track progress toward a business objective

Every **KPI** is a metric, but not a way around



KPIs

Example: Monthly Revenue on Wayfair

- Things that matter most to keep your business **alive** and **well**
- Monitor it to track progress toward a business objective

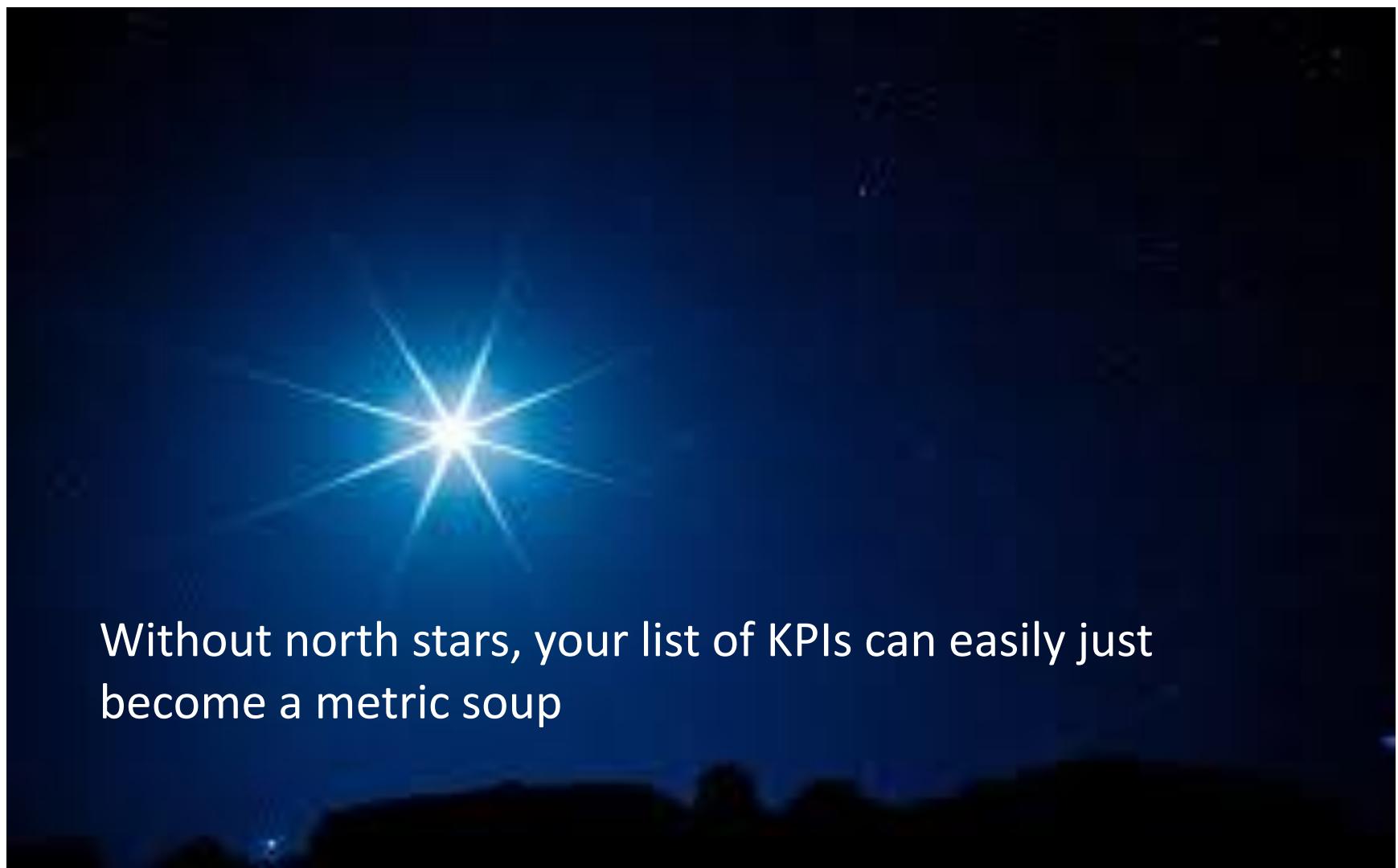
Ultimately, you need both.

KPIs keep you focused and quickly tell you what's working (or not working) in your business.

The rest of your metrics help you diagnose **WHY**.

Source: <https://www.grow.com/blog/metrics-and-kpis-are-different>

Every company needs a North Start Metric (NSM) to align all stakeholders and teams



Without north stars, your list of KPIs can easily just become a metric soup

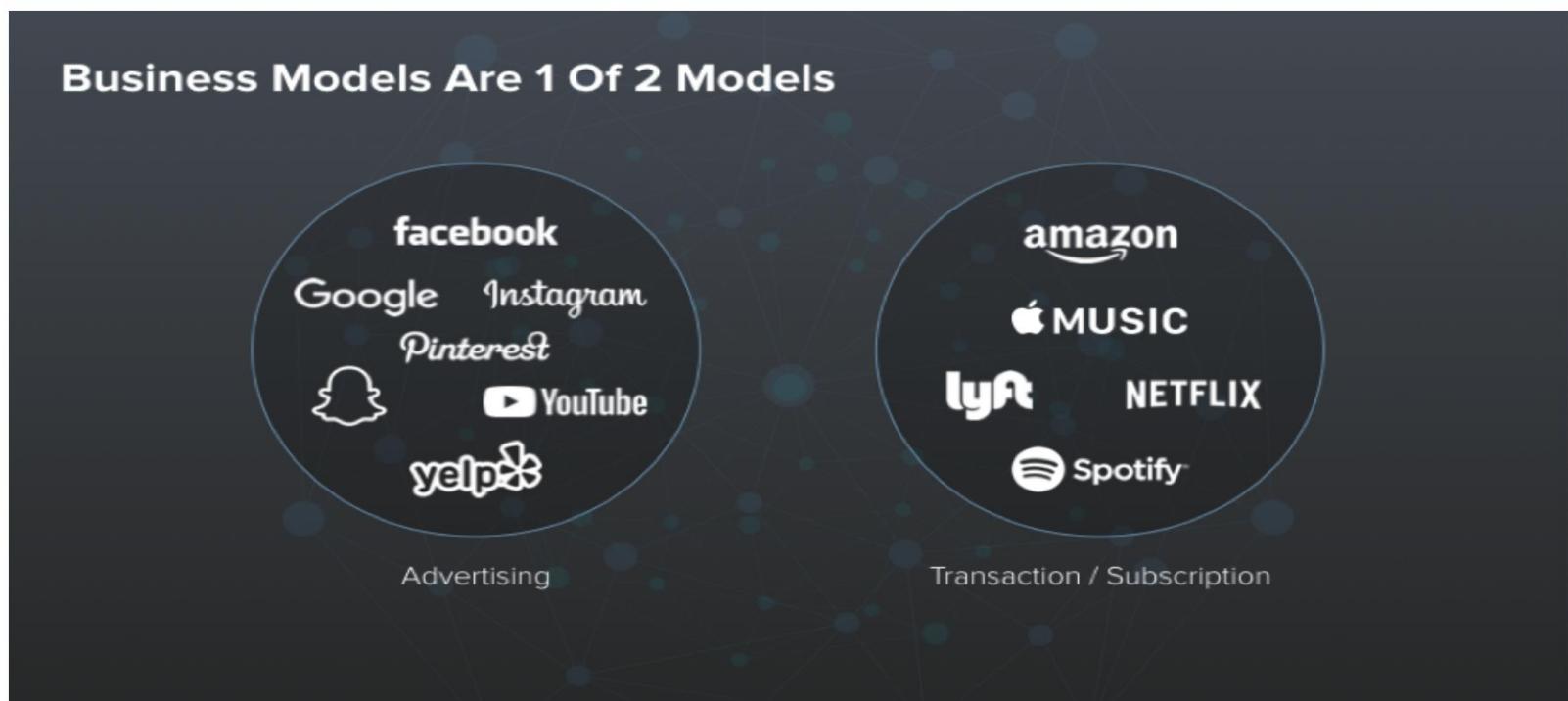
Finding the relevant NSM depends mainly on the business model

Advertising/Attention -driven

Focus on increasing engagement and time in app

Transaction/subscription-driven

Optimize for the lowest friction before the check out point



Source: <https://a16z.com/2018/12/07/when-advertising-isnt-enough-multimodal-business-models-product-strategy/>

Some NSM examples from big companies

- **Airbnb:** Number of Nights Booked
- **Facebook:** Number of daily Active Users
- **Quora:** Number of questions a user answers
- **WhatsApp:** Number of messages a user sends
- **Walmart:** Number of purchased transactions
- **Netflix:** Number of subscribers watching >X hrs of content per month

Some NSM examples from big companies

- **Airbnb:** Number of Nights Booked
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What could be the NSM for UberEats?

In-class Video: Alex Schultz: North start metric

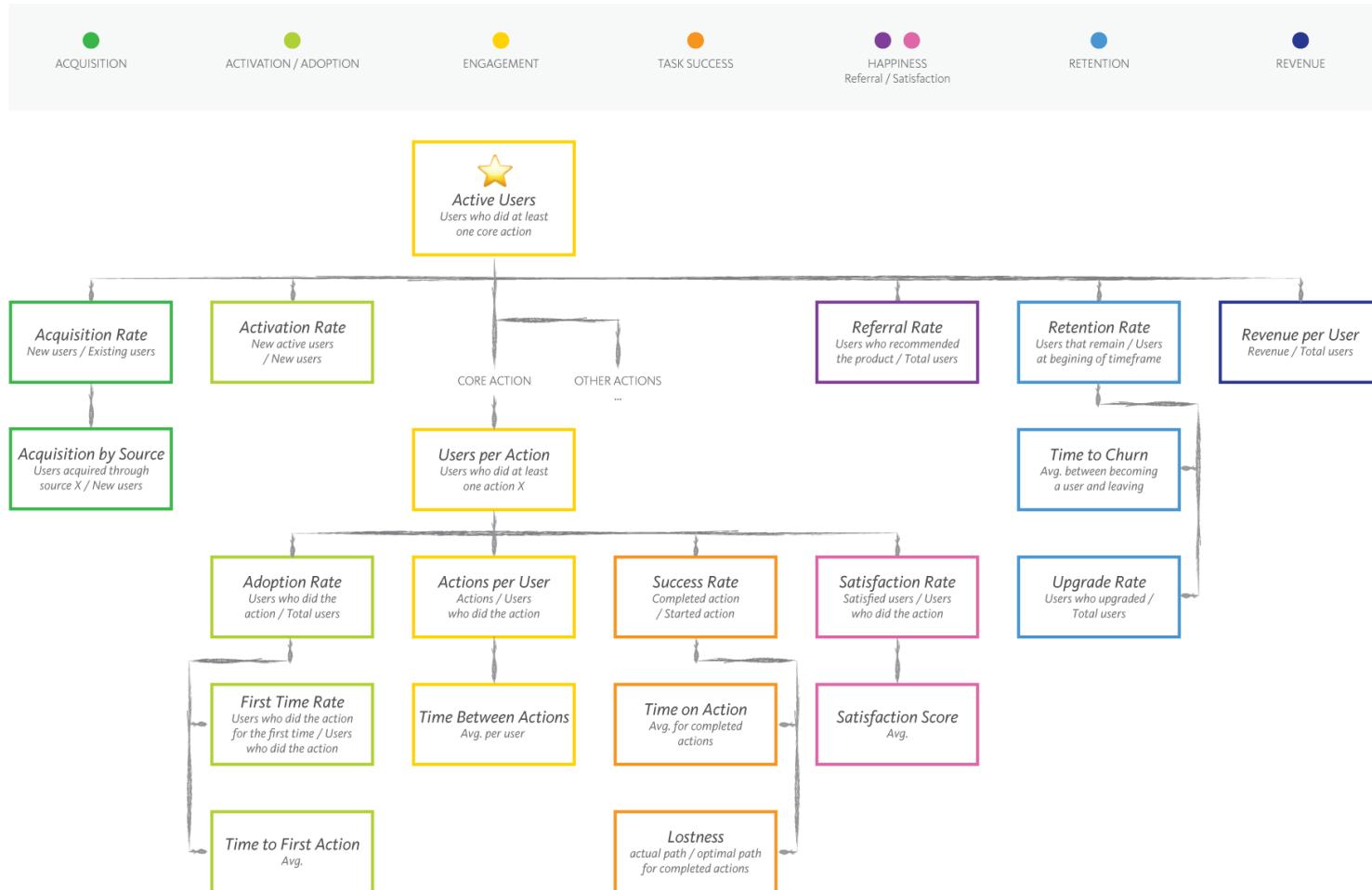
(Minute 11:15-16)

Growth

alex schultz

https://www.youtube.com/watch?time_continue=1&v=n_yHZ_vKjno&feature=emb_logo

Standard metrics for a generic product (product analytics)



<https://uxdesign.cc/product-metrics-that-matter-951b9e4d4eca>

In class exercise

1. Identify a north star metrics (NSM) for below businesses which matters the most for the growth of the companies

- Wayfair
- Doordash
- Ebay
- Open table

2. For all recommended NSMs bring at least 2 reasons of how each of product, marketing and sale team in above companies can relate to these metrics?

Example: for Facebook, the number of Daily/Monthly Active Users (DAU/MAU) is NSM determined by Mark Zuckerberg early on. This is the metric through which they can estimate the advertisement revenue from this number since they know historically for each MAU they can make up to \$x from the advertisers.

Reading/listening list

Relevant readings, articles, podcasts and videos

15-min round discussion for next week

- [Reading: Different type of Acquisition Channels](#)
- [Reading: 10 Most Important Ecommerce Metrics To Track](#)
- [Reading: Every product needs a north start metric](#)
- [Podcast: What's the north star metric \(minute 7 onward\)](#)
- [Reading: Lean Analytics – Use Data to Build a Better Startup Faster \(Chapter 1-4\)](#)

Extra interesting and relevant content

- [Reading: How to define a metric to prove or disprove your hypotheses and measure progress](#)
- [Reading: How Amazon, Google, and Belsimpel Perfected the Customer Journey](#)
- [Video: Find Your North Star Metric, Alex Schultz \(VP growth\)](#)
- [Podcast: Eric Ries -- From Lean to "Lean Startup" to "The Startup Way"](#)
- [Reading: Cross device marketing: the attribution challenge you cannot ignore](#)
- [Reading: Attribution modeling overview](#)
- [Reading: Product Metrics That Matter](#)

Post your questions @

Week 1 discussion board in

Blackboard

Lecture 2

Customer Analytics Frameworks and Different Business Models

Instructor: Ali Pilehvar, Ph.D.



9/9/2021

Agenda for today

- ▶ Discussions/questions from last week
 - ▶ Predictive Customer Analytics
 - ▶ Customer Analytics Framework:
 - AARRR
 - Eric's Rise's engines of growth
 - Lean analytics stages
 - ▶ Customer Analytics for Different Business Models
 - E-commerce
 - Software as a Service (SaaS)
 - Two-sided Marketplace
 - ▶ Hw2 and pre-read for next week
-

Discussion from last week

Learnings from last week

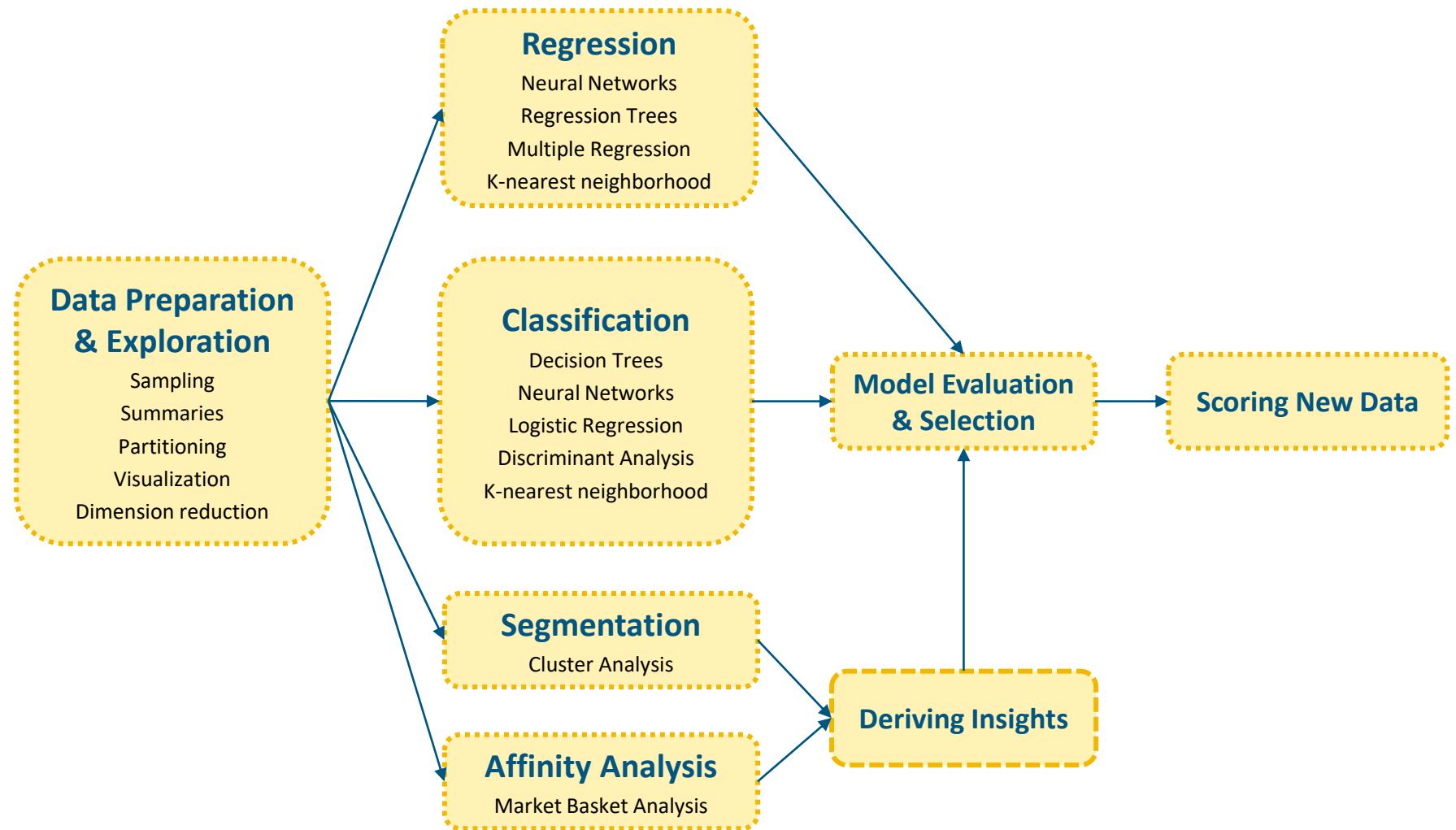
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Predictive Customer Analytics

Predictive Customer Analytics

- In the age of AI and Machine Learning, we can dig deeper into our customers' data to predict how they would behave in the future.
- A solid predictive model can help us make a more informed data-driven decision.
- Supervised learning methods for:
 - Predicting whether a customer would churn (Classification)
 - Predicting whether a customer would use a received promotion to buy a product (Classification)
 - Predicting product demand based on customer trends (Regression)
- Unsupervised learning methods for:
 - Segmenting customers into clusters based on their past behavior (Cluster Analysis)
 - Personalized recommendation for individuals/clusters (Market Basket Analysis)
 - Analysis of customers' sentiments towards our brand/products (Natural Language Processing Models)

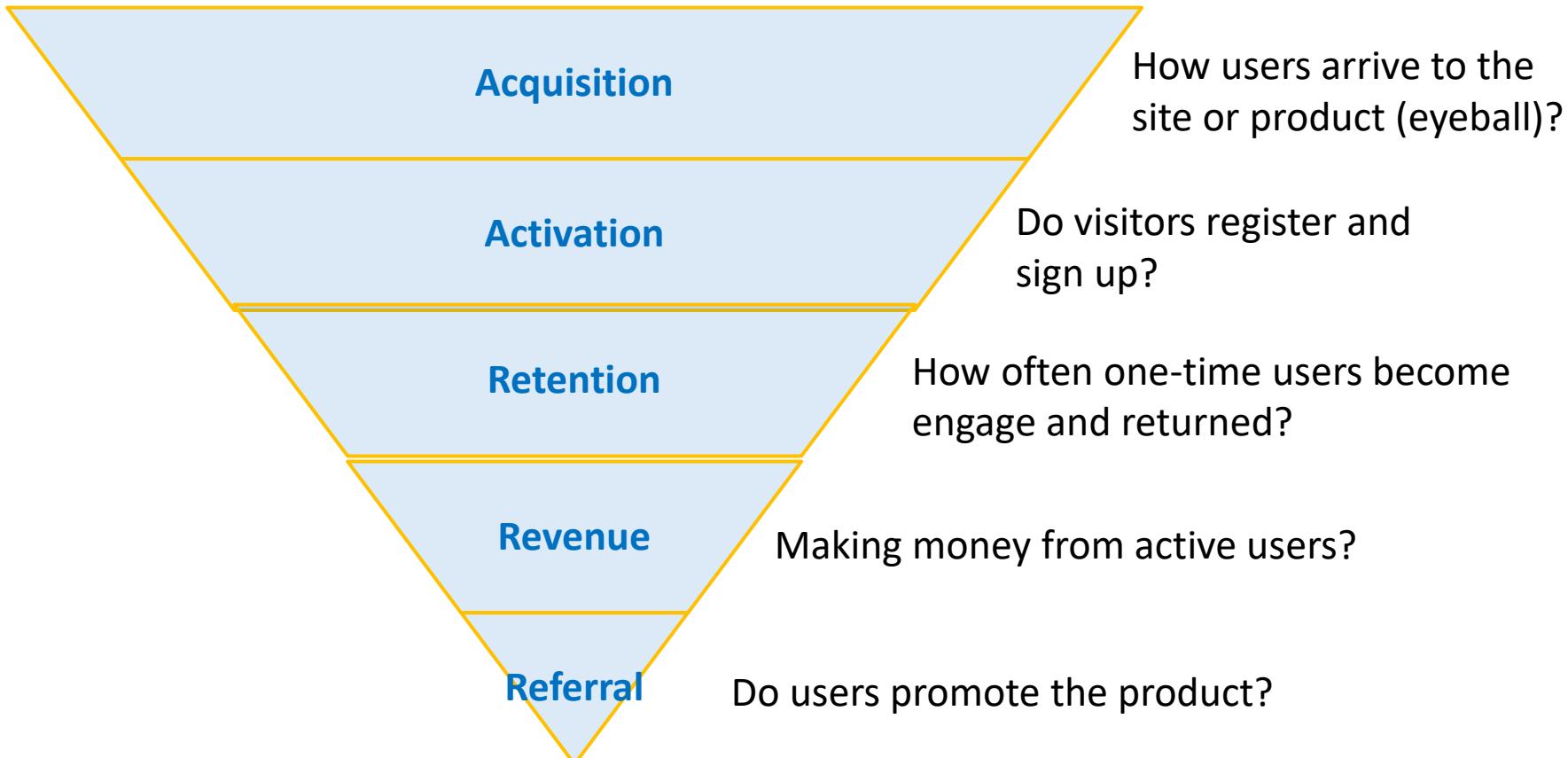
Data mining road map



Customer Analytics Framework

Dave McClure's **Pirate metrics** cover Customer Analytics across different stages of customer journey

- A growth framework known as **AARRR** has five stages through which a company can extract all values from the customers.



Sample customer metrics across AARRR stages (ideally, they should all be connected at the customer-level)

Stage	Sample metrics
Acquisition	Traffic from different channels, cost per click, search results, cost per acquisition (CAC), App open rate
Activation	Enrollment, signups, completed onboarding, subscription, views, login, add to watch list
Retention	Time since last visit, daily/weekly/monthly active users, frequency of visits, L30*, churn rate
Revenue	Customer life-time value, purchase conversion, shopping cart size, avg order value
Referral	Invite sent, viral coefficients, NPS score**

* Facebook's user engagement metric which is % of customers were active in a month, from 1 day out of the month to all 30

** Net Promoter Score (NPS) measures the loyalty of customers to a company. NPS scores are measured with a single question survey and reported with a number from -100 to +100, a higher score is desirable.

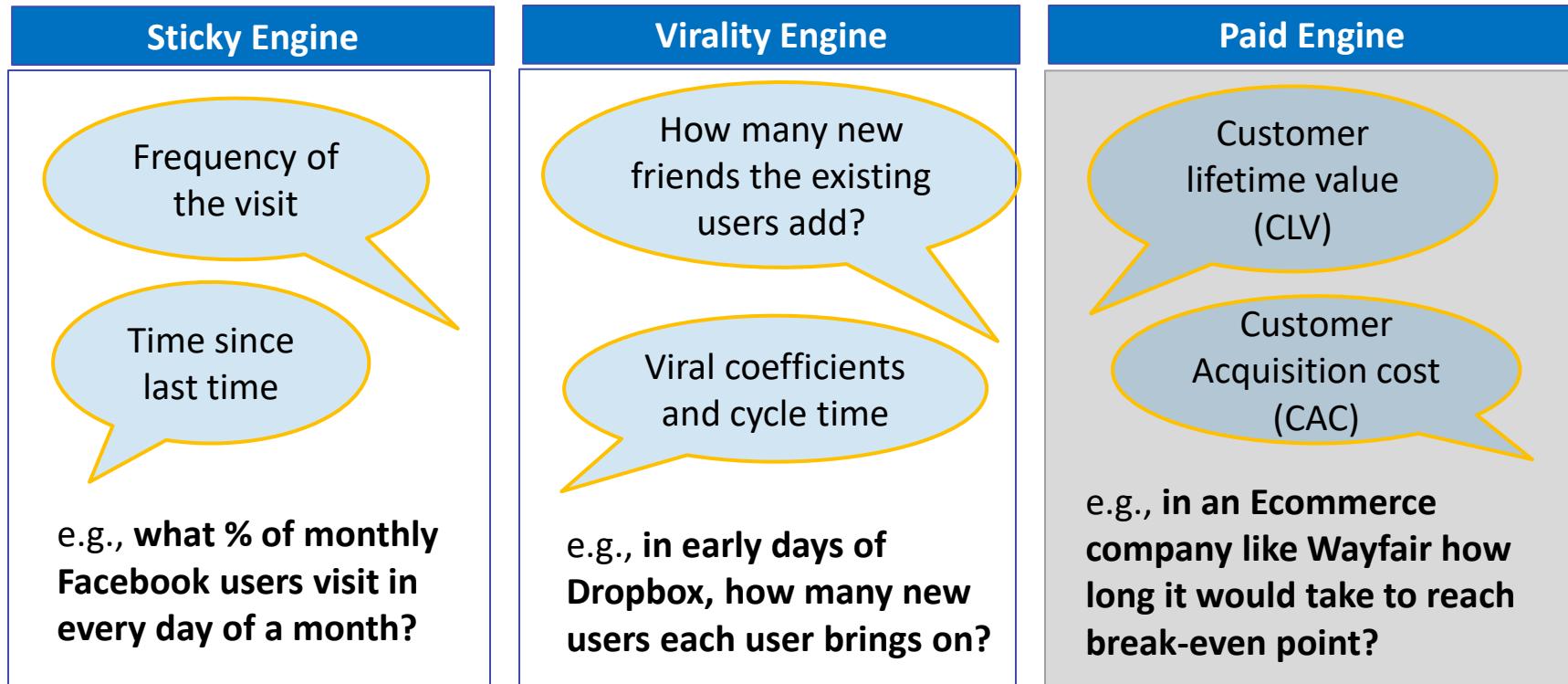
What metrics are relevant to each category will be unique to your business (example of pirate metrics for a music-streaming service)

Stage	Sample metrics
Acquisition	User sign-up rate, cost of acquisition
Activation	Conversion rate to paid accounts, songs played in first week
Retention	Monthly subscription renewal rate, churn rate
Revenue	Customer lifetime value, monthly recurring revenue
Referral	Percentage of customers sharing referral codes, successful referrals

Always avoid the vanity metric, rather focus on actionable metrics

Three engines that drive the growth and each has some associated Customer Analytics metrics

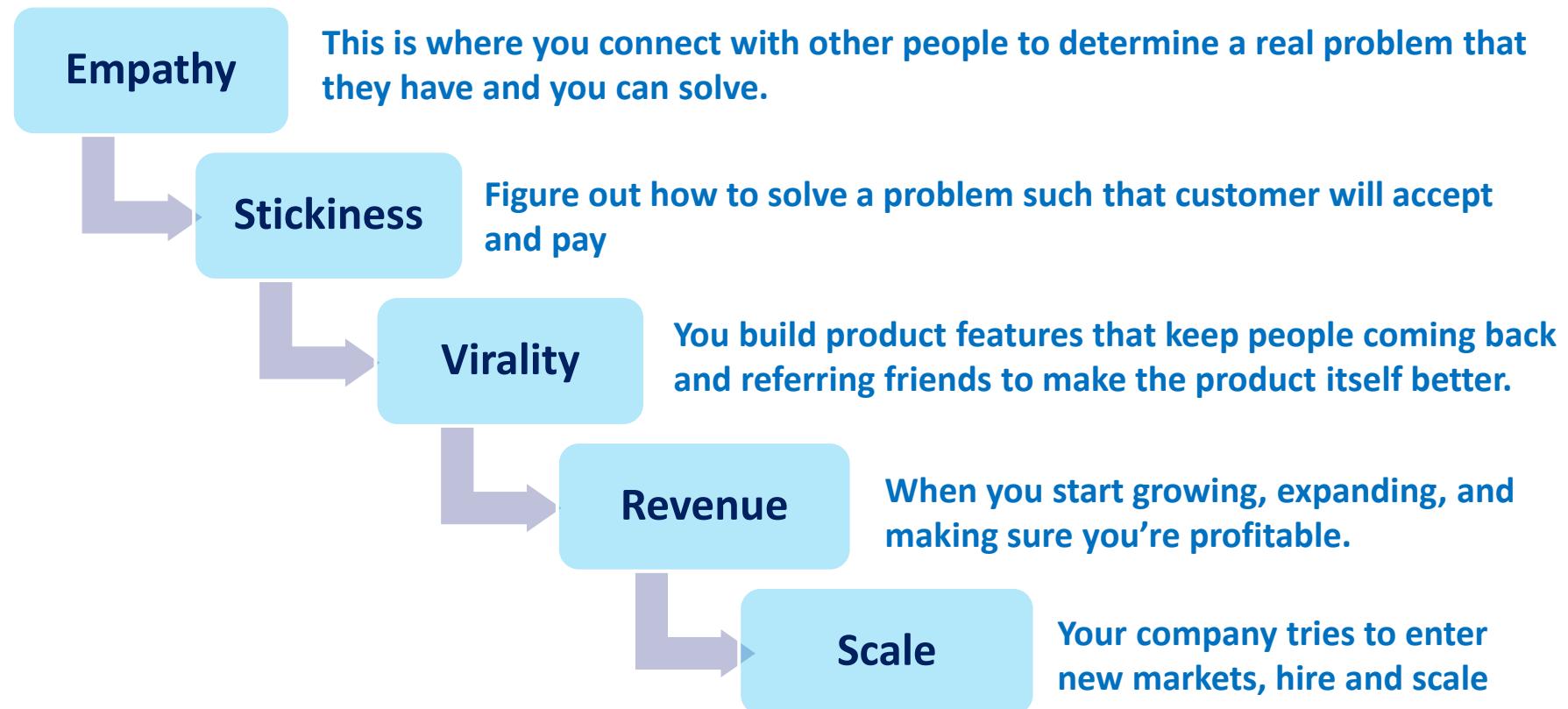
- Eric Ries's lean Startup focuses on three growth engines where customer analytics metrics should be impacted



Ultimate metric for a sustainable business

The Lean Customer Analytics stages

- Five stages are: **Empathy, Stickiness, Virality, Revenue and Scale**
- Most startups go through these stages to find product-market fit and grow

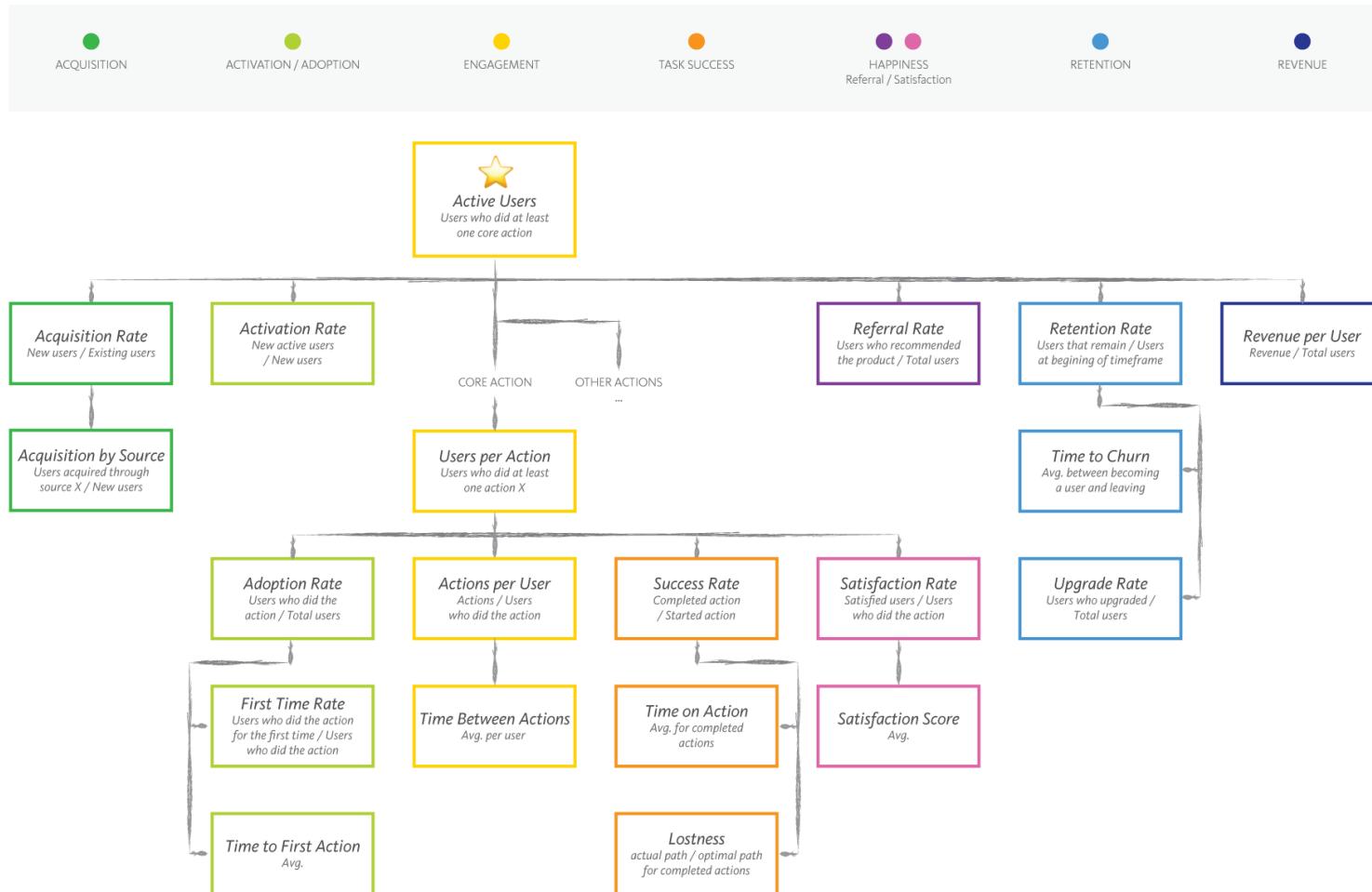


Lean analytics Examples

- Find the one metric that matters most, depending on what stage the companies in and the business model

	Product stage	Sample metric
Empathy	Idea validation	Sign up for a website
Stickiness	You do have a product now and test it in market (search for product-market fit)	Engagement metric (# of active user)
Virality	Growth phase, at how to bring more people into the top of the funnel.	Churn rate, virality coefficient
Revenue	Become a profitable business	Conversion from free to paid users, life-time value of the customers
Scale	Looking for new market, channels, functionality, segments, geography	Market share, penetration

Standard metrics for a generic product (product analytics)



<https://uxdesign.cc/product-metrics-that-matter-951b9e4d4eca>

What Business you are in?

Business model is combinations of how to get customers, what/how to sell, how to make money and how to deliver value

- To identify the **right metrics**, we should be able to first **identify the business models** and customer value chain.

Business aspect	Flipbook page(s)	Dropbox example
Acquisition channel	Inherent virality. Artificial virality.	Sharing files with others. Free storage when others sign up.
Selling tactic	Freemium.	Limited-capacity accounts are free; subscribe when you need more.
Revenue model	Recurring subscription.	\$99/year, monthly fees, enterprise tiers.
Product type	Platform.	Storage-as-a-service with APIs, collaboration, synchronization tools.
Delivery model	Hosted service. Digital delivery.	Cloud storage, web interface. Desktop client software.

Source: <https://www.pinterest.com/pin/585186545305807561>

Building the Customer Analytics framework and metrics depends on the type of business models they are in

- Different business models search for different growth metrics at their cores and face different customer journey
- Some companies employ more than one business model at once



E-commerce

Sell products to the customers online (e.g., Amazon)



Media Site

Creating content and making money from advertising (e.g., news site like CNN)



Software as a Service (saas)

Offers software on an on-demand basis (e.g., HubSpot, Slack)



Two-side marketplaces

Buyers and sellers can interact and transact (e.g., Uber, Airbnb)



Free Mobile App

Having model app and using in-app purchase to generate revenue



User-generated content

Getting users to generate content on the platform (e.g., Facebook, reddit)

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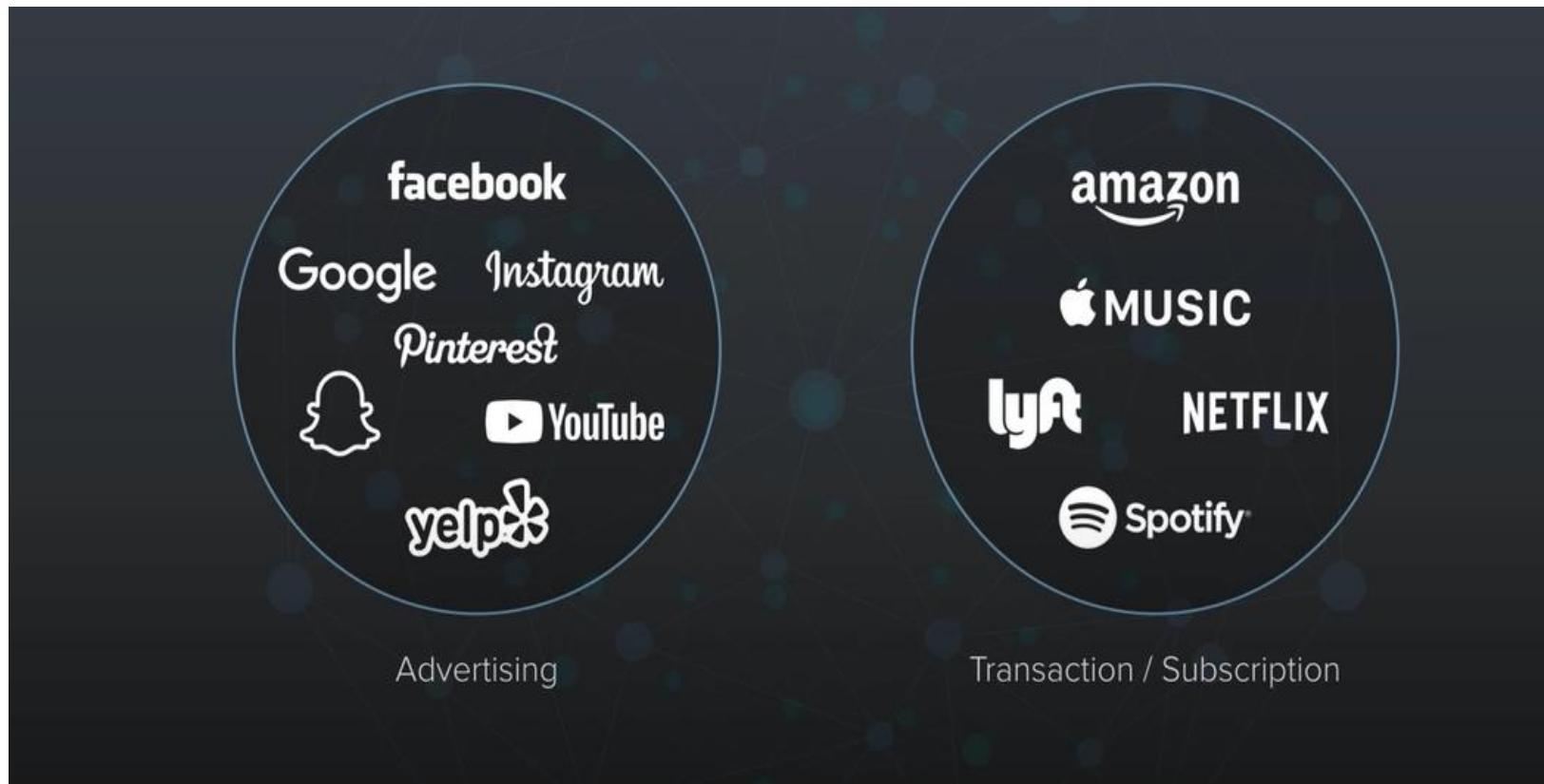
Buyers and sellers can interact and transact (e.g., eBay, Uber, Airbnb)

User-generated content

Getting users to generate content on the platform (e.g., Facebook, reddit)

Visiting the business model of biggest consumer internet companies in US

- They belong to either Advertising (Eyeball Economy) or Transaction/Subscription (Wallet Economy) Business models



Source: When Advertising Isn't Enough <https://www.youtube.com/watch?v=78pLij4xeVs>

Visiting the business model of biggest consumer internet companies in US , cont.

- Revenues are highly concentrated on either Advertising or Transaction/Subscription in US



Source: When Advertising Isn't Enough <https://www.youtube.com/watch?v=78pLlj4xeVs>

Chinese Consumer Internet companies embrace different business models compared to US counterparts (min 9:40-12:20)

- **Advertising-based** business model for Podcast in US *versus* **Subscription-based** business model for Podcast in China

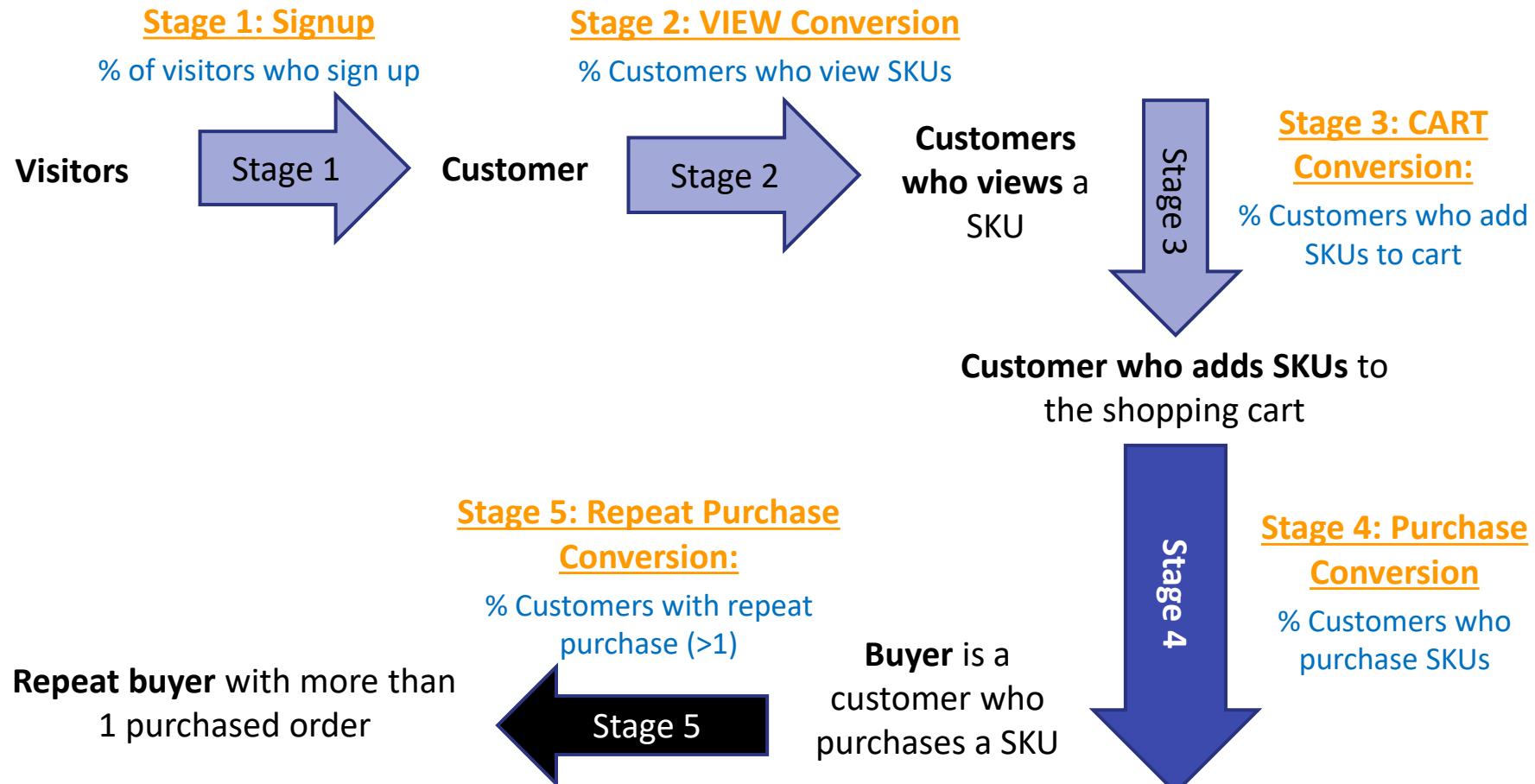


Source: When Advertising Isn't Enough <https://www.youtube.com/watch?v=78pLlj4xeVs>

Model 1: E-commerce Business Model

In an **e-commerce company**, a visitor buys something from a web-based retailer (e-tailer)

- A 5-stage buyer journey in an E-commerce company.



9 important metrics which e-commerce companies should care the most

Conversion Rate

The number of visitors who buy something

Purchase per year

Number of purchases made by each customer annually

Avg Shopping Cart Size

The amount of money spent on a purchase

Abonnement Rate

% of people who begin to make a purchase, and then don't

Customer Acquisition Cost (CAC)

The marketing spend to get one customer

Revenue per Customer

The lifetime value of each customer

Active Customers

Number of people who are engaged (e.g., bidder in eBay)

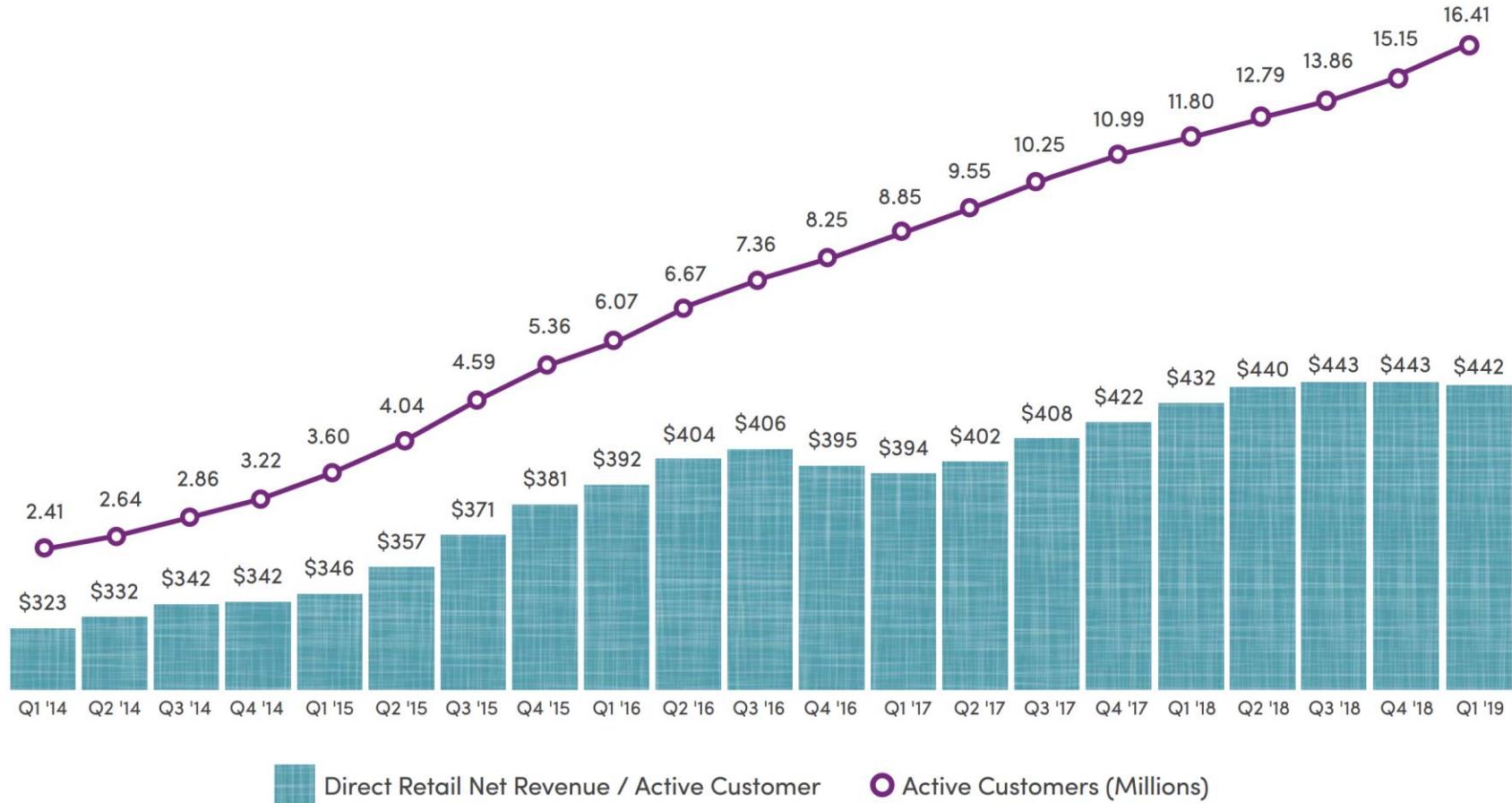
Effectiveness of Recommendations Services:

How likely a visitor is to add a recommended product to the shopping cart

Repeat Buyers

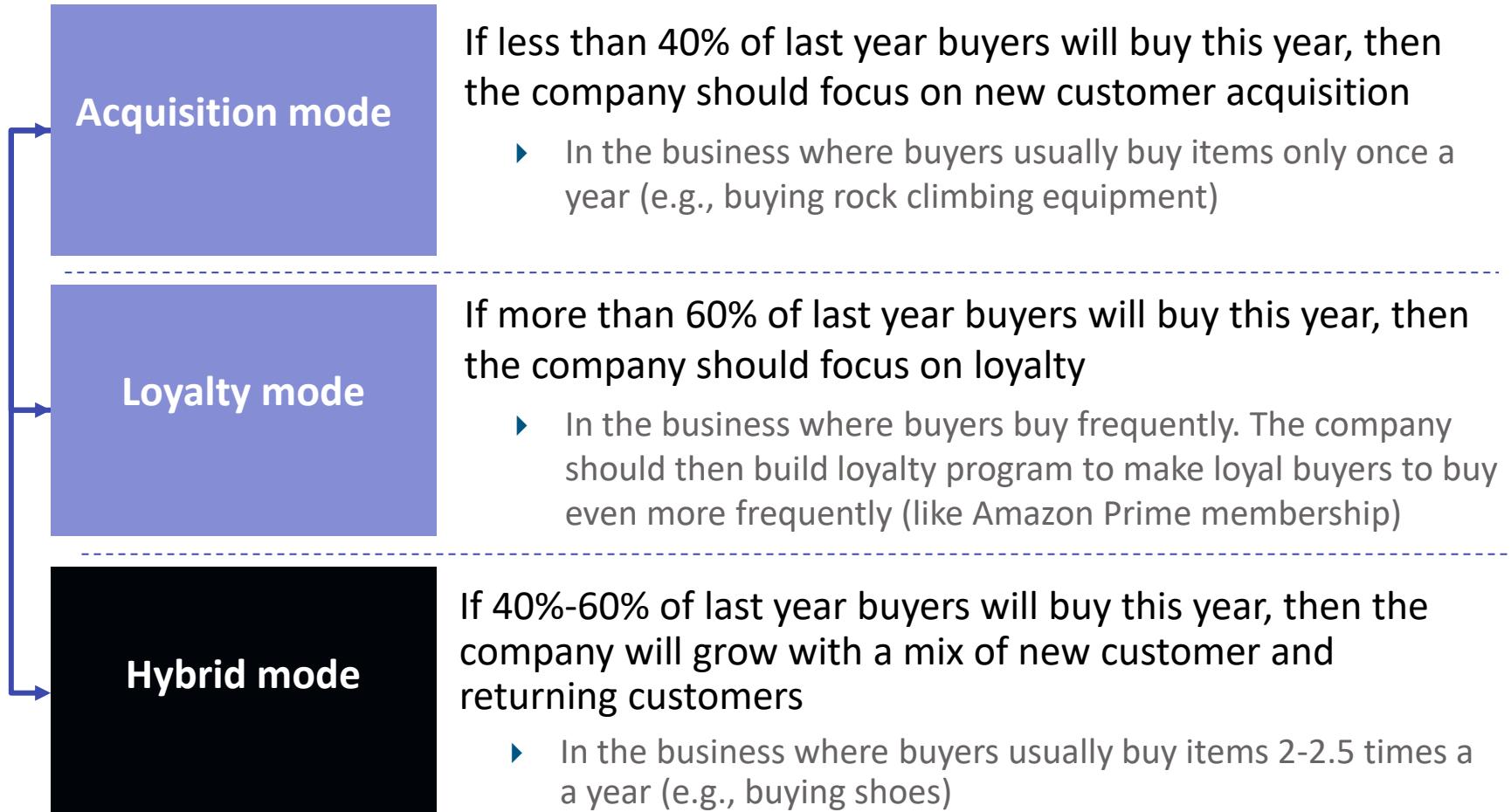
% of customers who do more than one transaction in a month or quarter

Wayfair.com reports on # active customers as well as revenue per customer in quarterly earning call (Q1 2019)



Source: [https://s2.q4cdn.com/848638248/files/doc_financials/2019/q1/Wayfair_Investors_Presentation_Q1_2019-\(3\).pdf](https://s2.q4cdn.com/848638248/files/doc_financials/2019/q1/Wayfair_Investors_Presentation_Q1_2019-(3).pdf)

Acquisition versus Retention E-commerce mode



E-commerce example

	Acquisition Channel	
	Comparison site	Display ad
# of visits	100,000	80,000
Registration Conversion	3%	5%
% of registered customers add something to basket	20%	25%
% of purchase conversion	90%	50%
Avg value per order (\$)	\$150	\$500
Number order per buyer	2	1

- **Which Channel is more valuable?**
 - **Which one has a better unit of economics?**
-

Ecommerce example , Cont'd

	Acquisition Channel	
	Comparison site	Display ad
# of visits	100,000	80,000
Registration Conversion	3%	5%
% of registered customers add something to basket	20%	25%
% of purchase conversion	90%	50%
Avg value per order (\$)	\$150	\$500
Number order per buyer	2	1
Display ad brings more revenue	\$162,000	\$250,000
Display ad brings more revenue/visit	\$1.6	\$3.1

This is not enough!

- To find out **MROI (Marketing Return of Investment)** we need to also have the marketing spend (\$) for each channel.
-

Model 2: Software As a Service (SaaS)

A SaaS (Software as a Service) company offers software on an on-demand basis

- Most SaaS Companies make money from a monthly or annual subscription fee that users pay.
- Many SaaS companies use a fermium model of customer acquisition to scale up the growth.
- Optimizing the onboarding experience is critical to make relevant visitors enroll with the service fast enough and convert them to paid users after some time.



9 important metrics which SaaS companies should care the most

Attention

How effectively the business attracts visitors

Enrollment

How many visitors become free or subscribed members

Stickiness

How much time customers use the product

Conversion How many of the users become paying customers

Revenue per customer
How much money a customer brings within a given time

Customer Acquisition Cost (CAC)
How much it costs to get a paying customer

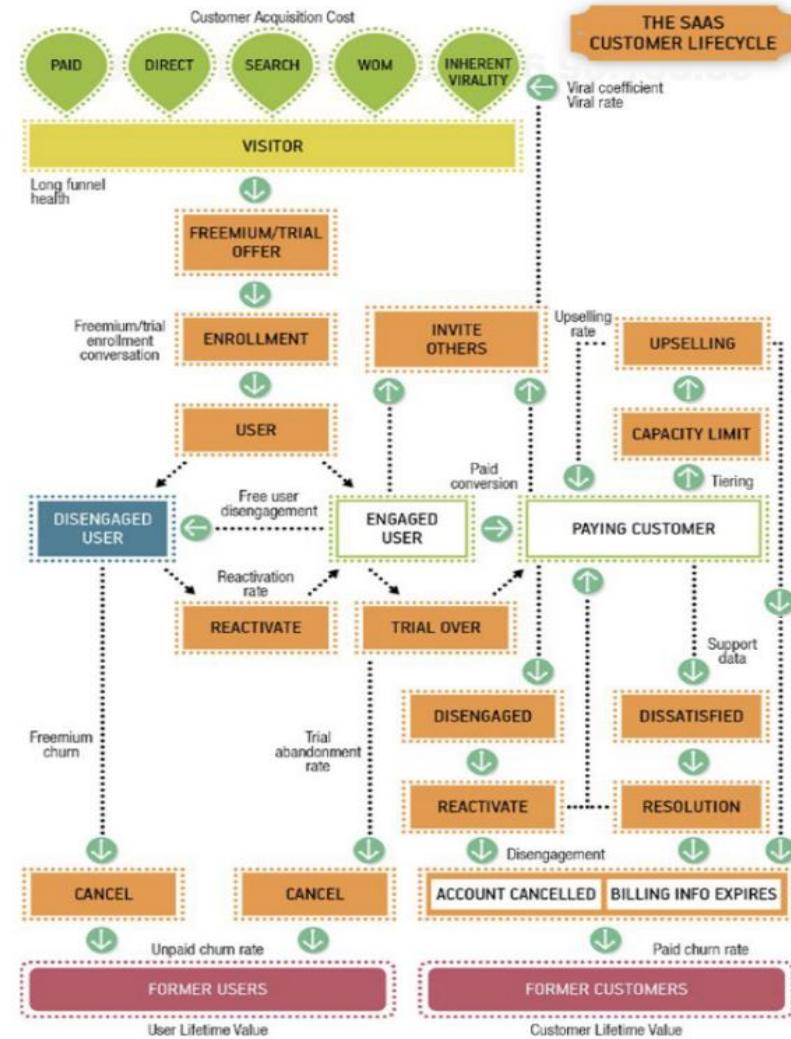
Virality How likely customers are to invite others and spread the words

Churn
How many users and customer leave during a certain time

Customer lifetime value (CLV)
How much customers are worth from cradle to grave

Visualizing the SaaS business model and buyer journey

- In a fermium or free-trail SaaS business model we have both users (not paid) and customers (paid).
- Pricing is a very important and should be very strategic in SaaS company.
- Value-based Pricing can create enough incentive for unpaid users to become paid users.



Source: <https://www.pinterest.com/pin/581245895627571126>

Ratio of CLV to CAC demonstrates the health of customer Economics in each SaaS company

- A SaaS company which provided cloud storage has the CAC (Customer Acquisition Cost) of \$160 to attract every new customer
- Customer only pays \$80 per year

Customer Economics does not look good

- A SaaS company now calculates the Customer Lifetime Value (CLV) for \$200 (*around 2.5 year of tenure*)
- Ratio of CLV to CAC is now ~100%, company is at the breakeven point

Sill far away from profitability

SaaS companies' objective is to have at least 300% CLV/CAC to manage a viable business with the growth potential.

Churn is one of the most important metrics for SaaS companies to predict the business growth rate

- Churn is the % of customers who abandon the service over time.
- Churned should be defined meaningfully and measured weekly, monthly or quarterly.
- Sometime companies use 90-days period in order to determine if customers are inactive (*e.g., not logged in within 90 days*)

Churn Rate for unpaid users

Cancelling the accounts or simply not coming back after some certain time

Churn Rate for paid customers

Cancelling the accounts, stop paying or converting to unpaid version

$$\text{Churn rate: } \frac{(\text{Number of churns during period})}{(\#\text{ customers at the beginning of period})}$$

Churn Example in a fermium SaaS company

	Jan 2019	Feb 2019	March 2019	April 2019	May 2019
Users					
Starting with	20,000	23,000	27,000	32,000	38,000
Newly Acquired	3,000	4,000	5,000	6,000	6,500
Total	23,000	27,000	32,000	38,000	44,500
Active Users*					
Starting with	8000	8,900	10,100	11,600	13,400
Newly Active	900	1200	1500	1800	1950
Total	8,900	10,100	11,600	13,400	15,350
Paying users					
Starting with	600	610	620	630	640
Newly paid	90	120	150	180	195
Lost	-80	-110	-140	-170	-190
Total	610	620	630	640	645

*Active users are the ones who logged in *at least once* during that month

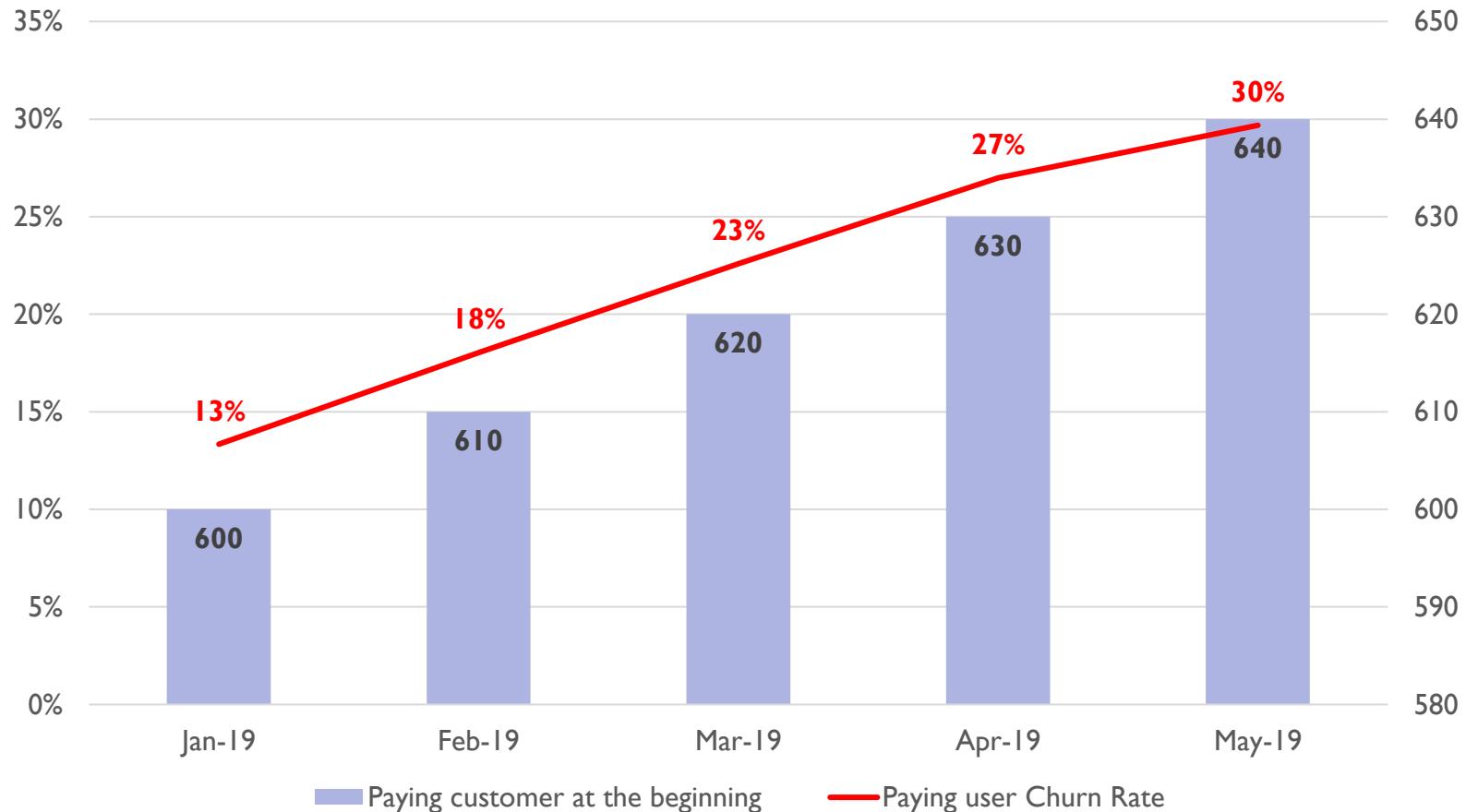
Churn Example in a fermium SaaS company, Cont'd

	Jan 2019	Feb 2019	March 2019	April 2019	May 2019
Paying users					
Starting with	600	610	620	630	640
Newly paid	90	120	150	180	195
Lost	-80	-110	-140	-170	-190
Total	610	620	630	640	645
Churn Rate	13%	18%	23%	27%	30%
(Number of churns during period)					
# customers at the beginning of period)					

- Average monthly churn of 21% means that an average paid customers stay around for around 5 months ($100/21$)
- This will show how to calculate the lifetime value of a customer as
[5 month × average monthly revenue per customer]

Churn Example in a fermium SaaS company, Cont'd

- Any other insights we can derive from observing churn rate over time?



Model 3: Two-Sided Marketplace

Two-sided marketplaces have two side of **seller** and **buyer** who interacts and transacts with each other

- The objective of marketplaces is **to facilitate the interaction** between seller and buyer to complete a transaction.
- The seller is responsible for listing and promoting the product.
- The biggest challenge is to attract enough number of buyers and sellers.

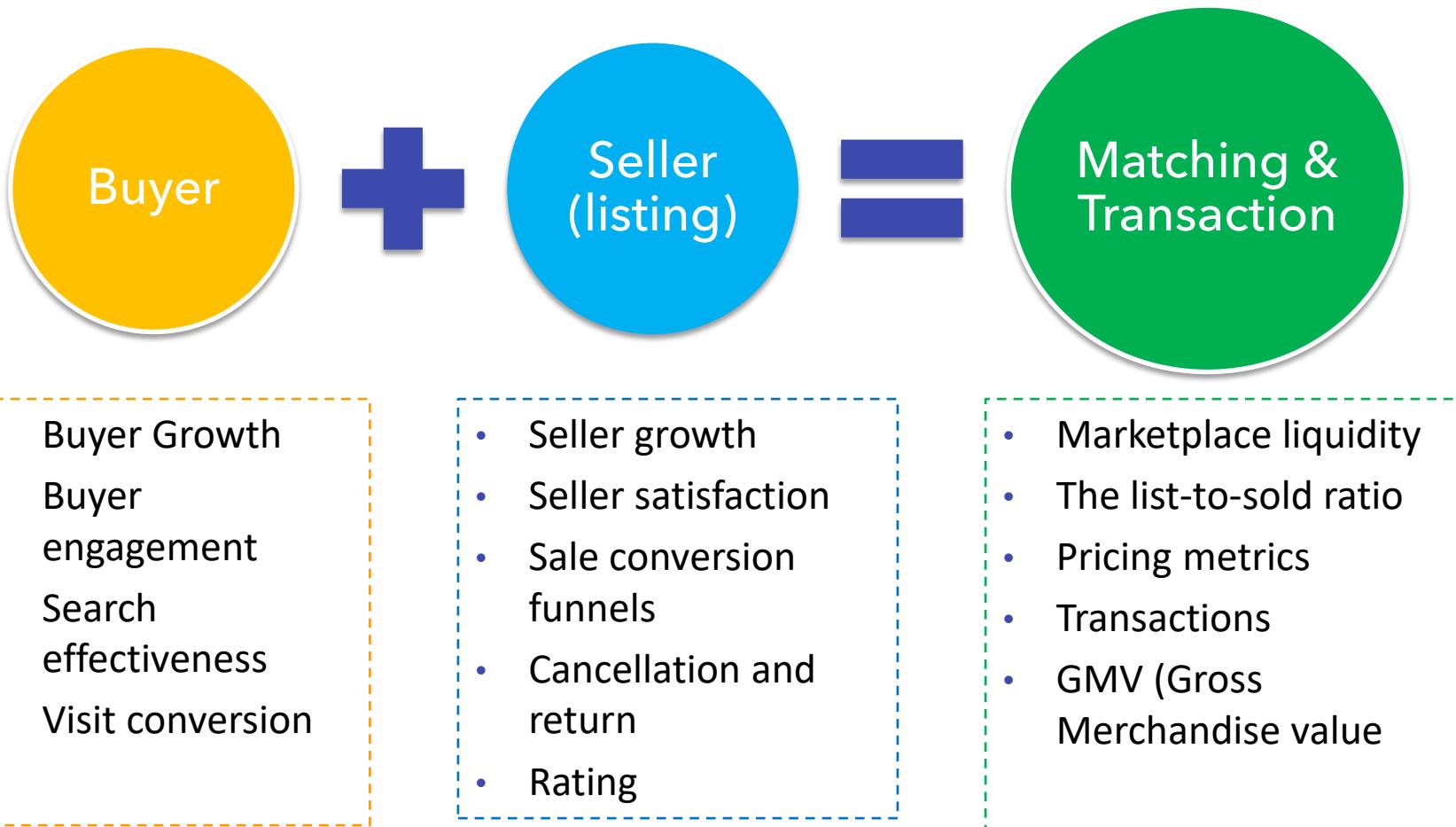
B2C (business to consumer)



C2C (consumer to consumer)



Metrics in two-sided marketplaces should capture the health of buyers+ sellers +matching quality (liquidity)



Two-sided marketplace metric examples

Unique visitors

Returning Visitors

Registered visitors

Visitor/seller ratio

Buyers (1+Purchase)

Engaged buyers last 30 days

Engaged buyers/active seller ratio

Engaged buyers/active listing ratio

Active sellers (listing last 30 days)

% active sellers

Active listing with more than 5 views

% active listing

Growth of buyers

- ▶ These could be VANITY metrics though!
- ▶ We should care more about visitors who would make purchase

Buyer engagement and activity

- ▶ More actionable and meaningful buyer metrics

Seller growth

- ▶ Not all the sellers have high-quality
- ▶ They might get onboarded and then only use the marketplace once to test the price

More Marketplace Metrics from Andreessen Horowitz

(one of biggest and well-known Venture Capitalists in the world)

Match rate (aka utilization rate or success rate)

- Driver utilization time for ridesharing — what % of the time are drivers driving around with a passenger, vs. empty?
- How often are employers filling their posted role in job marketplaces? And how often are job seekers finding jobs?

Take rate

- In marketplace businesses, gross merchandise volume (GMV) and revenue are frequently used interchangeably. But GMV does not equal revenue.
- Gross merchandise volume is the total sales dollar volume of merchandise transacting through the marketplace in a specific period.
- Revenue is the portion of GMV that the marketplace “takes.”

Market Depth (more supply)

- **Homogenous marketplaces** (Uber, Lime Scooter): When users open Lime, how many cars/scooters will they see near them? (*value to users eventually plateaus with greater market depth*)
- **Heterogenous marketplaces** (Airbnb): user's tastes may be quite specific, so every additional listing on the platform would bring more value.

Power user curves

Are users becoming more engaged over time?

- *Power user curves (commonly called L30 charts for 30 days of use, or L7 charts for 7 days of use) are histograms of users' engagement, showing the total number of days users were active in doing a particular action in a given timeframe*

Source: <https://a16z.com/2020/02/21/marketplace-metrics/>

Homework + Reading/listening Pre-read

Due 9/16, 7pm EST

HW1 will be posted in the assignment
section of BB, 9/9, 10pm EST

Relevant readings, articles, podcasts and videos

15-min round discussion for next week

- [Reading: AARRR framework](#)
- [Video: How to Increase The Lifetime Value \(LTV\) of Your SaaS Customers](#)
- [Video: Nine Business Models and the Metrics Investors Want](#)
- [Reading: Metrics for a two-sided marketplace product](#)
- [NFX Podcast: How VCs See Your KPIs](#)

Other interesting and relevant content

- [Reading: The Power User Curve: The best way to understand your most engaged users](#)
- [Reading: Lean Analytics – Use Data to Build a Better Startup Faster \(Chapter 5-13\)](#)
- [Reading: Lean Analytics summary](#)
- [Reading: Make Your Pirate Metrics Actionable](#)
- [Video: When Advertising Isn't Enough](#)
- [Reading: 13 Metrics for Marketplace Companies](#)
- [Reading: 12 Things about Product-Market Fit](#)

Questions

Email me @ Alipilehvarm@GWU.EDU

Lecture 3

Growth and User Acquisition

Instructor: Ali Pilehvar, Ph.D.



9/16/2021

Office hour moving forward

- ▶ Wednesday 7pm-8 pm EST
- ▶ Monday 7:30-8:30 am EST

Agenda for today

- ▶ 10 min discussion from last week
- ▶ Customer Acquisition Cost (CAC)
- ▶ Calculating CAC for Different marketing acquisition channels
- ▶ In-class case study
- ▶ The importance of Network effects in two-sided marketplace businesses
- ▶ Project team Spreadsheet [here](#)
- ▶ Homework 2 will be posted after the class

10 min discussion from last week

More about the LTV (life-time value) of customers

A “basic” LTV formula

This basic formula for LTV is commonly accepted as a useful starting point for estimating the LTV of SaaS customers. However, it's only a rough estimate, and doesn't properly account for Monthly Recurring Revenue (MRR) expansion, contraction or the fact that churn doesn't occur linearly (see pages 2 & 3).

$$LTV = ARPA \times \sum_{n=0}^{\# \text{ of months to examine}} (1 - \text{Customer churn rate})^n$$

This can be simplified to the following formula, which will trend to the same result:

$$LTV = \frac{ARPA}{Cust. Churn Rate}$$



Important: Make sure that both these values are from the time range for which you are measuring LTV.

Basic Maclaurin Expansions

$$\frac{1}{1-x} = 1 + x + x^2 + x^3 \dots = \sum_{n=0}^{\infty} x^n$$

Learnings from last week

- [a16z Podcast: The Basics of Growth — User Acquisition](#)
- [Reading: AARRR framework](#)
- [Reading: Hooked: How to Build Habit-Forming Products](#)
- [Video: How to Increase The Lifetime Value \(LTV\) of Your SaaS Customers](#)
- [Video: Nine Business Models and the Metrics Investors Want](#)
- [Reading: Metrics for a two-sided marketplace product](#)

Customer Acquisition Cost (CAC):

The One Metric That Can Determine Your Company's Fate

Companies do not grow themselves, entrepreneurs grow them

- Founders/growth marketers should find the best place acquiring the most relevant and fitted customers to their business and double down on those channels
- Paid marketing tactics could be a good starting point to find product-market fit in the short-term, but it's not sustainable in a long-term!

Drivers in Growth Equation



Monthly **acquired**
customers (*new number
you gain*)



Monthly customers **retained**
from previous month (Active
customers)
[churn is part of this]

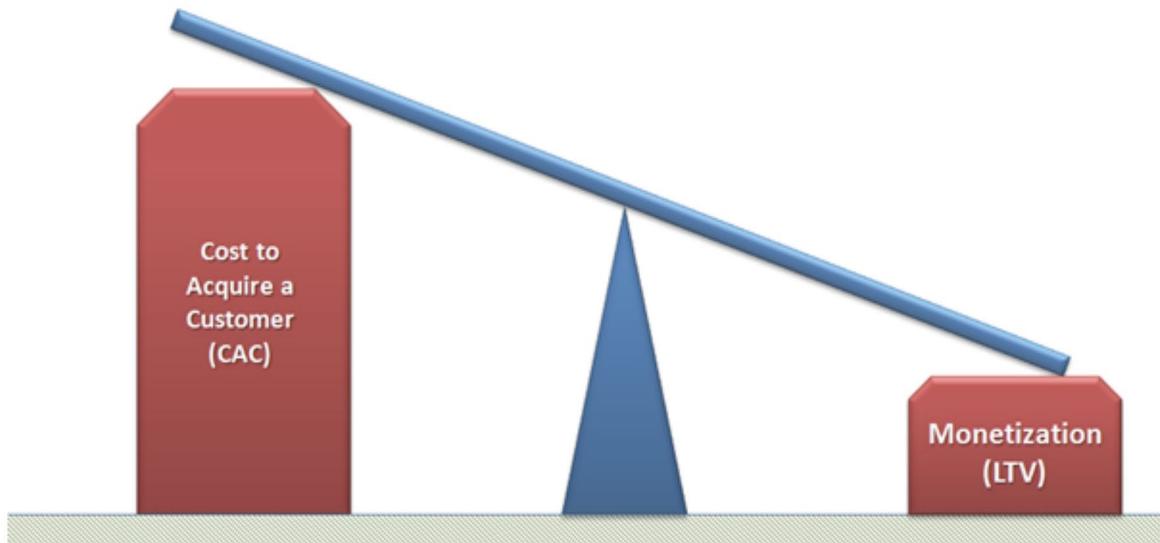


Monthly customers **resurrected** from past
(inactive customers)

CAC is the cost of convincing a potential customer to buy a product or service.

- Customer Acquisition Cost (CAC) is simply all **costs spent to acquire new customers** divided by **number of new customers acquired during the same period**.

- It is NOT difficult to figure that business model fails when **CAC (the cost to acquire customers)** exceeds **LTV (lifetime value of customers or the ability to monetize those customers)**



Source: <https://www.entrepreneurs.com/startup-killer/>

CAC (Customer Acquisition Cost) versus CPA (Cost Per Acquisition)

CAC: Cost to acquire a customer
(a buyer of an e-commerce, paying
customer in SaaS business)

HubSpot CAC for B2B SaaS

CAC =

- Cost to Acquire Paying User to **Basic Plan**
- Cost to Acquire Paying User to **Pro Plan**
- Cost to Acquire Paying User to **Enterprise Plan**

<http://reforge.com/cac>

CPA: Cost to acquire something that is
not customer (e.g., registrants, bidders,
users)

HubSpot CPA for B2B SaaS

CPA =

- Cost Per Lead
- Cost Per Sales Qualified Lead
- Cost Per Trial

<http://reforge.com/cac>

Dropbox CAC for Freemium

CAC =

- Cost to Acquire Paying User to **Pro Plan**
- Cost to Acquire Paying User to **Team Plan**

<http://reforge.com/cac>

Dropbox CPA for Freemium

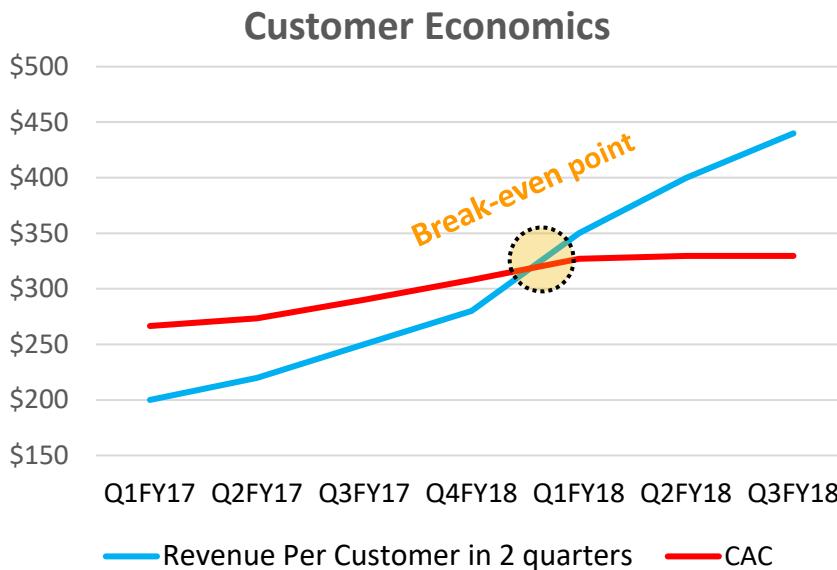
CPA =

- Cost Per Registration of **Free** User
- Cost Per Activated **Free** User
- Cost Per Other Activation Behavior for **Free** User

<http://reforge.com/cac>

CAC is important for both investors and companies- *it determines the profitability of Unit Economics*

	Q1FY17	Q2FY17	Q3FY17	Q4FY18	Q1FY18	Q2FY18	Q3FY18
Revenue Per Customer during 2 quarters	\$200	\$220	\$250	\$280	\$350	\$400	\$440
Total Paid Marketing cost	\$80,000	\$96,800	\$117,128	\$141,725	\$171,487	\$207,499	\$251,074
Number of Paid New Customers	300	354	404	460	524	629	762
Number of non-paid New Customers (free Channels)	700	900	1300	1900	2300	2550	2700
CAC	\$267	\$273	\$290	\$308	\$327	\$330	\$330
Blended CAC	\$80	\$77	\$69	\$60	\$61	\$65	\$73



- Looking into only **blended CAC** could be misleading as it might mask the true CAC from paid channels.
- The company reaches to break-even point at Q1FY18 ($CAC \approx LTV$)

CAC example- AdWords in an e-commerce company

Monthly Numbers	Scenario 1	Scenario 2
Total Visitors	10,000	10,000
SEM* Cost per click (CPC)	\$0.60	\$1
Registration Conversion	2%	2%
Purchase conversion	20%	20%
Marketing cost		
Number of sale and marketing staff	5	3
Salary of each staff	\$7,000	\$7,000
SEM Marketing Spend*	\$6,000	\$6,000
Customer base		
Number of Registration	200	200
Number of paid customers	40	40
Customer Acquisition Cost (CAC)		
With headcount costs	\$1,025	\$775
Without headcount costs	\$150	\$250

Scenario 2 is better when accounting for everything

* SEM (Search Engine Marketing) is the process of gaining website traffic by purchasing ads on search engines.

- The direct cost of marketing staff should be included when calculating the CAC (in-house staff *versus* outside agencies)
-

Big consumer apps get their first 1,000 users via different channels and tactics

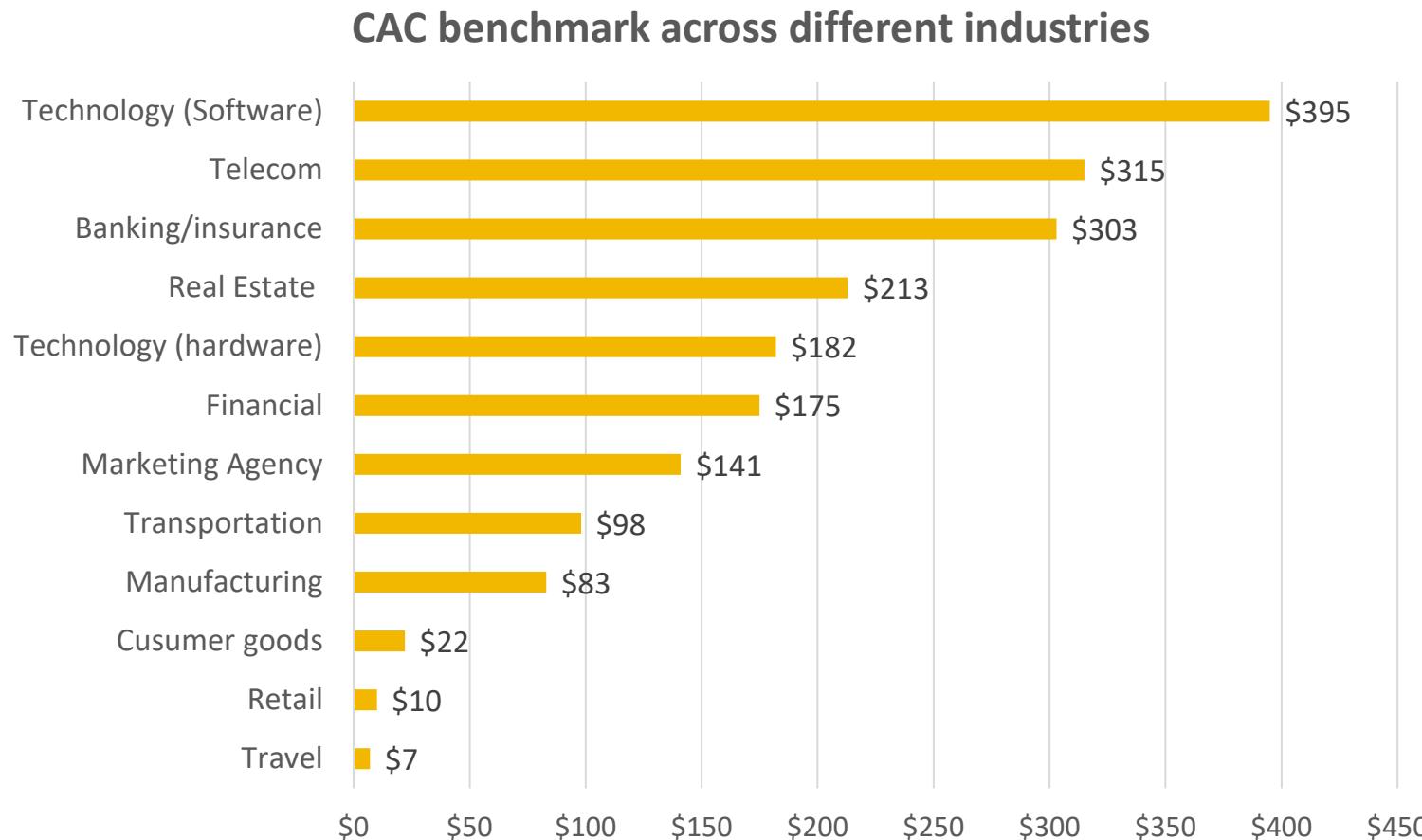
Takeaways from Lenny Rachitsky's [research](#):

- Just **seven strategies** account for every consumer apps' early growth.
- Most startups found their early users from just a single strategy. A few like Product Hunt and Pinterest found success using a handful.

1. Go to your users, offline	      
2. Go to your users, online	    
3. Invite your friends	      
4. Create FOMO	  
5. Leverage influencers	   
6. Get press	   
7. Build a community	 

Source: <https://www.lennyrachitsky.com/p/how-the-biggest-consumer-apps-got>

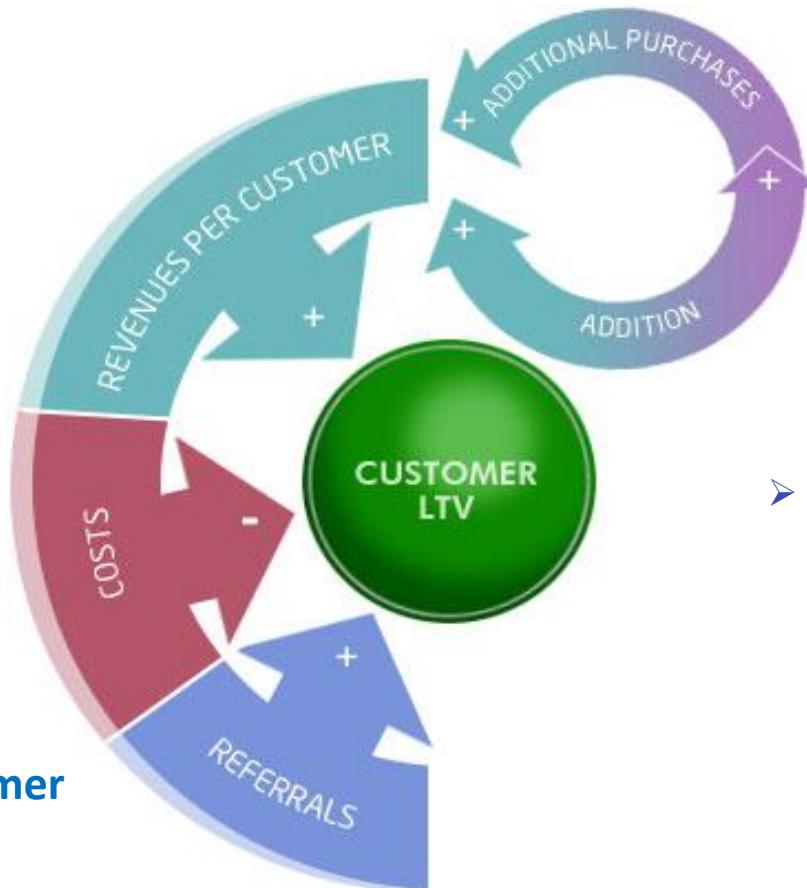
Avg CAC benchmark across different industries



Source: <https://www.entrepreneur.com/article/225415>

LTV to CAC Ratio

- **User's LTV (life-time value)** is the amount of value a customer contributes to your business over their lifetime – which starts with a new customer's first purchase or contract and ends with the “moment of churn.”
- **User's LTV =CLV (customer lifetime value)**



- Low CAC and maximizing LTV is so important to maintain a healthy and profitable business.
- **The ratio should always be at least 3:1.**

Source: <https://www.propellercrm.com/blog/customer-acquisition-cost>

The danger of relying on Avg CAC numbers without any segmentation

- It is all about **segmentation, segmentation and segmentation!**



➤ **Segmentation based on customer types/attribute:** Different types of customers behave very differently and might have different purchase intent and pain points to solve **[this is more significant for enterprise and B2B products]**



➤ **Segmentation based on the acquired channels:** Different acquisition channels could have different nature/characteristics and produce very different CAC based on their costs, conversion rates, and other factors.



➤ **Segmentation based on geographic and location:** The location of the customer can have a large effect on your CAC (countries, regions, languages)

The DocuSign example- segmenting by customer type

The screenshot shows the DocuSign Pricing page. At the top, there's a navigation bar with links for Access Documents, Contact Us, DocuSign, Products, Industries, Developers, Support, Pricing, More, FREE TRIAL, LOG IN, and a search icon. Below the navigation, the title "Packaging and Pricing" is displayed, followed by the subtext "The most globally trusted electronic signature service". A callout for "ARE YOU A REAL ESTATE PROFESSIONAL?" with a link to "View DocuSign for Real Estate Editions" is also present.

The main content area displays four pricing plans:

- Personal:** \$10 per month when paid annually. Includes a "BUY NOW" button, a "Single User Plan" section with features like 5 document sends per month, Basic Fields, and Mobile App, and a "See More Features" link.
- Standard:** \$25 per user, per month when paid annually. Includes a "BUY NOW" button, a "For more than 1 user, call 1-877-720-2040" section, and a "See More Features" link.
- Business Pro:** \$40 per user, per month when paid annually. Includes a "BUY NOW" button, a "For more than 1 user, call 1-877-720-2040" section, and a "See More Features" link.
- Advanced Solutions:** Call for more info (1-877-720-2040) or CONTACT US. Includes a "Customizable Platform" section with a long list of features including All of the Business Pro features plus: Integrations, Connectors, APIs, SSO, Enterprise-level Support, Embedded Signing, Admin/User Management, Advanced Branding, and more. It also has a "See More Features" link.

- They create different segments of target customers
- They do different marketing efforts and tactics to acquire new customers for each segment
- They should be able to calculate the CAC separately for each customer segment

Source: <https://brianbalfour.com/essays/average-cac-mistakes-growth>

The DocuSign example-cont'd

	DocuSign Example									
	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct
Marketing Expenses (divided into 4 for each customer type)	\$10,450	\$11,892	\$12,347	\$12,395	\$13,538	\$10,385	\$10,395	\$13,485	\$12,347	\$13,538
Sales Expenses (20% to pro, 80% to enterprise)	\$30,122	\$34,321	\$38,943	\$38,234	\$40,438	\$44,784	\$48,348	\$44,321	\$44,756	\$44,943
-- Free Trial Support (only for enterprise)	\$8,000	\$8,000	\$8,000	\$8,000	\$8,000	\$8,000	\$8,000	\$8,000	\$8,000	\$8,000
Total CAC Expenses	\$48,572	\$54,213	\$59,290	\$58,629	\$61,976	\$63,169	\$66,743	\$65,806	\$65,103	\$66,481
Total New Customers	421	431	467	449	457	498	457	438	432	419
-- Personal	211	224	250	232	243	285	233	211	212	203
-- Standard	184	184	184	184	184	184	184	184	184	184
-- Business Pro	23	19	30	28	22	25	35	40	32	30
-- Advanced (Enterprise)	3	4	3	5	8	4	5	3	4	2

Avg CAC is misleading as it would NOT say how the cost is growing over time for each customer segment

	DocuSign Example									
	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct
Marketing Expenses (divided into 4 for each customer type)	\$10,450	\$11,892	\$12,347	\$12,395	\$13,538	\$10,385	\$10,395	\$13,485	\$12,347	\$13,538
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-- Business Pro	23	19	30	28	22	25	35	40	32	30
-- Advanced (Enterprise)	3	4	3	5	8	4	5	3	4	2
Average CAC	\$115	\$126	\$127	\$131	\$136	\$127	\$146	\$150	\$151	\$159
-- Personal CAC										
-- Standard CAC										
-- Business Pro CAC										
-- Advanced Enterprise CAC										

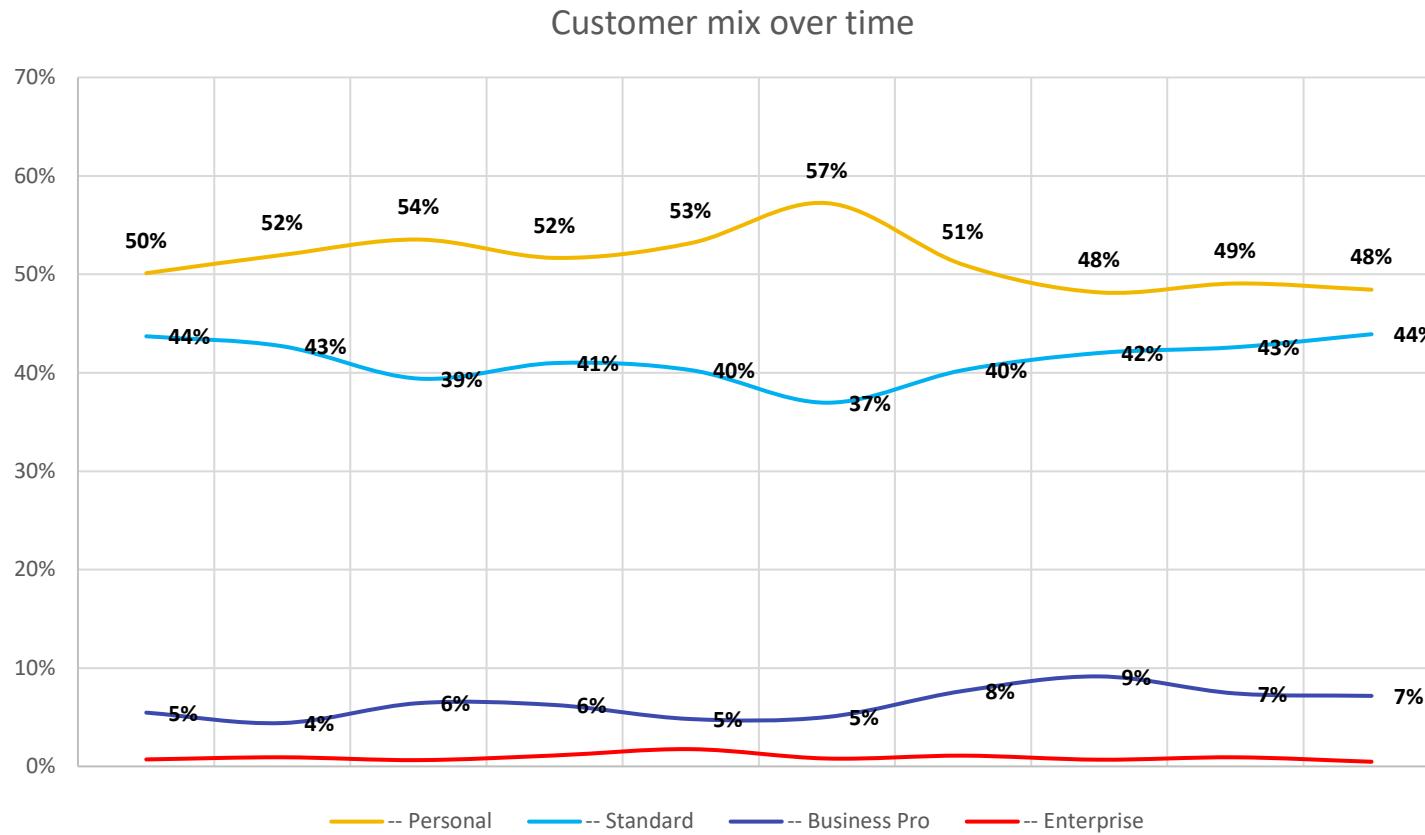
From looking only at the Avg CAC, the avg CAC is increasing in time!

Segmenting the data into different customer type would give us more insight on how each customer segment are doing!

	DocuSign Example									
	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct
Marketing Expenses (divided into 4 for each customer type)	\$10,450	\$11,892	\$12,347	\$12,395	\$13,538	\$10,385	\$10,395	\$13,485	\$12,347	\$13,538
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Total CAC Expenses	\$48,572	\$54,213	\$59,290	\$58,629	\$61,976	\$63,169	\$66,743	\$65,806	\$65,103	\$66,481
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-- Advanced (Enterprise)	3	4	3	5	8	4	5	3	4	2
Average CAC	\$115	\$126	\$127	\$131	\$136	\$127	\$146	\$150	\$151	\$159
-- Personal CAC	\$12	\$13	\$12	\$13	\$14	\$9	\$11	\$16	\$15	\$17
-- Standard CAC	\$41	\$47	\$53	\$52	\$55	\$61	\$66	\$60	\$61	\$61
-- Business Pro CAC	\$376	\$518	\$363	\$384	\$521	\$462	\$351	\$306	\$376	\$412
-- Advanced Enterprise CAC	\$11,570	\$9,607	\$14,080	\$8,337	\$5,467	\$11,606	\$9,855	\$15,609	\$11,723	\$23,669

What would be the reasons for increase in Avg CAC (from \$115 in Jan to \$160 in Oct)?

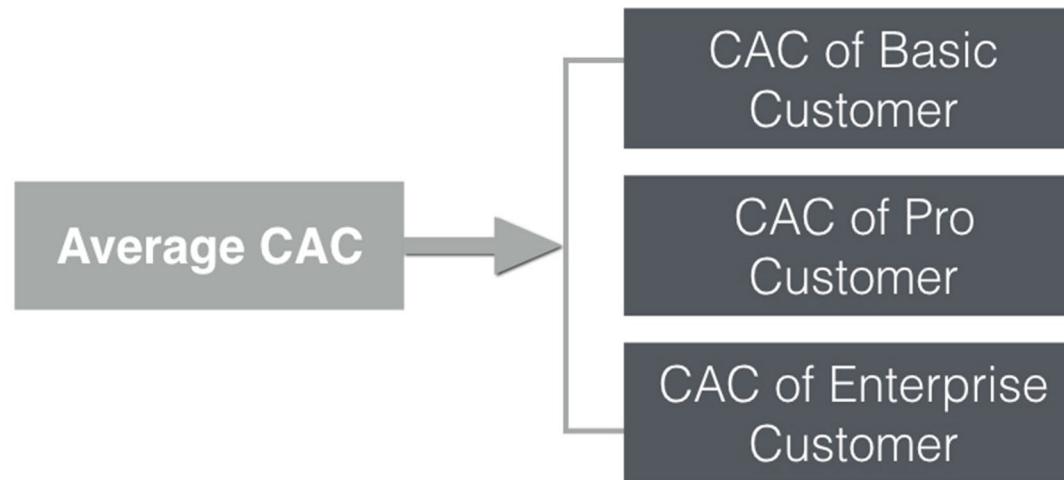
Should always watchout for any change % in customer mix over time



A lot of SaaS products serve multiple segments of the market:
small, mid market and enterprise

Segment CAC by Customer Type

Multi-Tier SaaS Business **HubSpot**

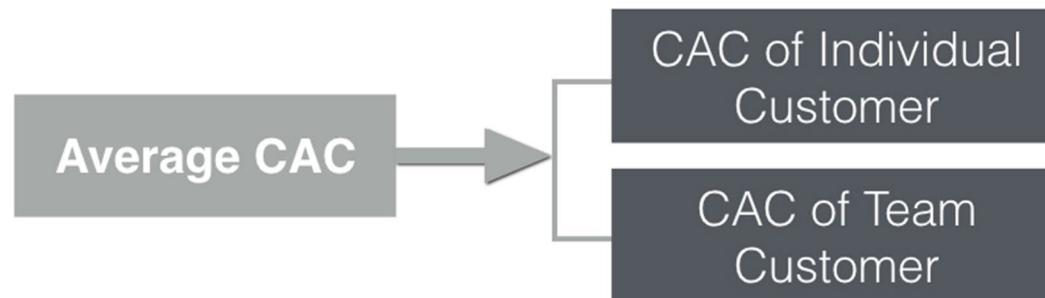


<http://reforge.com/cac>

In the fermium business model, there could be different types of free and paying customer to target

Segment CAC by Customer Type

Freemium Business  Dropbox



<http://reforge.com/cac>

The location of the potential customers can impact CAC or CPC (cost per click) significantly

- One study from [LABS](#) (2018) compared avg acquisition cost across three markets (United States +Canada, Europe and Latin America) and 5 different industries (Fashion, Electronics, Decor, Cosmetics and Beauty, and Travel)
- Due to less market saturation in Latin America, **Latin America has the lowest CPC.**

	US AND CANADA	EUROPE	LATAM
Fashion / Apparel	\$1.42	\$0.57	\$0.19
Electronics	\$1.78	\$0.71	\$0.24
Home Decor	\$0.51	\$0.20	\$0.07
Cosmetics and Beauty	\$0.83	\$0.33	\$0.11
Travel	\$0.42	\$0.17	\$0.08

AVG. COST PER CLICK

\$ 0.99

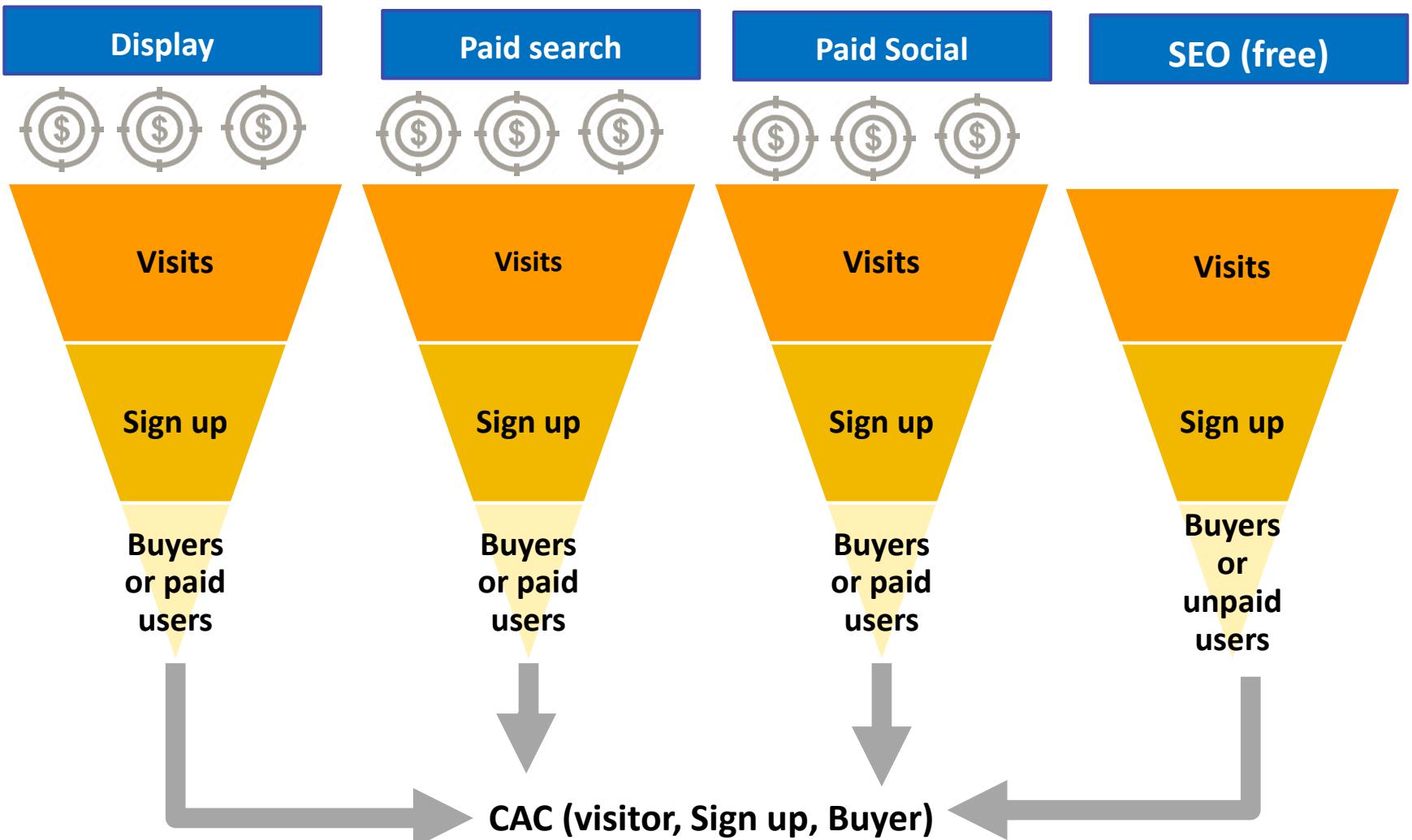
\$ 0.39

\$ 0.14

Source: <https://labs.ebanx.com/en/articles/inside/cac-is-cheaper-in-latin-america-learn-why/>

Calculating CAC for different Marketing Acquisition Channels

Different acquisition channels can produce different CAC and outcome



Marketing acquisition channels revisited

Organic Search (SEO)

Users find a website after using a search engine like Google or Bing, without referring by any other website.

Direct channel

Visitors who know about the brand come directly to the site

Social Media

Visitors come to the site via social media pages and post (e.g., Facebook, Instagram)

Paid per click (PPC)

Google search
paid social (e.g., Facebook)
Display ad

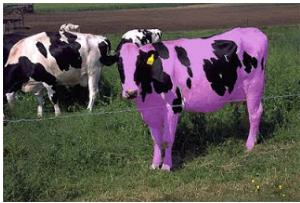
Email Marketing

Visitors who are opted-in to receive emails will be targeted
[great opportunity for personalization]

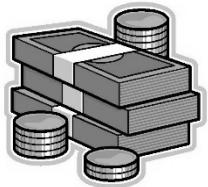
Referral/affiliate

Traffic coming from other 3rd parties (e.g., articles on FT which talked about a brand with the site link)

Paid search can be used a tactic to grow the business at the beginning, but might kill the competitive advantage



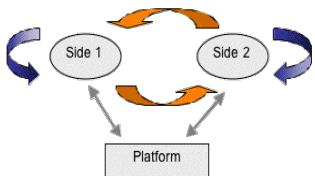
- Relying too much on paid search can make your business **indefensible** as every company with money can grow their business like yours.



- Paid search becomes **more expensive** over time since it would be more difficult to find the right audience due to saturation.



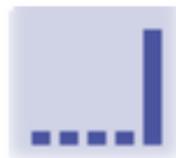
- The longer your campaigns run, the less effective they become as people start seeing your ads too often.



- If the product has the **network effect** (e.g., in two-sided marketspaces), you can use paid search to reach the critical mass (Facebook used paid to grow in new regions)

Tracking conversions is a **very first step** for companies to calculate the CAC for different marketing channels

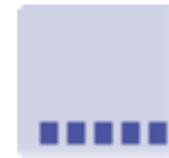
- Customer analytics team need to trace back a buyer to the “last touch” attribution source [*Google analytics default is last non-direct touch*]
- If we decide to go with last touch that means the last channel before the customer making the purchase (or become buyers) will get the full credit for that conversion (e.g., sale)
- If we feel that last touch is “good enough,” we can use that model for your CAC calculations, if not we might need to use other attribution models.



Last Interaction



First Interaction



Linear



Time decay



Position-based

UTM parameters are a great way to see the results of a marketing campaign

- A UTM code is a simple code that you can attach to a custom URL in order to track a **source, medium, and campaign name**
- This enables Google Analytics to tell you where searchers came from as well as what campaign directed them to you.
- you can simply go to Google's URL Builder, enter the values for your campaign, and click “generate URL,”



The screenshot shows a form titled "Google URL Builder" with six input fields:

- * Website URL:** A text input field with placeholder text "The full website URL (e.g. `https://www.example.com`)".
- * Campaign Source:** A text input field with placeholder text "The referrer: (e.g. `google`, `newsletter`)".
- * Campaign Medium:** A text input field with placeholder text "Marketing medium: (e.g. `cpc`, `banner`, `email`)".
- * Campaign Name:** A text input field with placeholder text "Product, promo code, or slogan (e.g. `spring_sale`)".
- Campaign Term:** A text input field with placeholder text "Identify the paid keywords".
- Campaign Content:** A text input field with placeholder text "Use to differentiate ads".

CAC example for different marketing channels

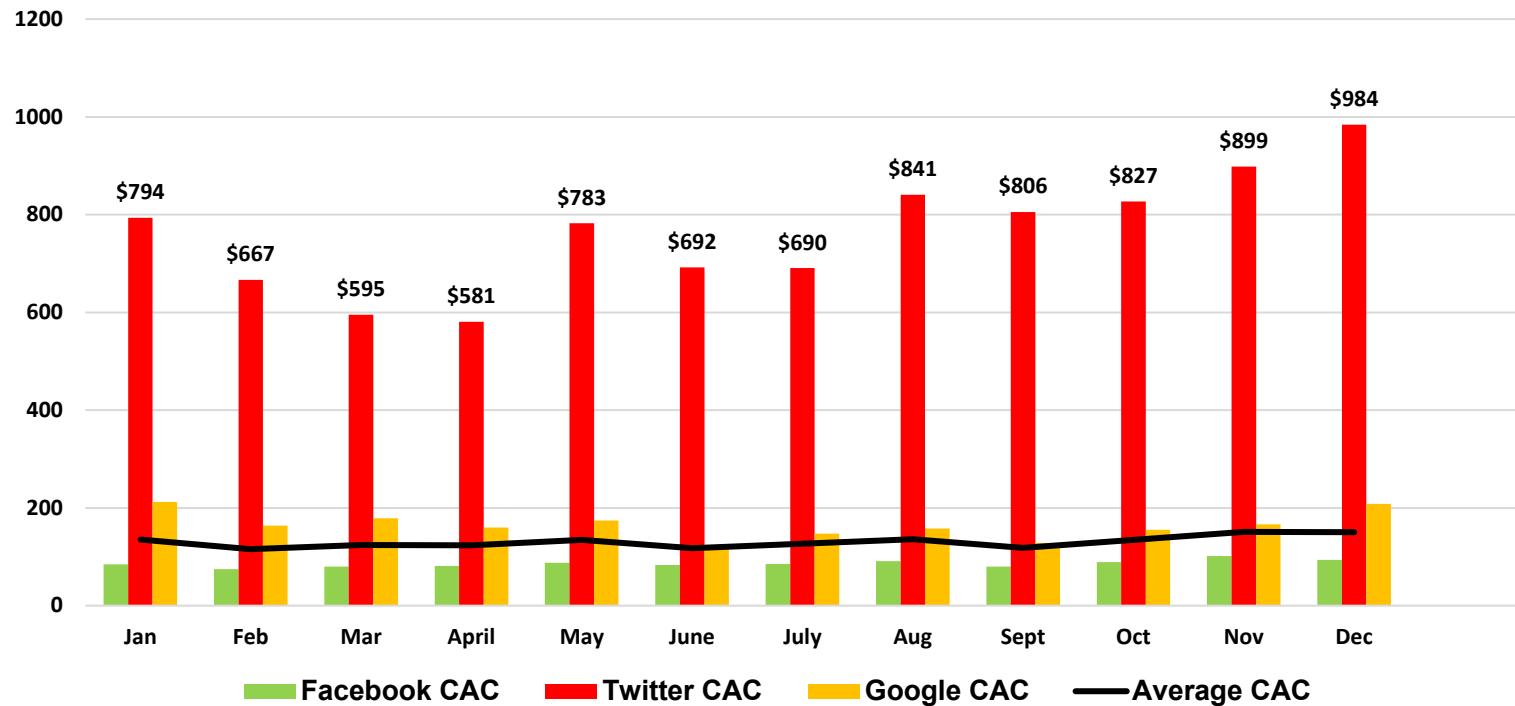
- **Blended CAC could be misleading!**
- **Calculating CAC at the marketing channel-level is critical [Tracking is the KEY here!]**

	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Total Marketing	\$75,000	\$75,000	\$75,000	\$79,000	\$79,000	\$79,000	\$83,000	\$83,000	\$83,000	\$87,000	\$87,000	\$87,000
-- Salaries	\$20,000	\$20,000	\$20,000	\$24,000	\$24,000	\$24,000	\$28,000	\$28,000	\$28,000	\$32,000	\$32,000	\$32,000
-- Facebook Ads	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000
-- Twitter Ads	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
-- Google Ads	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000
Total Expenses	\$75,000	\$75,000	\$75,000	\$79,000	\$79,000	\$79,000	\$83,000	\$83,000	\$83,000	\$87,000	\$87,000	\$87,000
New Customers	555	647	605	640	587	671	654	609	703	646	576	577
-- FB Customers	432	490	456	465	432	456	461	432	490	456	399	433
-- TW Customers	21	25	28	31	23	26	28	23	24	25	23	21
-- GOOG Customers	102	132	121	144	132	189	165	154	189	165	154	123
Blended CAC	\$135	\$116	\$124	\$123	\$135	\$118	\$127	\$136	\$118	\$135	\$151	\$151
-- Facebook CAC	\$85	\$75	\$80	\$82	\$88	\$83	\$85	\$91	\$80	\$89	\$102	\$94
-- Twitter CAC	\$794	\$667	\$595	\$581	\$783	\$692	\$690	\$841	\$806	\$827	\$899	\$984
-- Google CAC	\$212	\$164	\$179	\$160	\$174	\$122	\$147	\$158	\$129	\$156	\$167	\$209

Source: <https://brianbalfour.com/essays/average-cac-mistakes-growth>

Customer analytics team should identify the high-cost and low-cost channels to optimize CAC

- Customer analytics should recommend **winding-down the high-cost channels while scaling up the low-cost channels.**
- **Word of Caution:** This is only CAC, we need to also have **LTV to CAC ratio** for marketing ROI maximization.

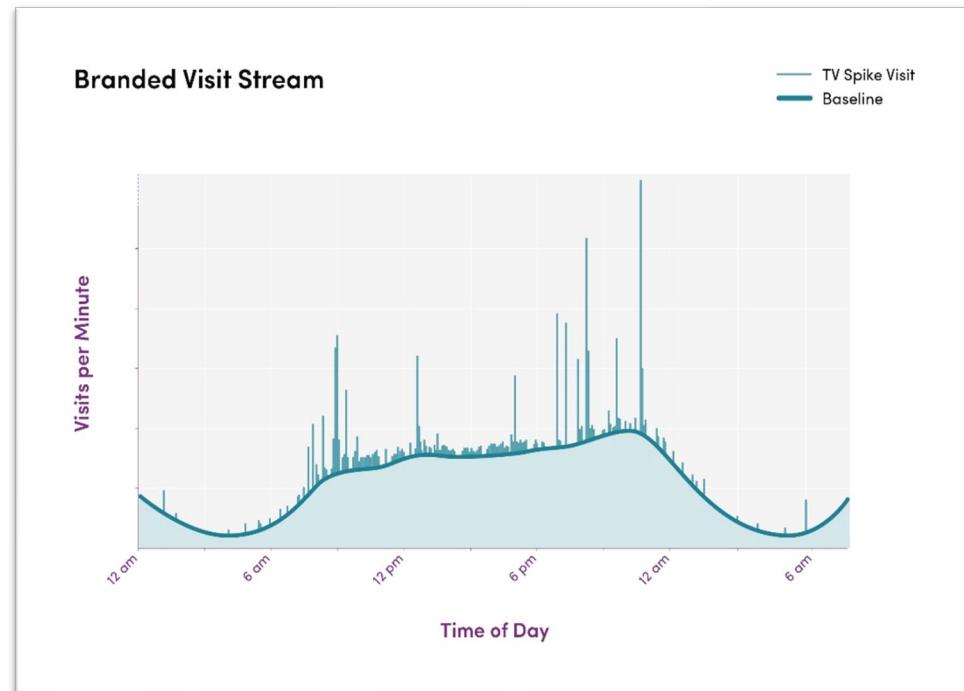


The impact of TV ads and offline campaign is difficult to measure

- TV advertising is very expensive, and this makes it one of the most important channels to optimize
- **Question:** is a visitor coming to the site due to the ad, or she would have visited anyway?

Example: Wayfair TV ad

- Minute-by-minute count of visitors who arrive at the Wayfair homepage.
- **Cost per spike visitor (CPSV)** is TV spend divided by number of incremental spikes.
- **Revenue is the one matters the most!**



Source: <https://tech.wayfair.com/data-science/2018/08/optimizing-tv-advertising-toward-return-on-investment/>

Some ways of improve CAC for your business



- **Improve on-site conversion across buyer journey:** set up goals in google analytics and perform A/B testing to improve the conversions from some call-to-actions (*e.g., try different landing pages*)



- **Optimize the mobile site:** improve the user experience (*mobile is future!*)

Value Propositions



- Work on your **value proposition language** and make it easy to understand while compelling enough
- **Shorten Your Sales Cycle:** The faster a new customer is signed, the less time and resources your company has spent acquiring them
- **Reward referrals:** If you can get consistent referrals from existing customers, your average CAC will drop significantly (viral loop)



Improving in conversion rates at upper-funnel stages would make the Economics Customer Acquisition (CAC) better

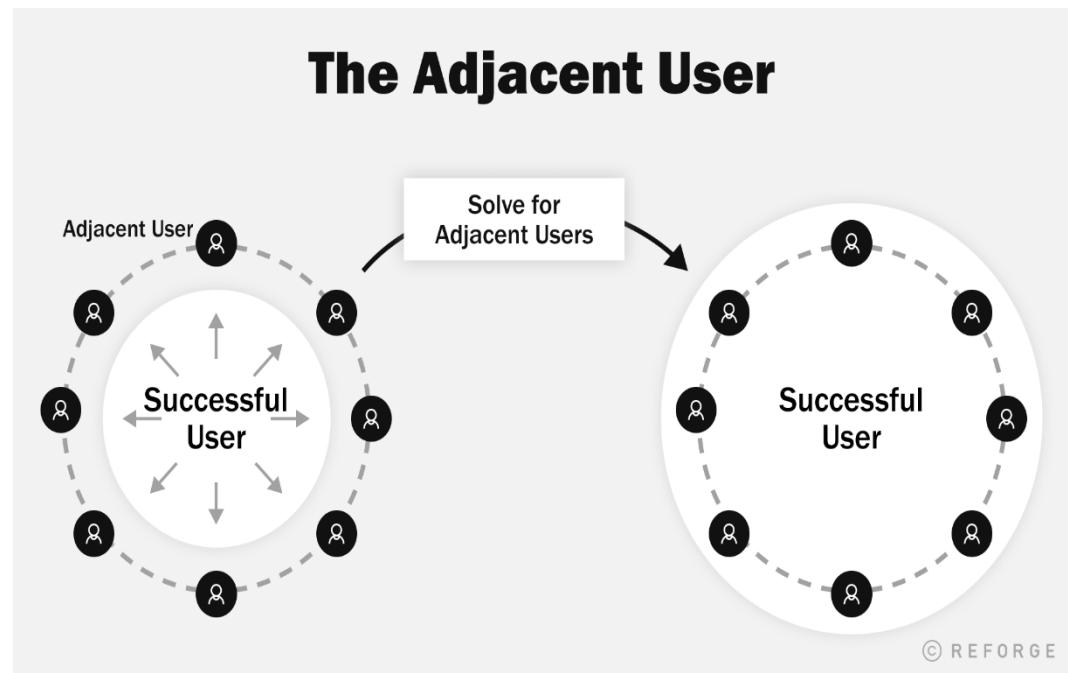
Monthly Numbers	Scenario 1	Scenario 2	Scenario 3	Comparing Scenario 3 to 2	
Total Visitors	10,000	10,000	10,000		
SEM Cost per click (CPC)	\$0.60	\$0.60	\$0.60		
Registration Conversion	2.0%	2.5%	2.8%	10%	Growth rate
Add to shopping cart	20%	22%	24%	9%	Growth rate
Purchase conversion	30%	30%	33%	10%	Growth rate
Marketing cost					
Paid search Marketing Spend	\$6,000	\$6,000	\$6,000		
Number of new customers					
Number of Registration	200	250	275	10%	Growth rate
Number of customers with something in shopping cart	40	55	66	20%	Growth rate
Number of buyers	12	16.5	21.78	32%	Growth rate
Customer Acquisition Cost					
Cost Per acquired registrant	\$30	\$24	\$22	-9%	Reduction in cost
Cost Per acquired registrant with something in cart	\$150	\$109	\$91	-17%	Reduction in cost
Cost per acquired buyer	\$500	\$364	\$275	-24%	Reduction in cost

- **10% improvement in conversion metrics could make the CAC per acquired buyer 25% Cheaper (2X more improvement in cost reduction).**

“Adjacent Users” Theory suggest there are some users who show high intent but struggling to adopt or engage

There are a set of users who show intent for your product but are not quite able to get over the hump. Those are your Adjacent Users

- You can think about your product as a series of circles.
- Each of these circles is defined by the primary user states that someone could be in. For example, Power, Core, Casual, Signed Up, Visitor.



<https://andrewchen.com/the-adjacent-user-theory/>

Instagram example of “Adjacent Users”

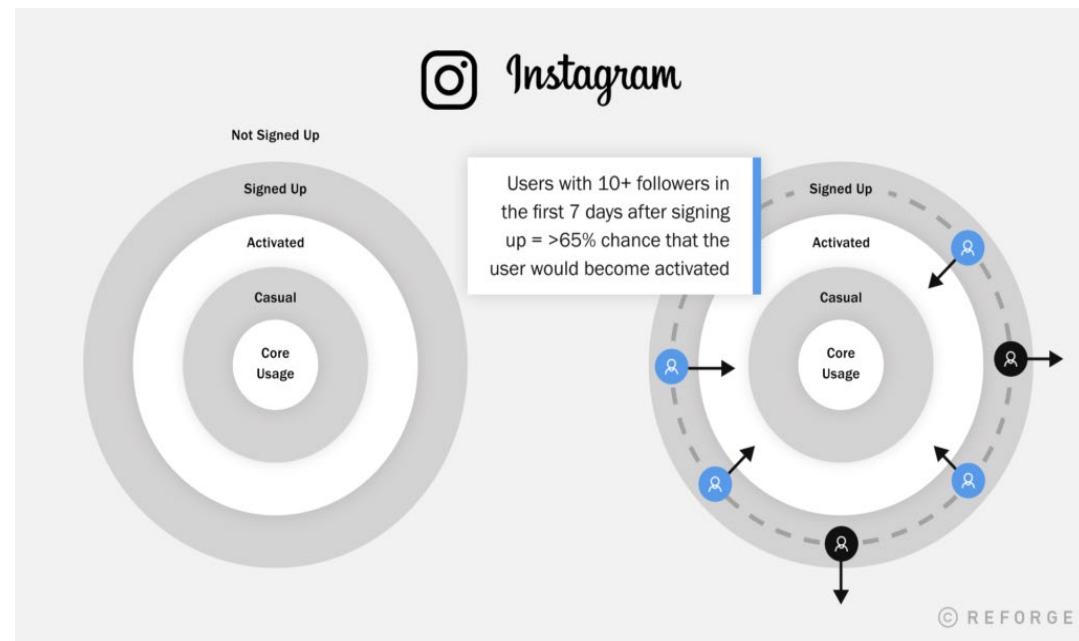
The primary thresholds that a user has to cross to becoming a core user:

Not Signed Up → Signed Up

Signed Up → Activated

Casual → Core Usage

- a user had more than 10 followers in the first 7 days after signing up there was over a 65% chance that the user would become activated.
- There was always a group of users on that margin that would struggle to build their audience.



<https://andrewchen.com/the-adjacent-user-theory/>

In-Class Case Study

(source: <https://andrewchen.co/how-to-actually-calculate-cac/>)

In-class CAC exercise (Scenario 1)

Scenario 1

	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Marketing Exp.	\$10,450	\$11,892	\$12,347	\$12,395	\$13,538	\$10,385	\$10,395	\$13,485	\$12,347	\$13,538	\$12,584	\$12,119
Sales Exp.	\$30,122	\$34,321	\$38,943	\$38,234	\$40,438	\$44,784	\$48,348	\$44,321	\$44,756	\$44,943	\$48,218	\$50,326
Total Exp.	\$40,572	\$46,213	\$51,290	\$50,629	\$53,976	\$55,169	\$58,743	\$57,806	\$57,103	\$58,481	\$60,802	\$62,445
New Customers	453	485	481	502	509	444	545	589	590	612	690	700
CAC	\$90	\$95	\$107	\$101	\$106	\$124	\$108	\$98	\$97	\$96	\$88	\$89

$$\text{CAC} = (\text{Marketing Exp} + \text{Sales Exp})/\text{New Customers}$$

More realistic situation:

- Suppose that it would take on average 60 days for a lead to become a new customer.
- How to re-calculate the CAC for above example?

In-class CAC exercise (Scenario 2)

Scenario 1	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Marketing Exp.	\$10,450	\$11,892	\$12,347	\$12,395	\$13,538	\$10,385	\$10,395	\$13,485	\$12,347	\$13,538	\$12,584	\$12,119
Sales Exp.	\$30,122	\$34,321	\$38,943	\$38,234	\$40,438	\$44,784	\$48,348	\$44,321	\$44,756	\$44,943	\$48,218	\$50,326
Total Exp.	\$40,572	\$46,213	\$51,290	\$50,629	\$53,976	\$55,169	\$58,743	\$57,806	\$57,103	\$58,481	\$60,802	\$62,445
New Customers	453	485	481	502	509	444	545	589	590	612	690	700
CAC	\$90	\$95	\$107	\$101	\$106	\$124	\$108	\$98	\$97	\$96	\$88	\$89

- **Assumption in Scenario 2:** it would take on average 60 days for a lead to become a new customer

Scenario 2	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Marketing Exp.	\$10,450	\$11,892	\$12,347	\$12,395	\$13,538	\$10,385	\$10,395	\$13,485	\$12,347	\$13,538	\$12,584	\$12,119
Sales Exp.	\$30,122	\$34,321	\$38,943	\$38,234	\$40,438	\$44,784	\$48,348	\$44,321	\$44,756	\$44,943	\$48,218	\$50,326
Total Exp.	\$40,572	\$46,213	\$51,290	\$50,629	\$53,976	\$55,169	\$58,743	\$57,806	\$57,103	\$58,481	\$60,802	\$62,445
New Customers	453	485	481	502	643	444	545	589	590	612	690	700
CAC	n/a	n/a	\$84	\$92	\$80	\$114	\$99	\$94	\$100	\$94	\$83	\$84

In-class CAC exercise (Scenario 3)

Scenario 1	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Marketing Exp.	\$10,450	\$11,892	\$12,347	\$12,395	\$13,538	\$10,385	\$10,395	\$13,485	\$12,347	\$13,538	\$12,584	\$12,119
Sales Exp.	\$30,122	\$34,321	\$38,943	\$38,234	\$40,438	\$44,784	\$48,348	\$44,321	\$44,756	\$44,943	\$48,218	\$50,326
Total Exp.	\$40,572	\$46,213	\$51,290	\$50,629	\$53,976	\$55,169	\$58,743	\$57,806	\$57,103	\$58,481	\$60,802	\$62,445
New Customers	453	485	481	502	509	444	545	589	590	612	690	700
CAC	\$90	\$95	\$107	\$101	\$106	\$124	\$108	\$98	\$97	\$96	\$88	\$89

- **Assumption in Scenario 3 : it would take on average 60 days for a lead to become a new customer, however sale expenses would be realized only within last 30 days**

Scenario 3	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Marketing Exp.	\$10,450	\$11,892	\$12,347	\$12,395	\$13,538	\$10,385	\$10,395	\$13,485	\$12,347	\$13,538	\$12,584	\$12,119
Sales Exp.	\$30,122	\$34,321	\$38,943	\$38,234	\$40,438	\$44,784	\$48,348	\$44,321	\$44,756	\$44,943	\$48,218	\$50,326
Total Exp.	\$40,572	\$46,213	\$51,290	\$50,629	\$53,976	\$55,169	\$58,743	\$57,806	\$57,103	\$58,481	\$60,802	\$62,445
New Customers	453	485	481	502	643	444	545	589	590	612	690	700
CAC	n/a	n/a	\$98	\$101	\$80	\$124	\$110	\$96	\$93	\$95	\$85	\$90

Recap on different definitions of CAC

- Basic definition

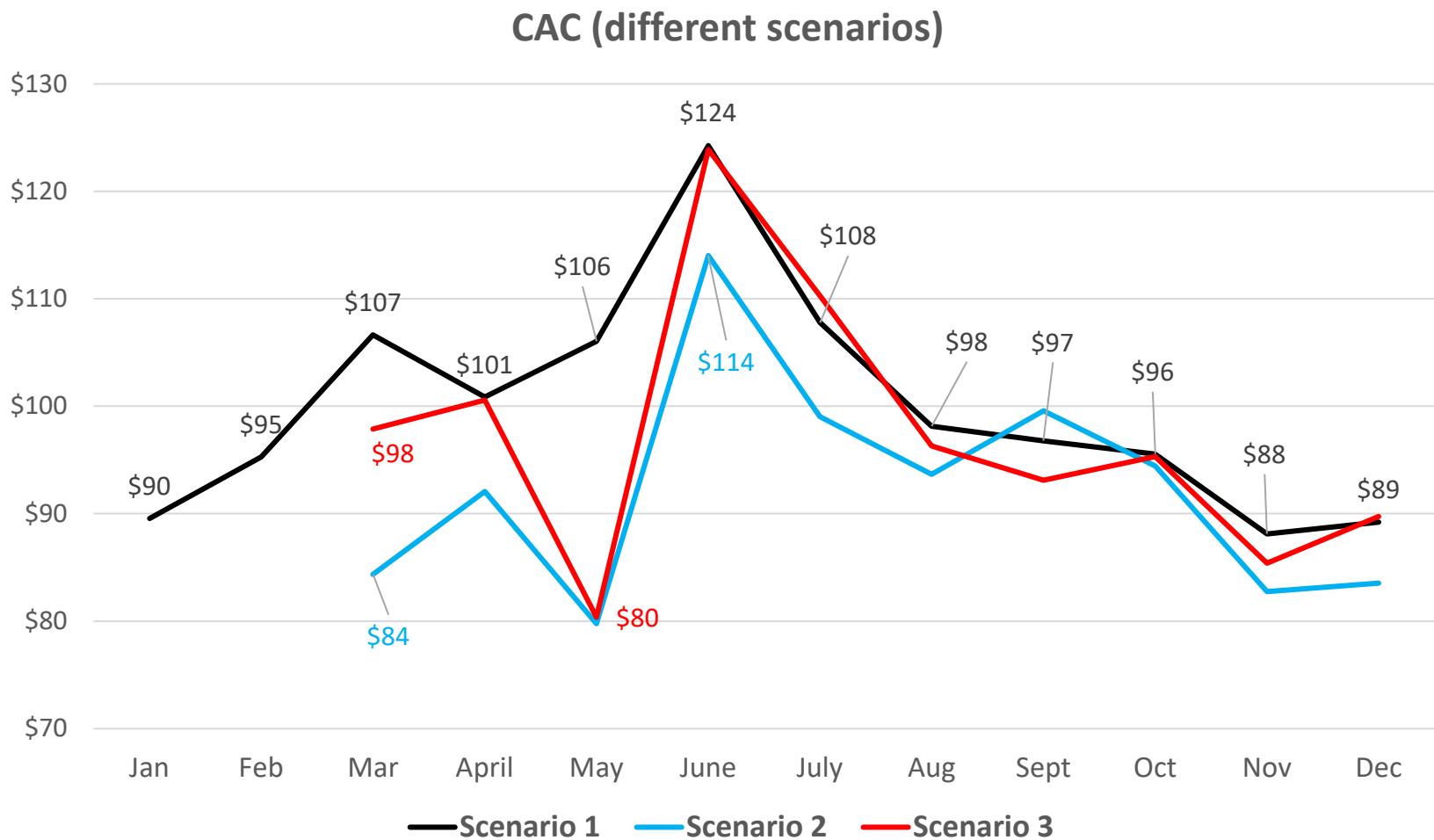
$$\text{CAC} = \frac{\text{[Direct Marketing cost} + \text{Direct Sale cost]}}{\text{Number of new acquired customers}}$$

- More advanced

n= Current Month

$$\text{CAC in month } n = \frac{\text{[Direct Marketing cost}(n-60) \\ + \frac{1}{2}\text{direct sale cost}(n-30) + \frac{1}{2}\text{direct sale cost}(n)]}}{\text{Number of new acquired customers (n)}}$$

Time between customer's first interaction (when marketing expenses would get recognized), and involvement of inside sales team changes CAC



The Law of Large number

Growth tends to decay over time even in the best businesses

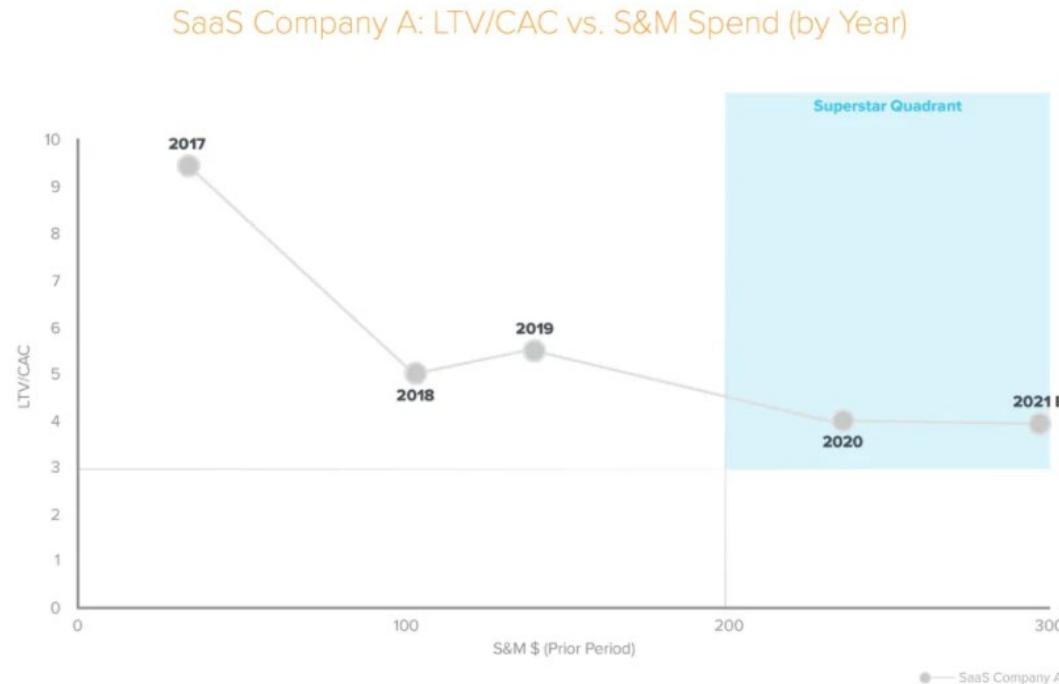
“If you’re fortunate enough to achieve product-market fit and your business starts to take off, typically, you know, when in the wonderful situation do you get this hyper growth where you’ll grow year over year, you know, it’s triple digits. It’s just exploding. And then gradually **the law of the large numbers** starts to kick in and maybe the 100% growth becomes 50% growth the next year, and then the law of large numbers continue to kick in and there’s 25% and then it’s 12.5% and so growth tends to decay over time even in the best businesses”

Jeff Jordan, a16z general partners

Source: [a16z Podcast: The Basics of Growth — User Acquisition\]](#)

Efficiency vs. Usage demonstration can be helpful to assess the growth health and CAC over time in growth Companies

- NBA teams now use **efficiency** and **usage** as the metrics that dictate the way they use possessions and how they find superstar players and build their lineups around those superstars.
- Many tech companies are starting to use a similar framework when allocating **capital** against go-to-market (GTM) efforts, often measured as lifetime value (LTV) over customer acquisition costs (CAC).



Source: [Using NBA Metrics to Scout Superstar Startups](#)

The importance of Network effects in two-sided marketplace businesses

Business with network effects starts with high CAC and over time CAC decreases due to more users on both sides

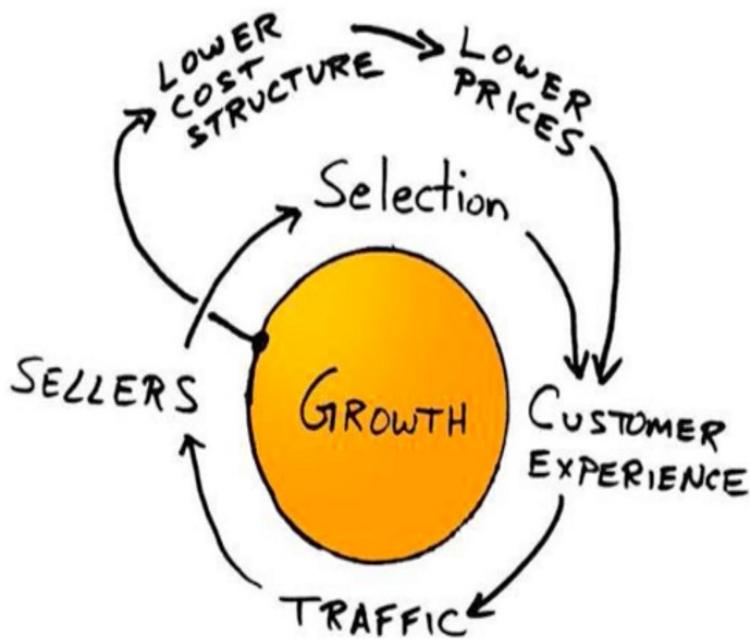
- A **network effect** is when new, additional users signing up for a product or service increases its value and utility for current and future users.
- If a product or service has a network effect, **its value and utility will increase as its user base grows.**
- The telephone and social networks are good examples of how network effects can impact a product or service.
- As more people started using these technologies, they became more valuable, and this brings more user for both side of the marketplace.



craigslist

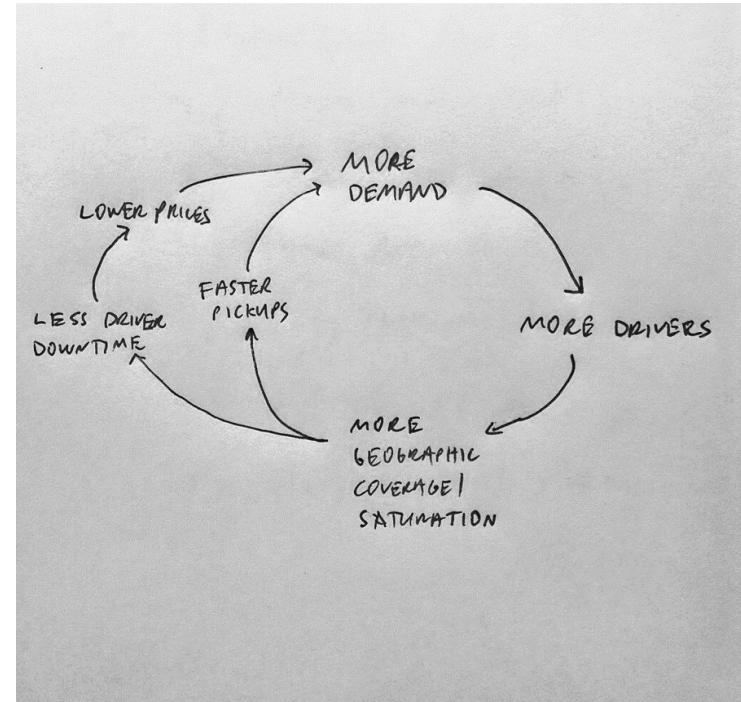
Network effect can act as the growth engine in two-sided marketplace business

Amazon's Flywheel effect



Source: <https://sellics.com/blog-applying-amazon-flywheel-to-your-online-business/>

David Sack's Famous Napkin Sketch for Uber



Source: <https://otherspecify.com/2017/02/02/david-sacks-famous-napkin-sketch-for-econ-101/>

**Homework + reading/listening
assignment**

Deliverables for next week

- HW2 will be posted in the assignment section of BB, 9/16, 8pm EST [*Due 9/23, 7pm EST*]

Please add the list of your project team member @ [here](#)

Relevant readings, articles, podcasts and videos

10-min round discussion for next week

- [Reading: Customer Acquisition cost](#)
- [Podcast: The Basics of Growth — User Acquisition](#)
- [Reading: Optimizing TV Advertising Toward Return on Investment](#)
- [Reading: How To Become A Customer Acquisition Expert](#)
- [Reading: The 19 Channels You Can Use to Get Traction](#)
- [Reading: The ‘Oh, Shit!’ Moment When Growth Stops](#)
- [Reading: The Adjacent User Theory](#)

Extra interesting and relevant content

- [Reading: Notes on customer acquisition and viral marketing from First Round Capital CEO Summit](#)
 - [Reading: How To \(Actually\) Calculate CAC](#)
 - [Reading: Your Average CAC is Lying to You -- What to do Instead](#)
 - [Reading: The network effects bible](#)
-

Questions

Email me @ Alipilehvarm@GWU.edu

Lecture 4

User Retention and Engagement

Instructor: Ali Pilehvar, Ph.D.



9/23/2021

Agenda for today

- ▶ Group Projects [team and details]
- ▶ 10 min discussion from last week
- ▶ User Retention is getting users back, but how?
- ▶ How companies calculate customer retention rate?
- ▶ Understanding the retention using Cohort Analysis
- ▶ Engagement and power user metrics
- ▶ In-class example
- ▶ Homework 3 to be posted after the class [HW 1-2 grades will be posted by next week]

Office hour moving forward

- ▶ Wednesday 7pm-8 pm EST
- ▶ Monday 7:30-8:30 am EST

10 min discussion from last week

Learnings from last week

- [Reading: Customer Acquisition cost](#)
- [Podcast: The Basics of Growth — User Acquisition](#)
- [Reading: Optimizing TV Advertising Toward Return on Investment](#)
- [Reading: How To Become A Customer Acquisition Expert](#)
- [Reading: The 19 Channels You Can Use to Get Traction](#)

**User Retention is getting users back,
But how?**

Customer retention is all about how well we can create loyal customers base and keep them coming back

- As a business, in addition to attracting new customers, you always want to keep your current customers **engaged and interested in your products**

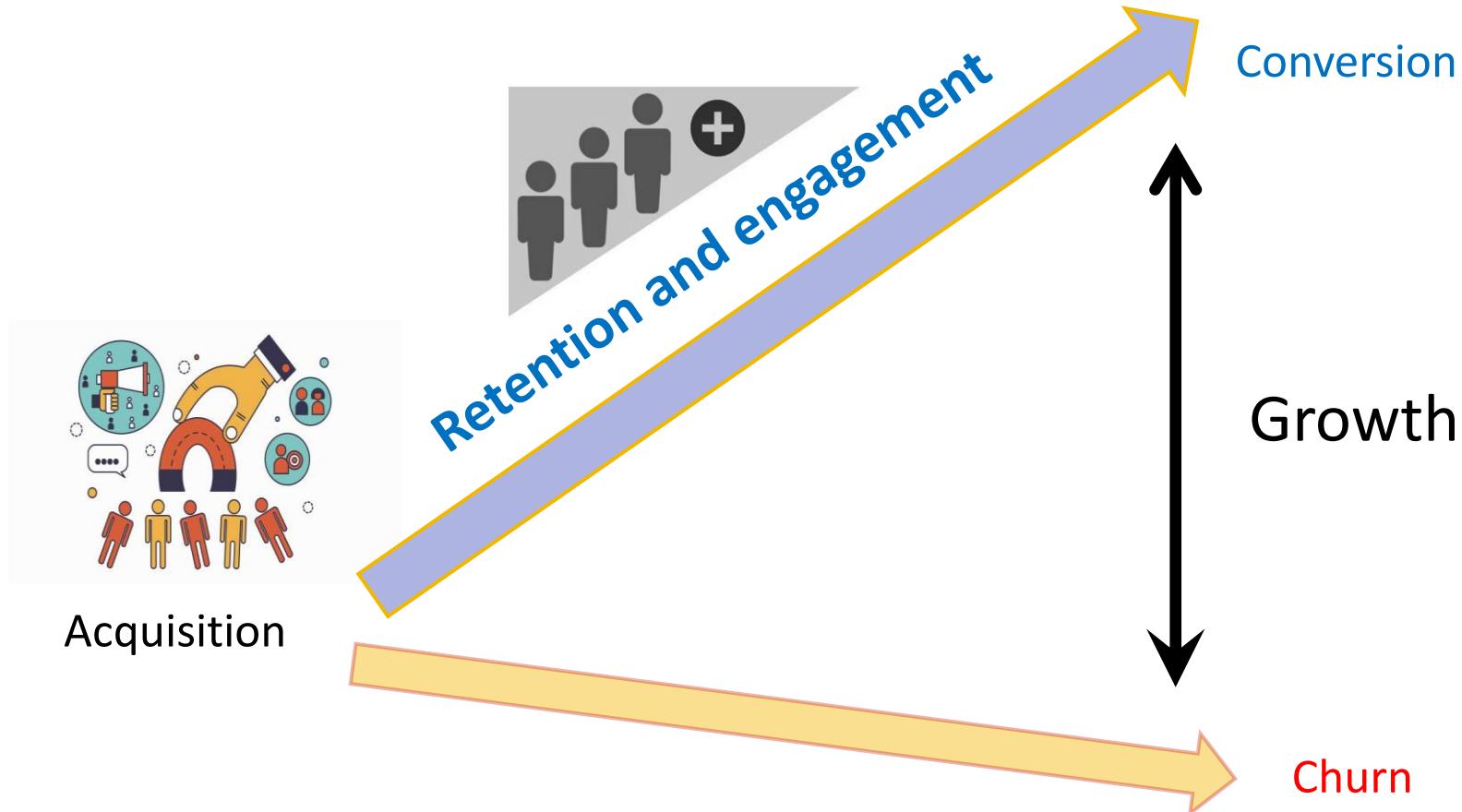
- Customer retention increases your customers' lifetime value and **boost your revenue**

- **The best customer retention tactics enable you to form a lasting relationships with consumers who will become loyal to your brand.**



Retention is the essential for long-term growth, specifically for companies in a competitive space

- Once you acquire new users, we must keep them engaged, retain or even reactivate them (e.g., most women in America have downloaded the Pinterest app, so how they can grow more then?)



Retention is a continuous process and necessitates using different marketing tactics and strategies

You Send	That Contain	So Users
<ul style="list-style-type: none">• Emails• Push Notifications• In-App Notifications• Web Notifications• SMS/MMS• & more	<ul style="list-style-type: none">• Personalized messaging• Deals, coupons• Promotions• Announcements• & more	<ul style="list-style-type: none">• Click• Buy• Upgrade• Share• Consume content• Create content• Review• & more

Retention is cheaper than acquiring new customers

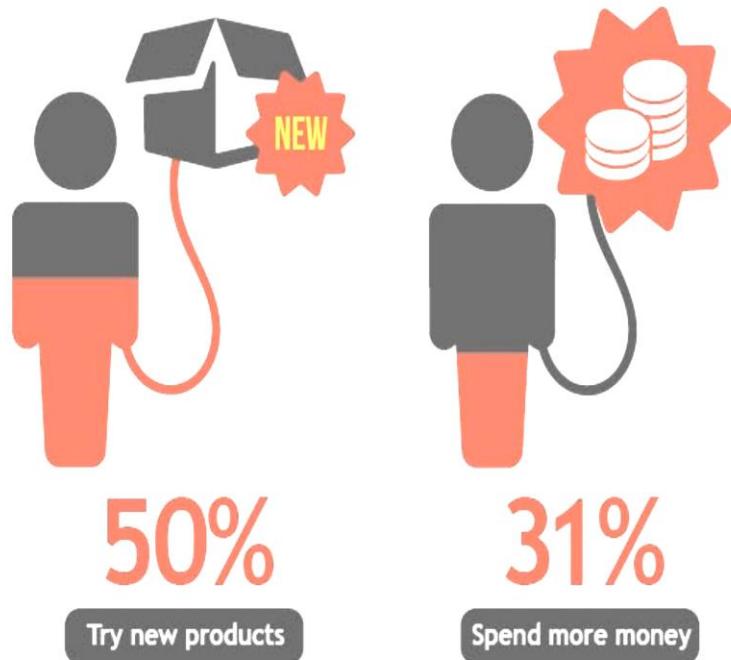
- It costs 5 times as much to attract a new customer than to keep an existing one

[Source]

- Research done by Bain and company shows increasing customer retention by 5% increase profit by 25%-95%

[Source]

Existing customers are **50%** more likely to try new products and spend **31%** more, when compared to new customers.

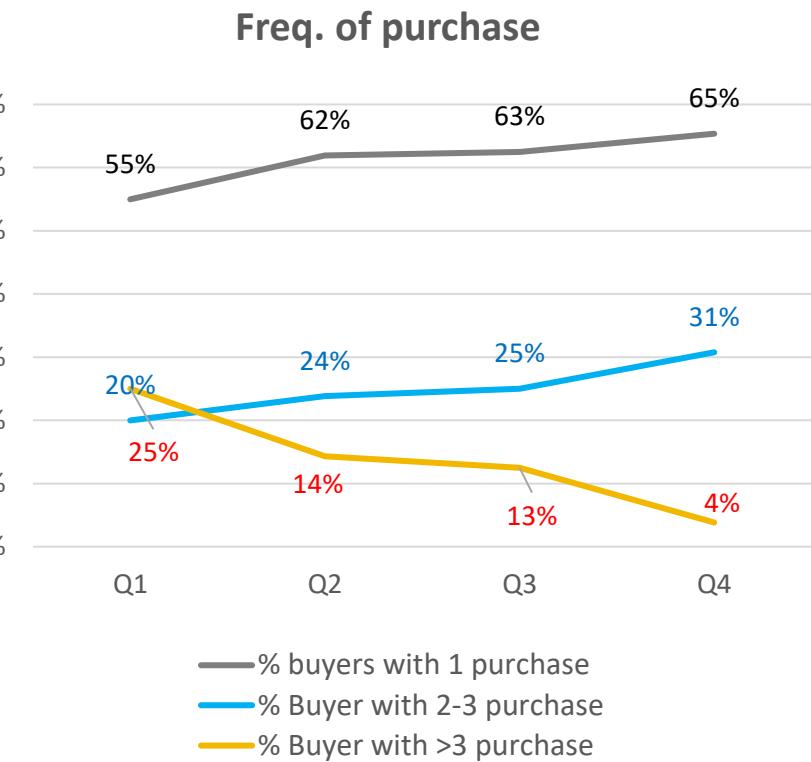
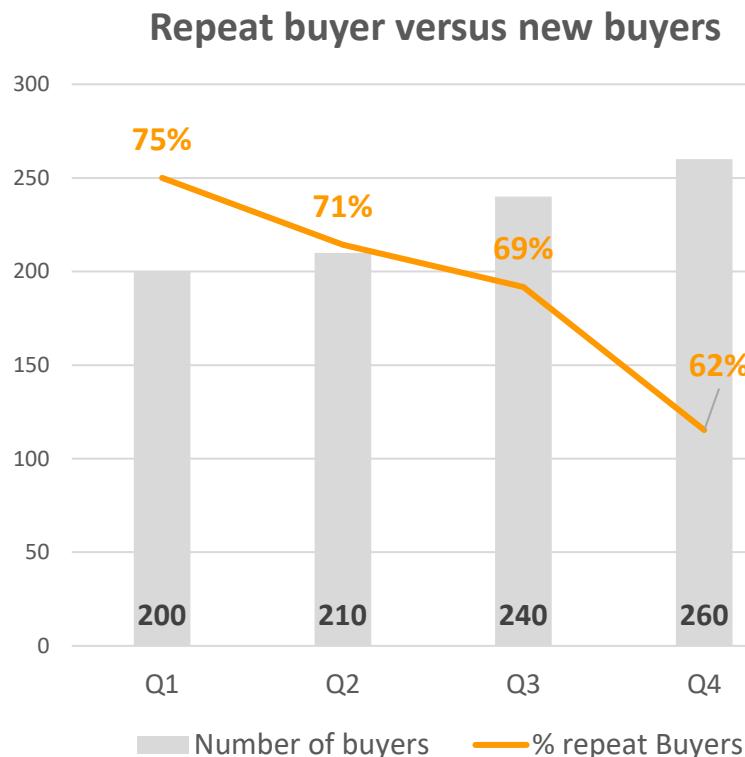


Source: <https://www.invespcro.com/blog/customer-acquisition-retention/>

We can derive some quick insights about retention mode of a business by looking into repeat customer behavior

➤ **What can we learn from repeat buyer behavior?**

➤ **How can we increase the repeat behavior here?**



Online Channels used primarily for customer retention versus acquisition among companies

Online Marketing Channel	Acquisition	Retention	Both Equally
Mobile messaging	23%	58%	19%
Email	21%	52%	27%
Mobile apps	30%	44%	26%
Mobile and web push notification	34%	39%	27%
Social media marketing	31%	28%	41%
Web retargeting	61%	22%	18%
Mobile web	52%	18%	30%
Website	29%	16%	55%
SEO (Organic) search	66%	6%	28%
Online display advertising	85%	4%	11%
Paid search	86%	2%	13%

Source: <https://www.invespcro.com/blog/customer-acquisition-retention/>

How companies calculate customer retention rate?

Customer Retention Rate (CRR) is a marker of how loyal your customers are

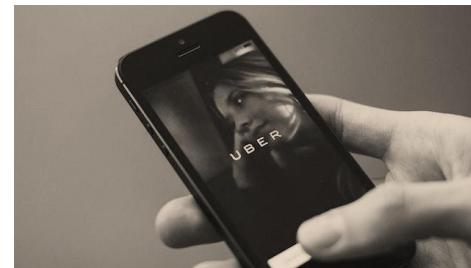
- Retention Rate simply means among a group of customers that shopped with you in some historical period (e.g., 6-12 months ago), what proportion of them are still active now because they've shopped recently (e.g., *within the last 6 months*).
- **Retention rate** incorporates a window of time between two orders. The window of time that you choose to use is dependent upon the types of **product you sell**.

Grocery industry



Biweekly or daily?

Ride Hailing



Weekly or Monthly?

Furniture

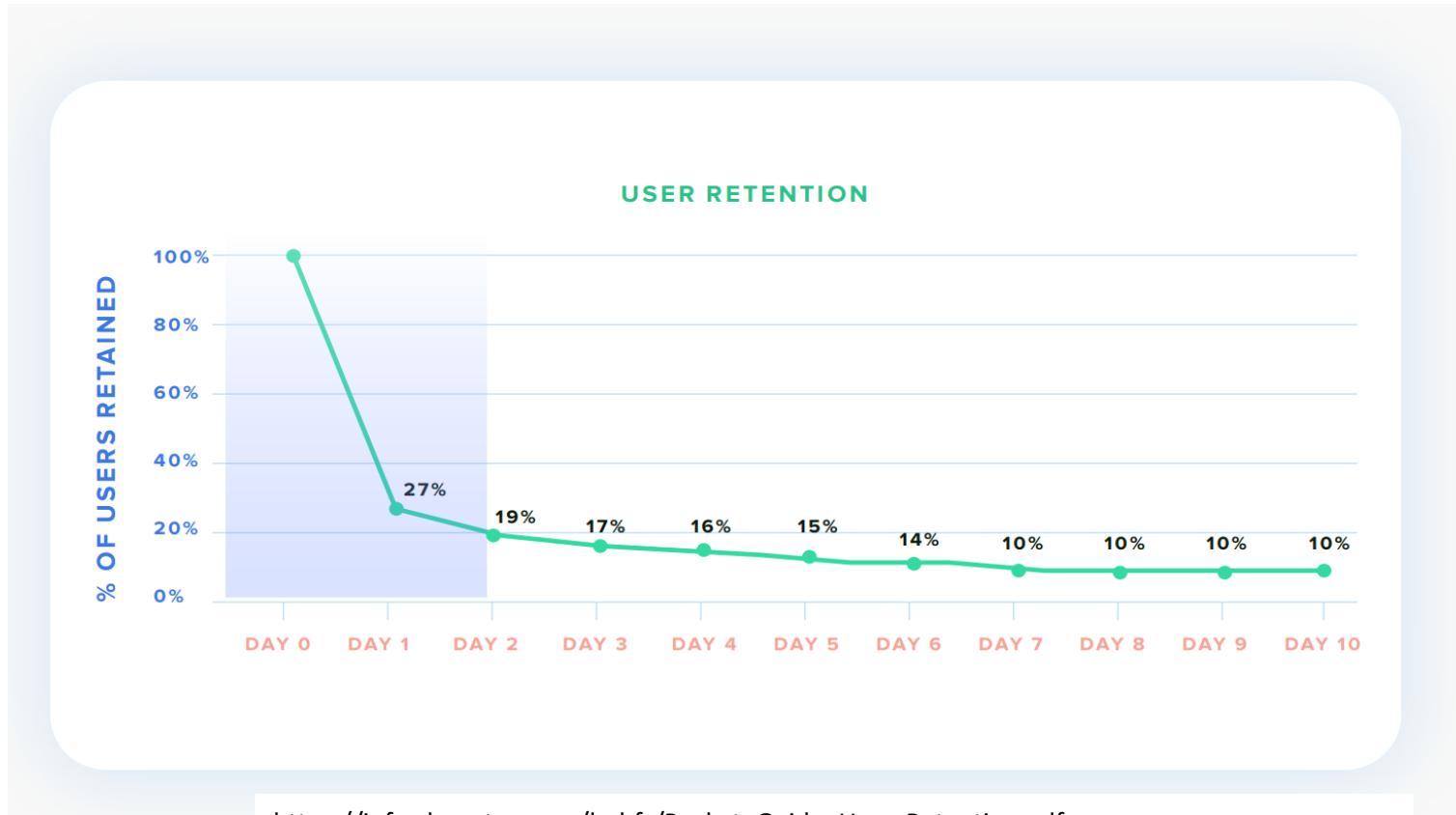


Monthly or annually?

Source: <https://ometria.com/blog/how-to-calculate-customer-retention-rate-in-e-commerce>

Customer retention rate (CRR) is one important metric to measure business retention

- Many companies have problem retaining and engaging their customers
- Retention is a very big problem for mobile apps



Customer Retention Rate (CRR) Formula for subscription-based SaaS businesses

$$\left(\left\{ \text{Number of Customers at the end of Period} \right\} - \left\{ \text{Number of new Customers acquired during Period} \right\} \right) / \left\{ \text{Number of Customers at the beginning Period} \right\}$$

	Jan	Feb	Mar
Number of customer at the beginning	50,000	50,000	50,000
Number of new Acquired customer	7,000	10,000	8,000
Number of customer at the end	52,000	55,000	52,000
Number of Retained Customers	45,000	45,000	44,000
Overall Retention Rate	90%	90%	88%

Customer Retention Rate (CRR) Formula for E-Commerce businesses

$$\left\{ \begin{array}{l} \text{Number of Buyers in this} \\ \text{period who also} \\ \text{purchased in previous} \\ \text{period} \end{array} \right\} / \left\{ \begin{array}{l} \text{Number of} \\ \text{Buyers in} \\ \text{previous period} \end{array} \right\}$$

Number of buyers
Number of new buyers
Number of repeat buyers
Number of buyers from previous month

	Jan	Feb	Mar
50,000	54,000	48,000	
7,000	10,000	8,000	
43,000	44,000	40,000	
	30,000	35,000	
Retention Rate (from prev period)		60%	65%

Difference between Repeat Rate and Retention Rate for E-Commerce businesses

Repeat Rate:

$$\frac{\text{Number of Buyers in this period coming from previous periods}}{\text{Number of Buyers in this period}}$$

	Jan	Feb	Mar
Number of buyers	50,000	54,000	48,000
Number of new buyers	7,000	10,000	8,000
Number of repeat buyers	43,000	44,000	40,000
Number of buyers from previous month		30,000	35,000
 Retention Rate (from prev period)			
Repeat Rate	86%	81%	83%

Other retention-related metrics which measure the loyalty, frequency of purchase and customer experience



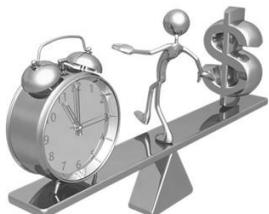
#1. Repeat Customer rate:

- **Total repeat buyers/total customers**
- This is a great measure of the overall pulse of your customer experience



2. Average order value (AOV)

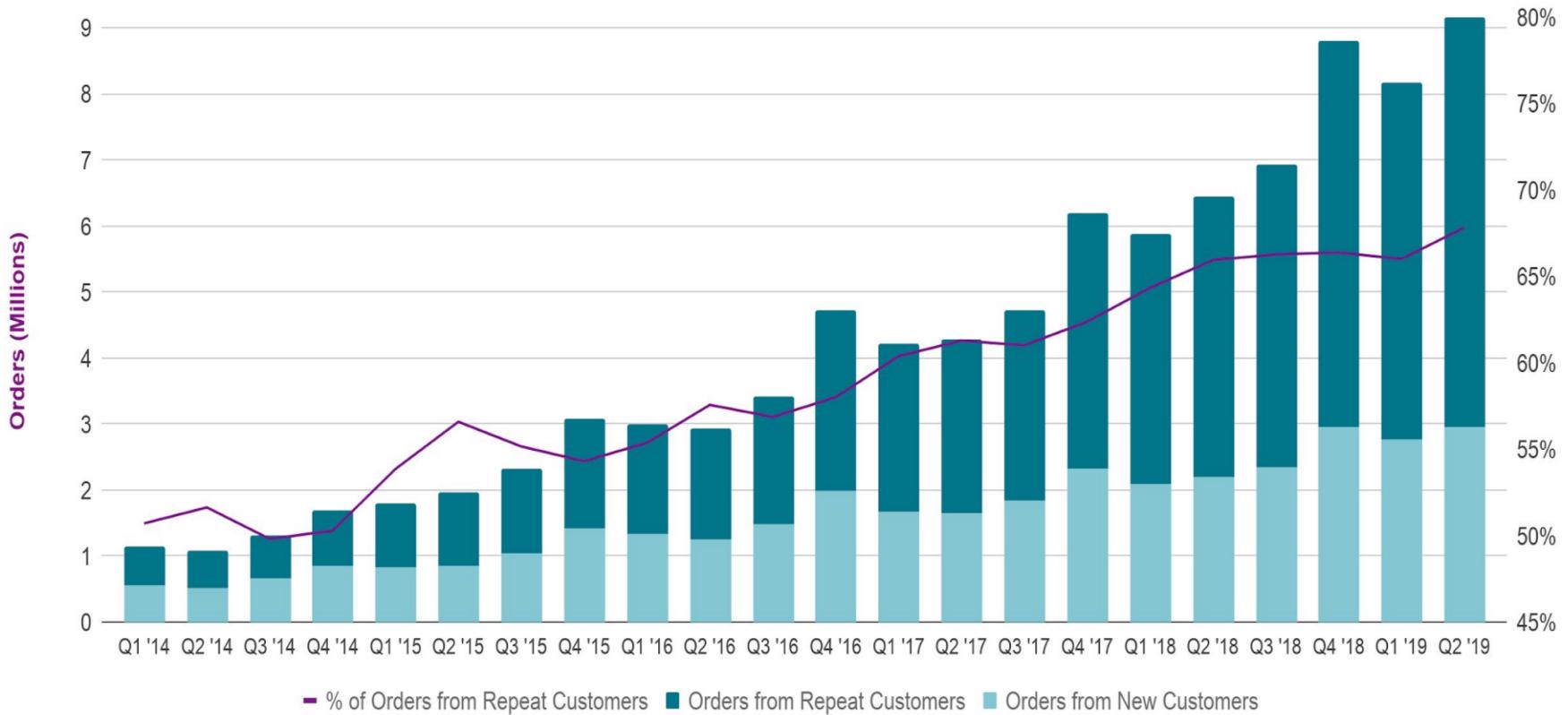
- **Revenue/number of orders**
- Focus on deriving more revenue value from loyal customers
- Can a good purchase experience encourage more spending?



#3. Customer lifetime value (CLV)

- **The amount of value a customer contributes to your business over their lifetime**
- It's worth determining which customers have the highest CLV

Retention metrics are reported by companies (e.g., Wayfair.com) in their quarterly earning call to the public



Source: https://s24.q4cdn.com/589059658/files/doc_financials/quaterly/2019/q2/Q2'19-Wayfair-Investor-Presentation.pdf

There are some rule of thumbs to increase retention in a product within a specific demographic of the customers

Raise your price

Reconsider your value proposition

Follow up on every interaction with the customer

Upsell

Emphasize engagement as soon as possible

Develop a regular interaction schedule

Follow your customers on social media

Consider a loyalty program

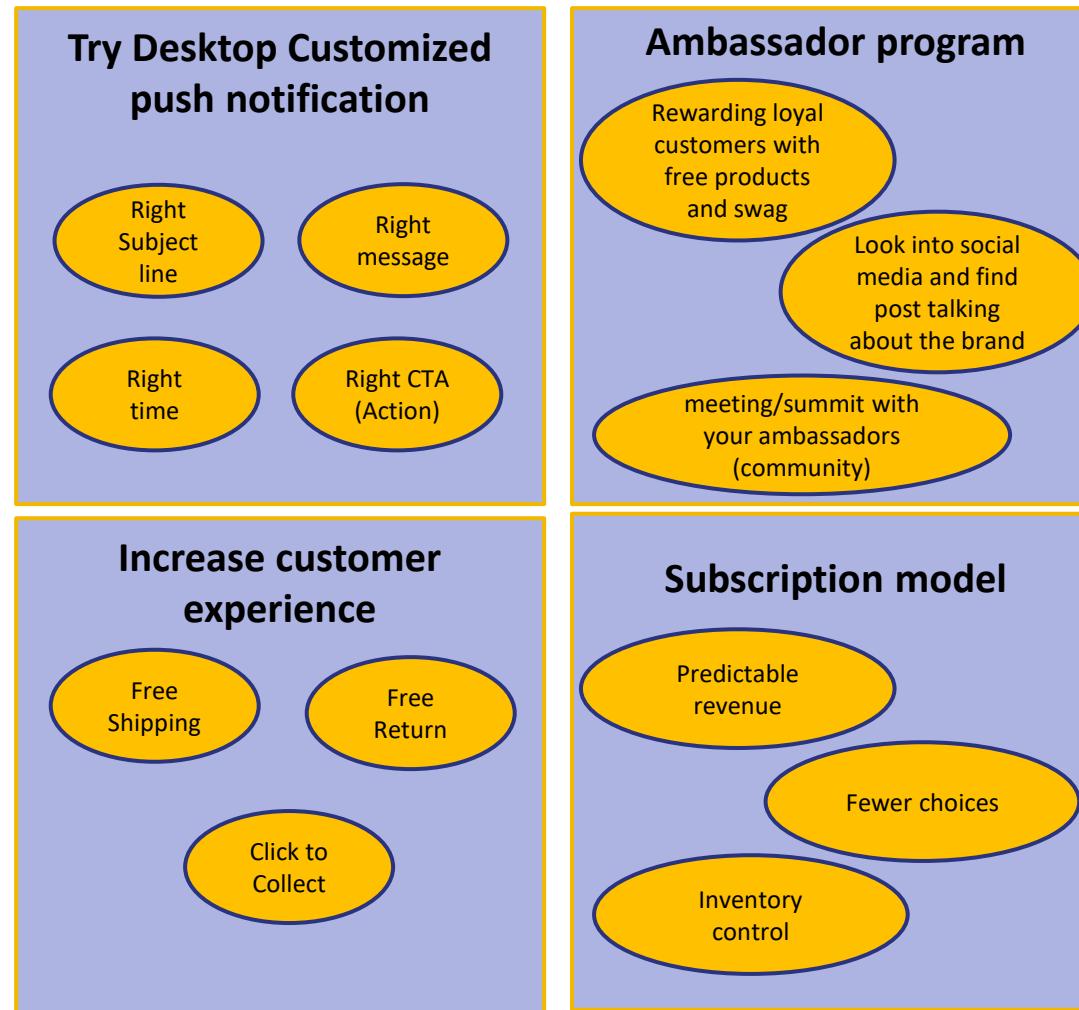
Create a retention team

Measure meaningful customer engagement

Upgrade the customer automatically

Make it easy for customers to leave

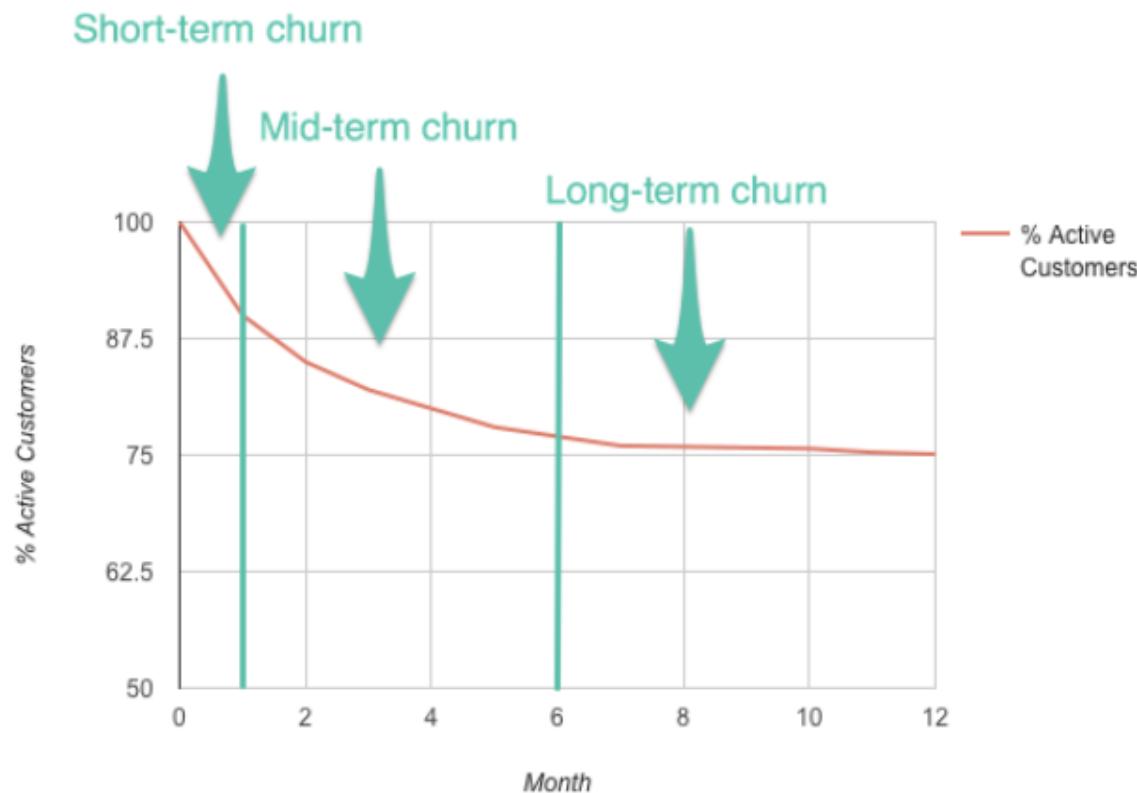
Some effective retention methods which can apply to E-commerce businesses



One big mistake is Not Calculating Retention at different Stages of Customers' Lifetimes

Retention Rate can vary within customer lifecycle.

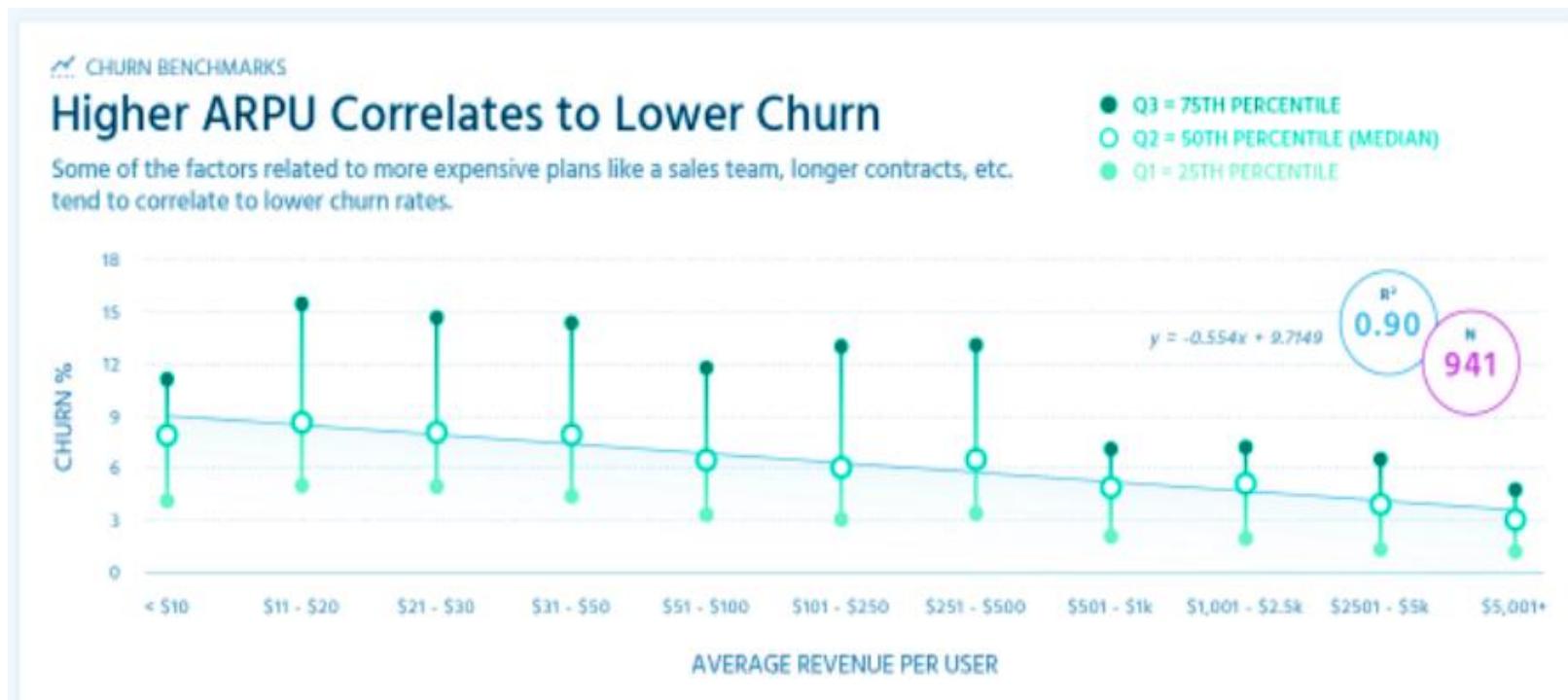
(customers who sign up at different times will have different retention rates)



Source: <https://www.profitwell.com/customer-retention/calculate-retention-rate>

Customers on different plans (different segments) will typically show different rates of user retention

- Enterprise-tier customers, or those customers with most expensive plans more likely to have higher user retention
 - One study also found that higher percentages of annual contracts correlate with better retention.



Source: <https://www.profitwell.com/customer-retention/calculate-retention-rate>

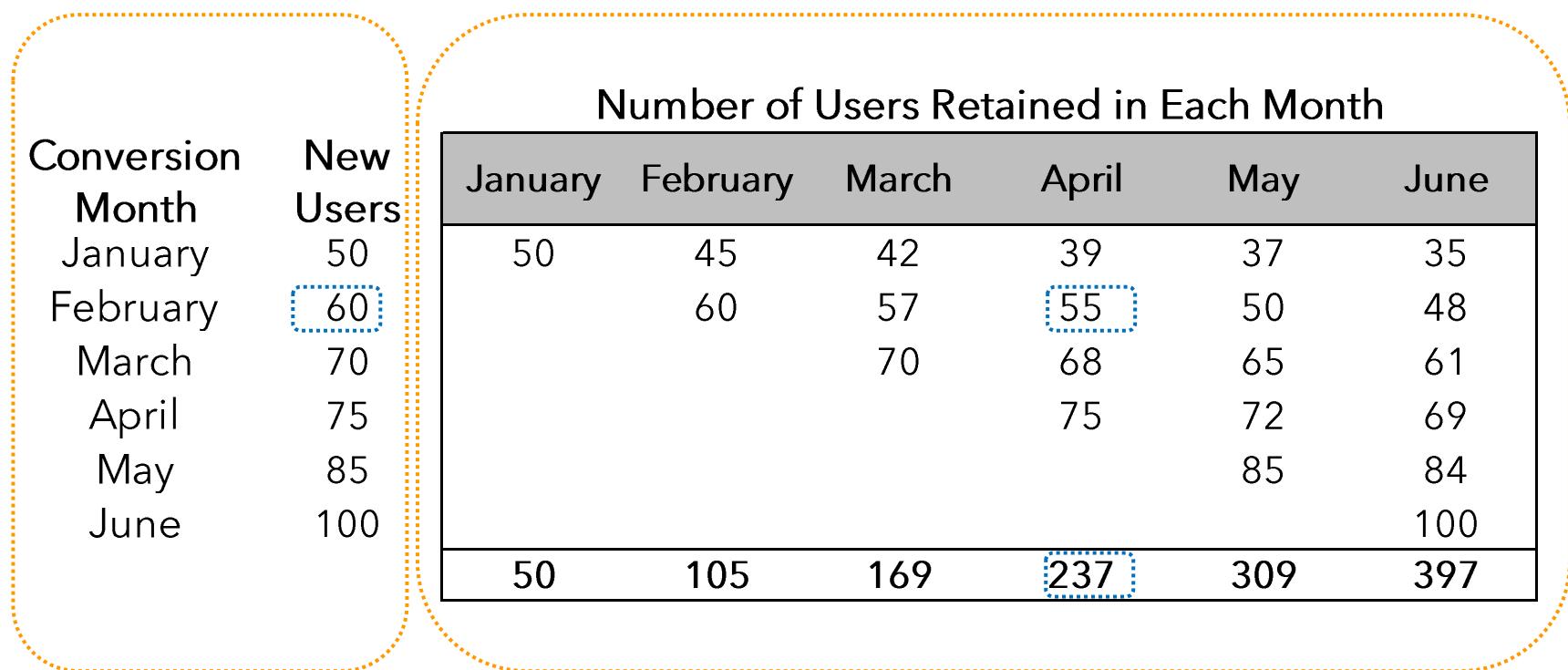
Understanding the retention using Cohort Analysis

What is cohort analysis?

- A **cohort** is a group of customers who share something in common such as their sign-up date, first purchase date, acquisition channel, location etc.
- Cohort analysis is a temporal study of users' data to get insights on how different cohorts behave over the time.
- It enables us to look at growth metrics at a disaggregated level to get a more accurate and realistic picture of the actual growth rate, customer lifetime values, churn rates, etc.
- It is also helpful in studying customers' loyalty and how it evolves over time with changes to our product designs

Cohort analysis example

- Monthly acquired users are considered *cohorts here*
- Users who are acquired every month could be engaged/retained/churned over next few months



Cohort analysis example, cont'd

- We can re-label the previous table to show the number of users from each cohort retained after 'n' month from their first conversion

Conversion Month	New Users	Number of Users Retained 'n' Month After Conversion					
		0	1	2	3	4	5
January	50	50	45	42	39	37	35
February	60	60	57	55	50	48	
March	70	70	68	65	61		
April	75	75	72	69			
May	85	85	84				
June	100	100					
		440	326	231	150	85	35

Calculating the retention rate for each cohort, example cont'd

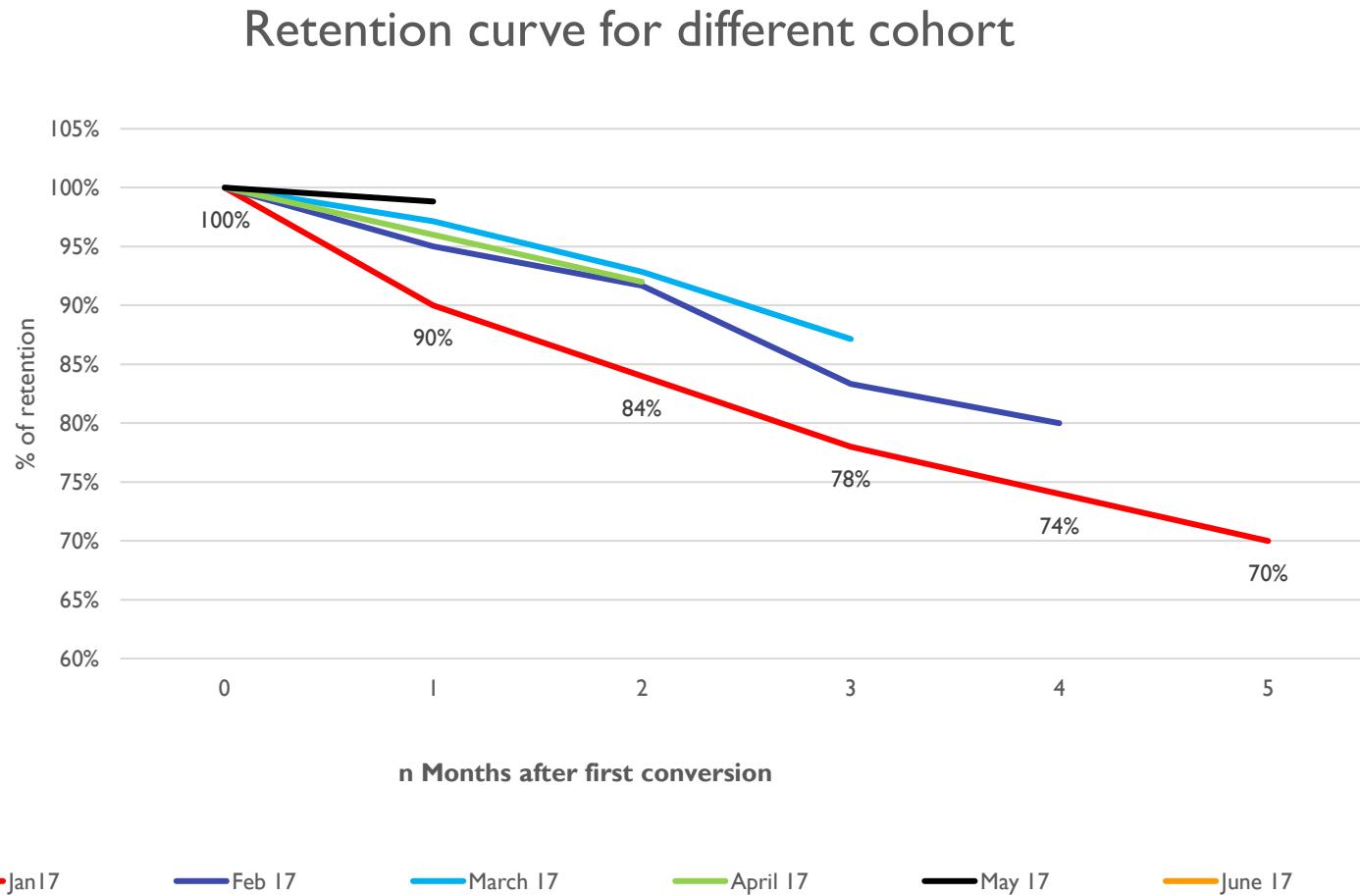
➤ What can we learn from our cohort analysis example?

More recently acquired cohorts have higher retention rate across their tenure (is it surprising?)

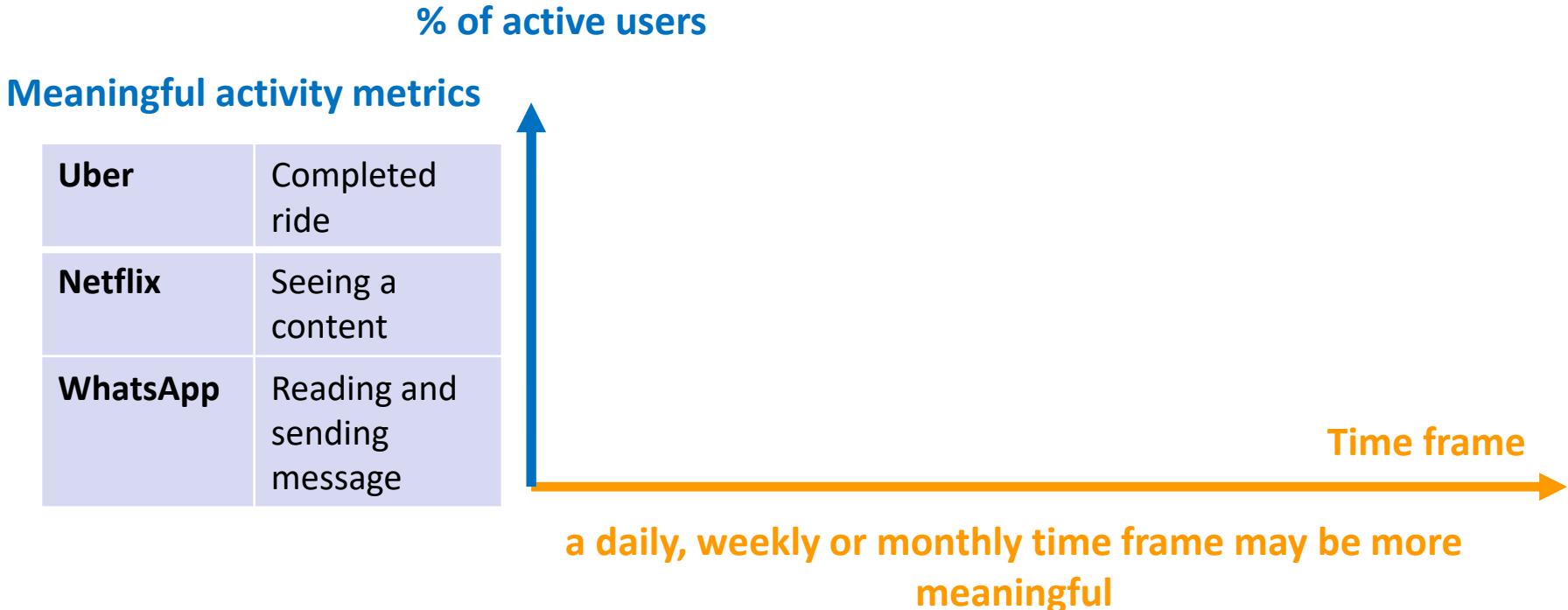


	0	1	2	3	4	5
January	100%	90%	84%	78%	74%	70%
February	100%	95%	92%	83%	80%	
March	100%	97%	93%	87%		
April	100%	96%	92%			
May	100%	99%				
June	100%					
	100%	96%	91%	83%	77%	70%

Retention curve for different cohorts

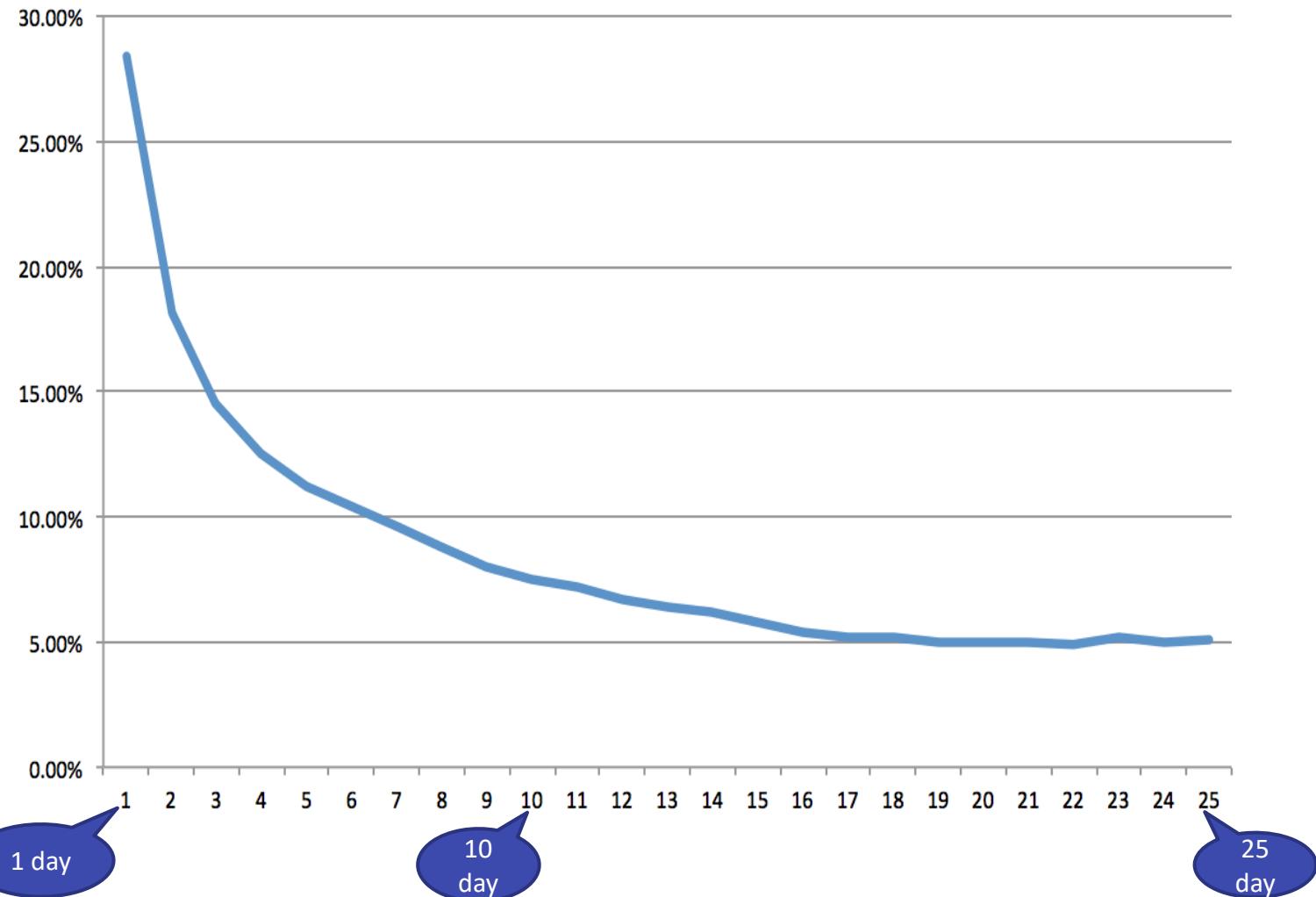


Retention is measured relative to two factors: time frames and meaningful activity events



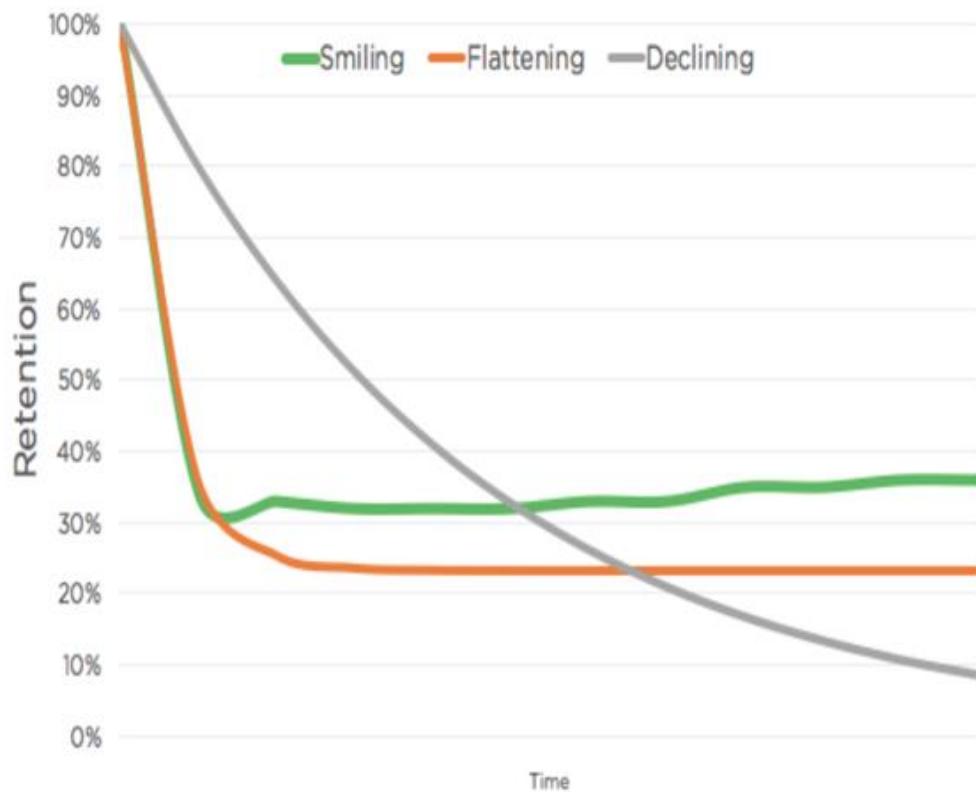
Daily	a social app or game would expect daily usage.
Weekly	Ride sharing app
Quarterly	travel product might expect users to come back once per quarter

Below retention curve shows the percent of users that remain active after a period of time



Different types of retention curves

- **Smiling curves** when a product is truly exceptional, its retention curve will rise over time
- **Flattening curves** suggests that a percentage of users who sampled the product found value
- **Declining curves** when a product has not achieved product-market fit, the retention curve will continuously decline



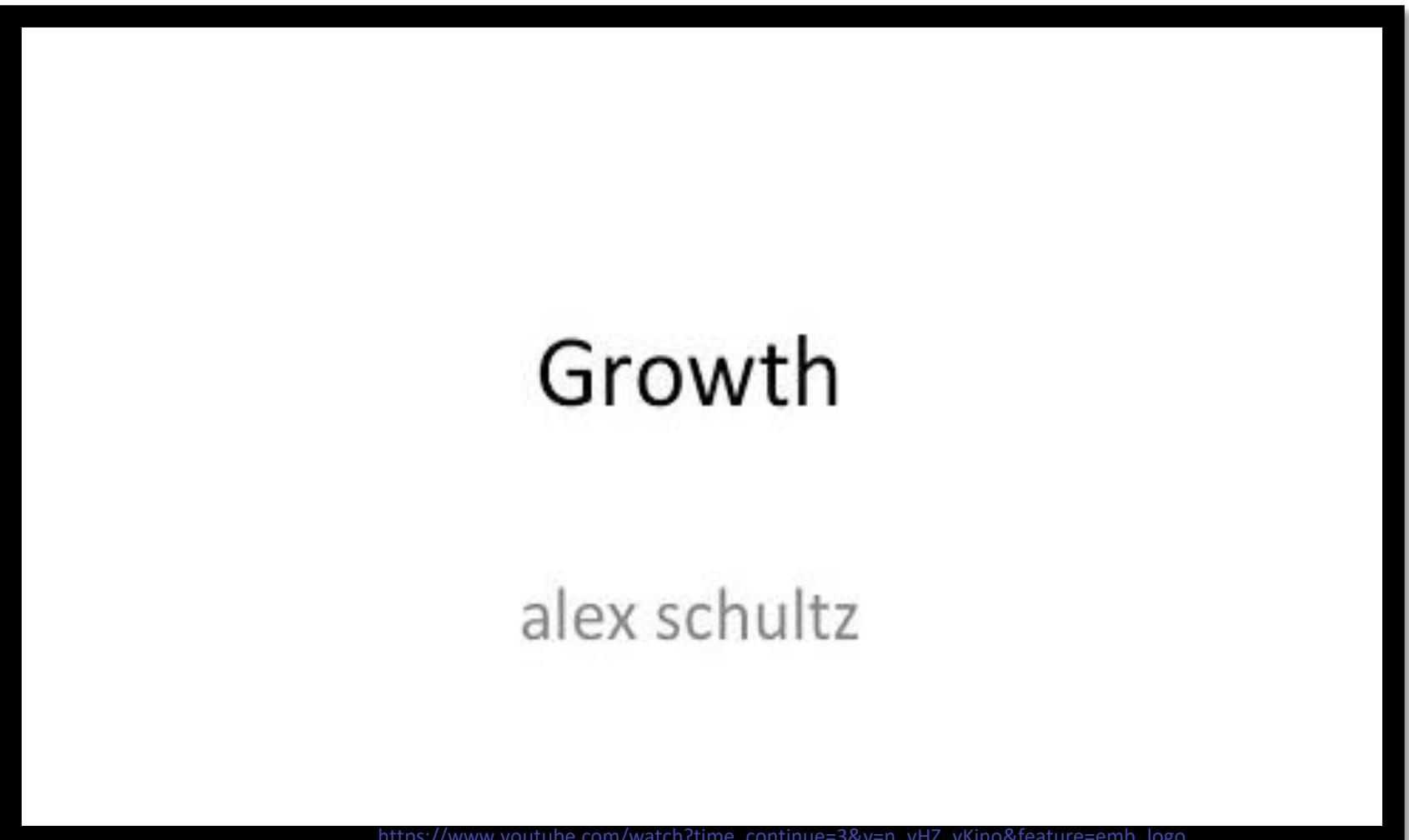
<https://www.sequoiacap.com/article/retention/>

Can you think of some **user cohorts** for below businesses to calculate the retention rate?

- **How do you define a meaningful retention metric in each business?**
- **What can we learn from these cohorts?**



How to Get Users and Grow - **Alex Schultz** (Facebook Growth)
min 2:30-6:30



Growth

alex schultz

https://www.youtube.com/watch?time_continue=3&v=n_yHZ_vKjno&feature=emb_logo

Engagement and power user metrics

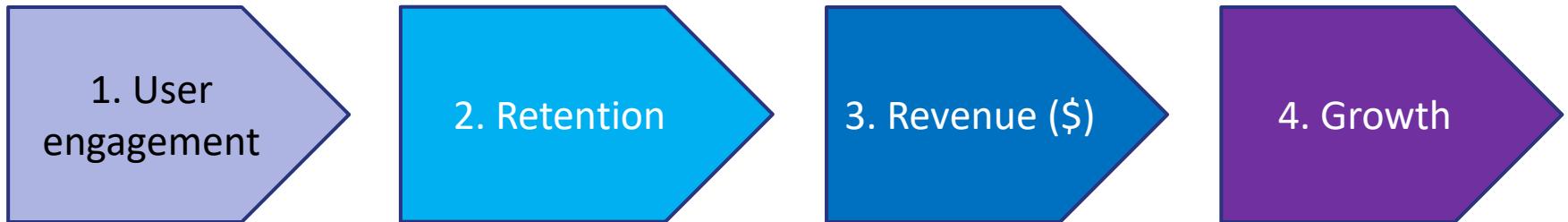
User engagement is when your customer is realizing value from your product/service/website/app

"Engagement is when your customer is realising value from your SaaS."

- Lincoln Murphy (sixteenventures.com)



User engagement deeply impacts growth metric of the business



1. If users are getting more value from your business, then they are going to stay around for longer.
2. If user stays longer, we can retain them longer leading to
3. more opportunity to generate revenue and increase Customer life-time value, and this
4. All leads to GROWTH

Power user curve is the best way to understand the most engaged users

- **Power users** drive some of the most successful companies (power users love the products more than anyone else and are highly engaged)
- Who are power users here?



- What are most meaningful engagement metrics in order to find power users?

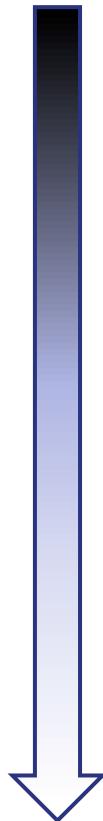


DAU/MAU can be used to measure engagement metric or **stickiness** for a daily product like Facebook and Pinterest

DAU: Daily Active users, **MAU:** Monthly Active users

Where can be DAU/MAU used or not used?

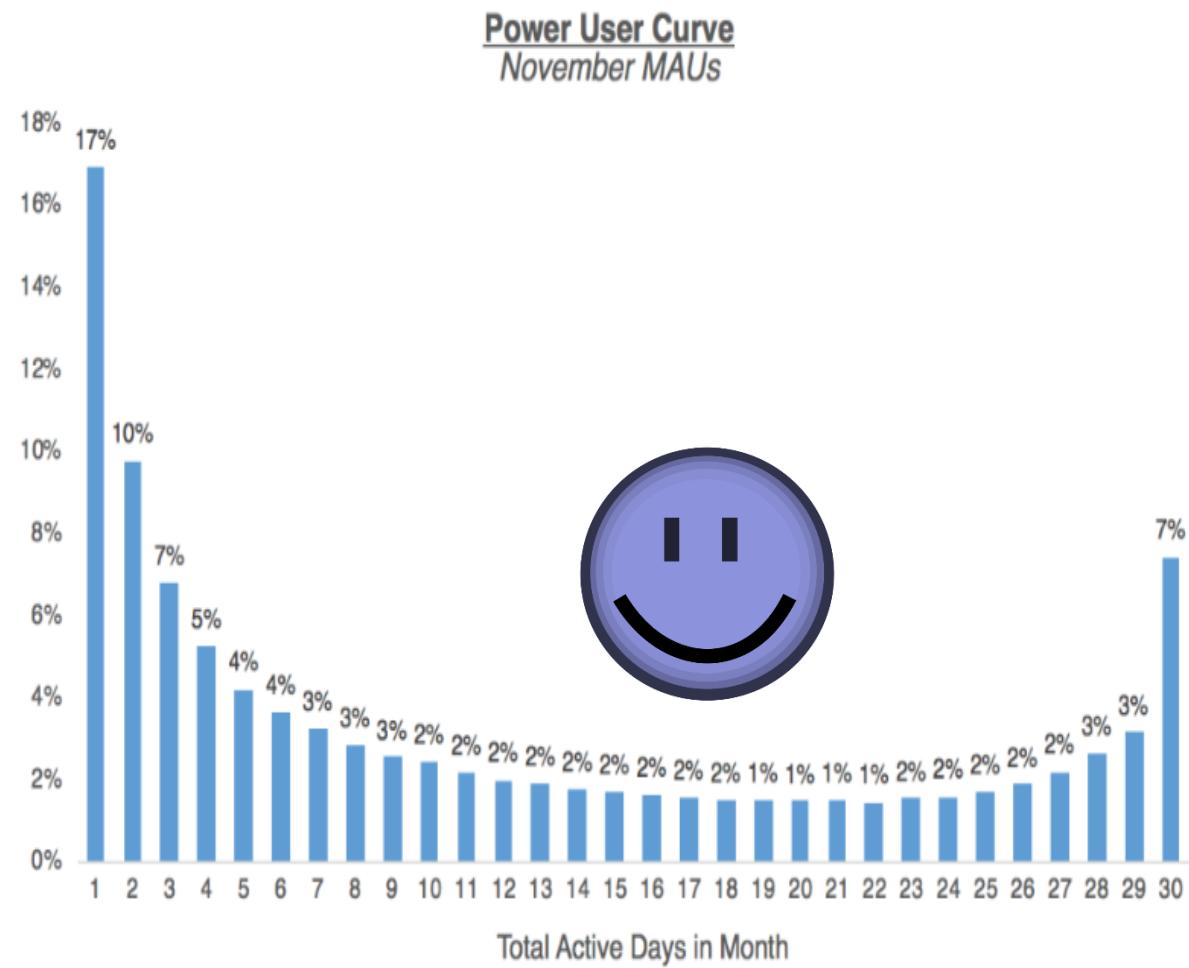
Freq. of usage is declining



- DAU/MAU is more than 60% for Facebook- 60%+ of its MAUs coming back daily.
- DAU/MAU is good for **daily used products and apps**.
- A lot of super important products like Google Analytics, Dropbox, Salesforce, etc. might only be used 1-2x/week at most.
- For Airbnb, users only travel a few times a year (the average consumer only travels ~2x/year). Yet there are multi billion-dollar companies built in this space.
- Much of e-commerce have infrequent user behaviors. You buy mattresses, new sunglasses, watches, etc. infrequently.

What is Power User Curve (also commonly called the activity histogram or the “L30”)?

- L30 [L28] is coined by the Facebook growth team.
- L30 is a **histogram** of users' engagement by the total number of days users were active in a month (*from one day in a month all the way to 30 days*)
- Like L30, L7 is used to capture 1-7 days activity of users in a weekly basis.



<https://andrewchen.co/power-user-curve/>

For website and web-apps, typically 60%-80% of new users are lost within the first week of signup

- Improvements that company makes in week 1 engagement carry through the entire retention curve (**week 1 is very important**)



<https://blog.popcornmetrics.com/5-user-engagement-metrics-for-growth/>

Retention versus frequency for different app categories

1. Social games have high frequency but once you burn through the content, you tend to churn [high DAU/AMU]

2. E-commerce/retail sites have low retention rate as well as low frequency

3. You don't often check weather app, maybe only on cloudy days, but you might do it through your entire life

4. News apps have both high frequency and high retention



<https://andrewchen.co/dau-mau-is-an-important-metric-but-heres-where-it-fails/>

The Power user curve (L30) has some advantages over DAU/MAU

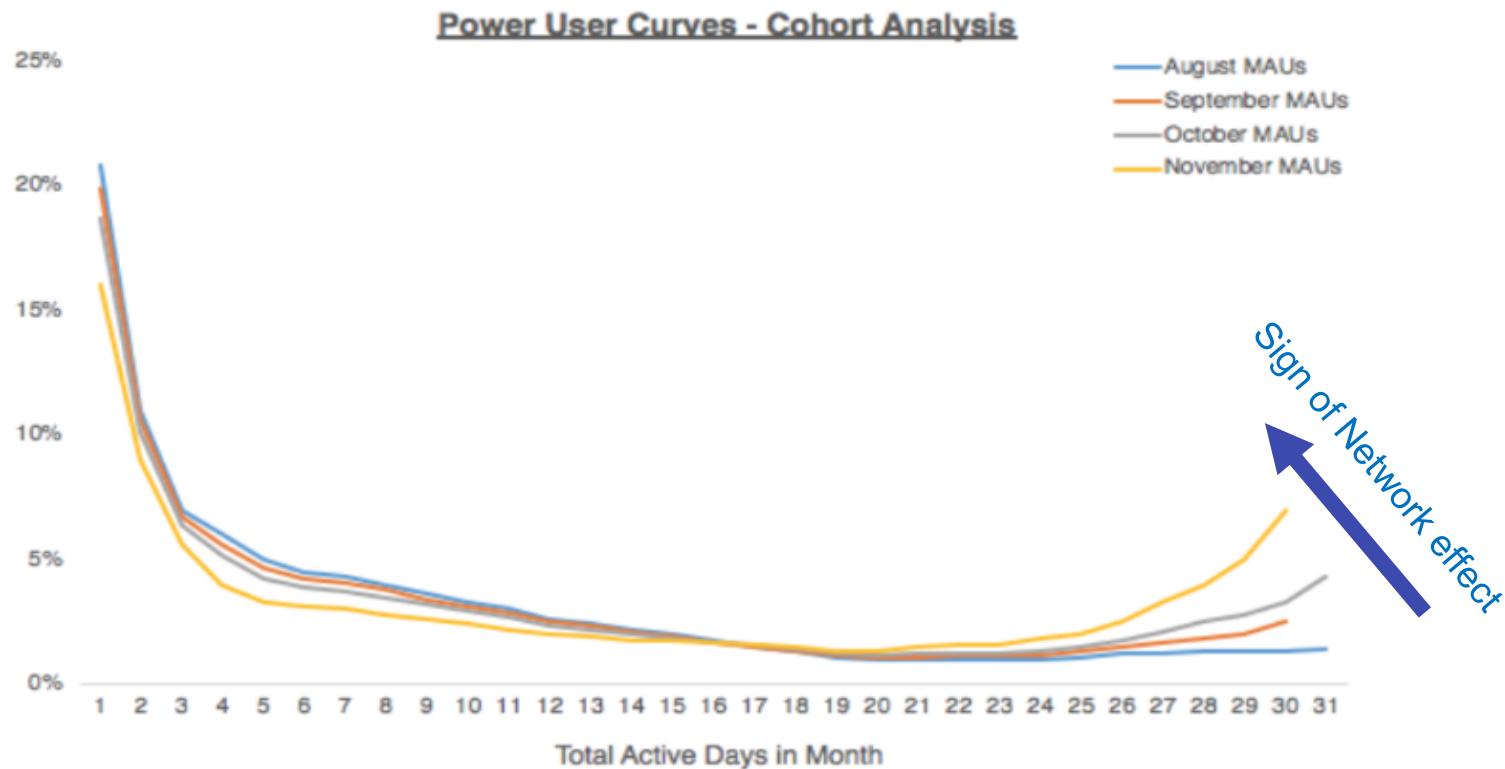
- It shows if you have a hardcore and engaged segments that coming for most days of month
- **DAU/MAU is only a single number**, whereas L30 shows the variability among your users: some are slightly engaged, whereas others are power users.
- When Power User Curves mapped to cohorts, it will let you see if your engagement is getting better over time.
- Like retention curve, **the power user curve will “smile” when things are good**



When network effect kicks in, the retention rate and engagement will improve for newer cohorts

Plotting the Power User Curve for different WAU* or MAU cohorts can also be very insightful

*WAU=weekly Active user



<https://andrewchen.co/power-user-curve/>

In-class example

In-class example (L7)

- We do have a data on 7-day activity (e.g., login) for around 19 customers in a product

User_id	Whether they come to the APP or not (Yes=1, NO=0)						
	day 1	day 2	day 3	day 4	day 5	day 6	day 7
222	0	1	0	0	0	0	0
336	0	0	0	0	0	1	0
743	0	0	0	0	1	0	0
876	0	1	0	0	0	0	0
883	1	1	0	1	0	1	1
1103	0	0	0	1	0	0	1
1443	1	1	1	1	1	1	1
1816	1	1	1	1	1	1	1
1986	1	0	0	0	1	1	1
2230	1	1	1	1	1	1	1
2526	0	0	0	0	1	0	0
2730	0	0	0	1	0	0	1
2821	0	1	0	1	0	0	1
5551	1	0	0	1	0	1	1
5847	1	0	1	0	0	0	0
6298	1	1	1	1	1	1	0
6520	1	0	0	1	1	0	0
6856	0	0	0	1	1	0	1
6972	1	1	1	1	1	1	0

In-class example (L7), Cont'd

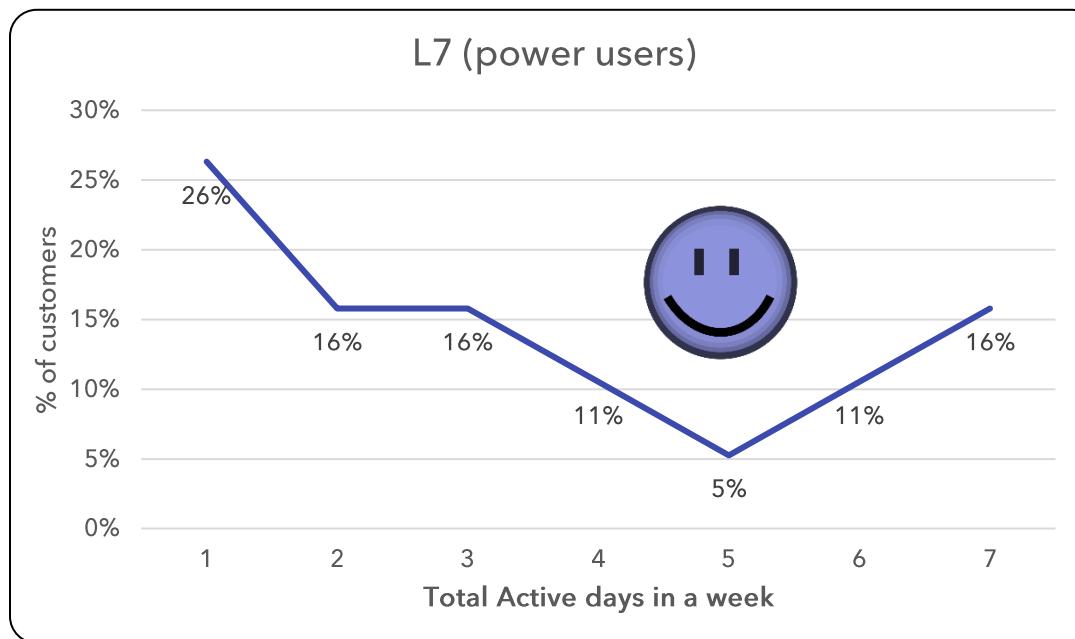
- We should find out how many days in 7 day they are active in the app

User_id	Whether they come to the APP or not (Yes=1, NO=0)							Sum
	day 1	day 2	day 3	day 4	day 5	day 6	day 7	
222	0	1	0	0	0	0	0	1
336	0	0	0	0	0	1	0	1
743	0	0	0	0	1	0	0	1
876	0	1	0	0	0	0	0	1
883	1	1	0	1	0	1	1	5
1103	0	0	0	1	0	0	1	2
1443	1	1	1	1	1	1	1	7
1816	1	1	1	1	1	1	1	7
1986	1	0	0	0	1	1	1	4
2230	1	1	1	1	1	1	1	7
2526	0	0	0	0	1	0	0	1
2730	0	0	0	1	0	0	1	2
2821	0	1	0	1	0	0	1	3
5551	1	0	0	1	0	1	1	4
5847	1	0	1	0	0	0	0	2
6298	1	1	1	1	1	1	0	6
6520	1	0	0	1	1	0	0	3
6856	0	0	0	1	1	0	1	3
6972	1	1	1	1	1	1	0	6

In-class example (L7) Cont'd

- What can be learned from L7 graph?

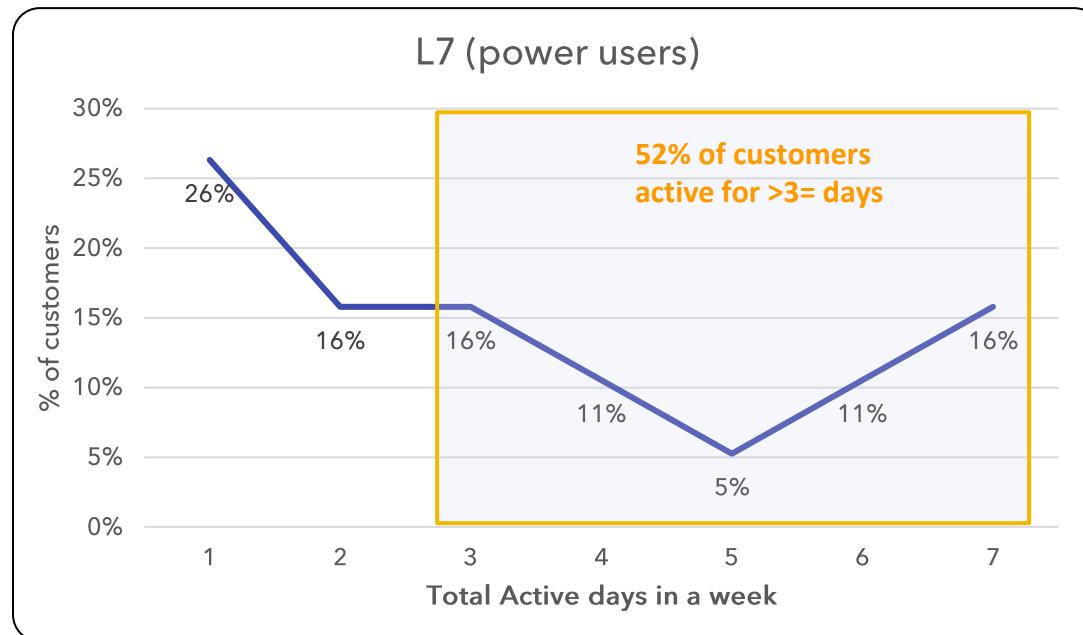
N customer	# of days active						
	1	2	3	4	5	6	7
%	25%	15%	15%	10%	5%	10%	15%



In-class example (L7) Cont'd

- What can be learned from L7 graph?

N customer	# of days active						
	1	2	3	4	5	6	7
%	25%	15%	15%	10%	5%	10%	15%



In-class example (L7), Cont'd

- DAU/WAU is around 50%.
- What can we learn from this?

	day 1	day 2	day 3	day 4	day 5	day 6	day 7
DAU	10	9	6	12	10	9	10
WAU	19	19	19	19	19	19	19
DAU/WAU	53%	47%	32%	63%	53%	47%	53%

In-class example (L7), Cont'd

- DAU/WAU is around 50%.
- What can we learn from this?

	day 1	day 2	day 3	day 4	day 5	day 6	day 7
DAU	10	9	6	12	10	9	10
WAU	19	19	19	19	19	19	19
DAU/WAU	53%	47%	32%	63%	53%	47%	53%

DAU/WAU of 50% means, on average users are active on average for 3 days in a week.

Reading/listening assignment

Deliverables for next week

HW3 will be posted in the assignment section of BB, 9/23, 9pm
EST [Due 9/30, 7pm EST]

Relevant readings, articles, podcasts and videos

10-min round discussion for next week

- [Reading: The Power User Curve: The best way to understand your most engaged users](#)
- [Podcast: The Basics of Growth — Engagement and retention](#)
- [Video: How to Get Users and Grow - Alex Schultz \(Facebook Growth\)](#)
- [Video: You are calculating Retention Wrong: RETENTION RATE FORMULA AND TOP MISTAKES](#)

Extra interesting and relevant content

- [Reading: Retention is king by Andrew Chen](#)
- [Reading: Use this spreadsheet for churn, MRR, and cohort analysis, by Andrew Chen](#)
- [Reading: Customer Acquisition Vs. Retention Costs – Statistics And Trends](#)
- [Reading: 4 KPIs You Should Track to Measure Ecommerce Retention](#)
- [Reading: User Engagement: 5 Awesome Metrics for Growth](#)

Questions

Email me @ Alipilehvarm@GWU.edu

Lecture 5

Revenue & Customer Economics

Instructor: Ali Pilehvar, Ph.D.



9/30/2021

Agenda for today

- ▶ 10 min discussion from last week
- ▶ Latency metric
- ▶ **Calculating Marketing ROI**
- ▶ **Customer lifetime value**
- ▶ **RFM (recency, frequency, monetary) customer scoring**
- ▶ **Case Study [a real deep dive into an actual business problem]**
- ▶ Group Project review
- ▶ Homework 4 to be posted after the class

Office hour moving forward

- ▶ Wednesday 7pm-8 pm EST
- ▶ Monday 7:30-8:30 am EST

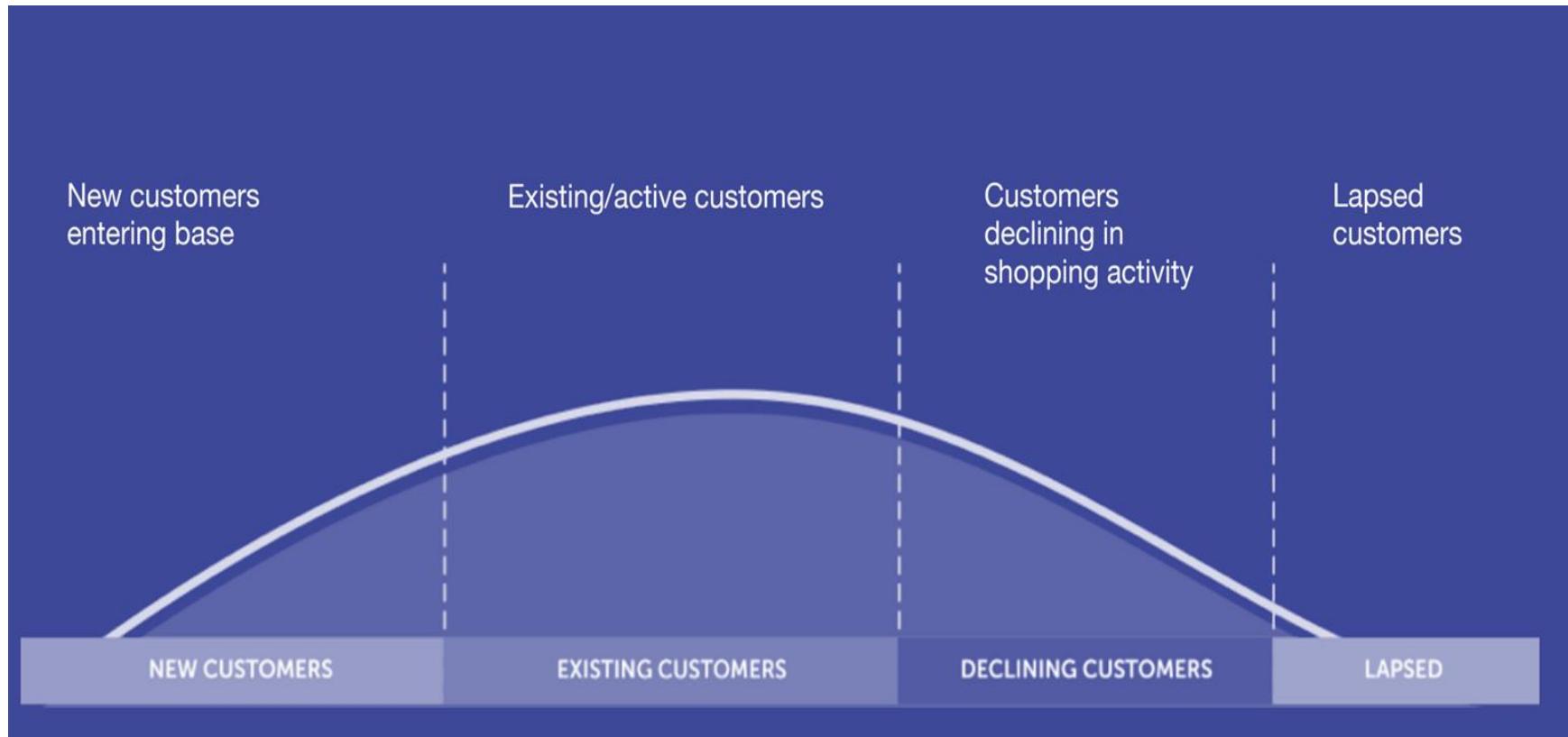
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Latency Metric

Customer lifecycle refers to all changes in customer behavior over time and is the clue to customer's future behavior

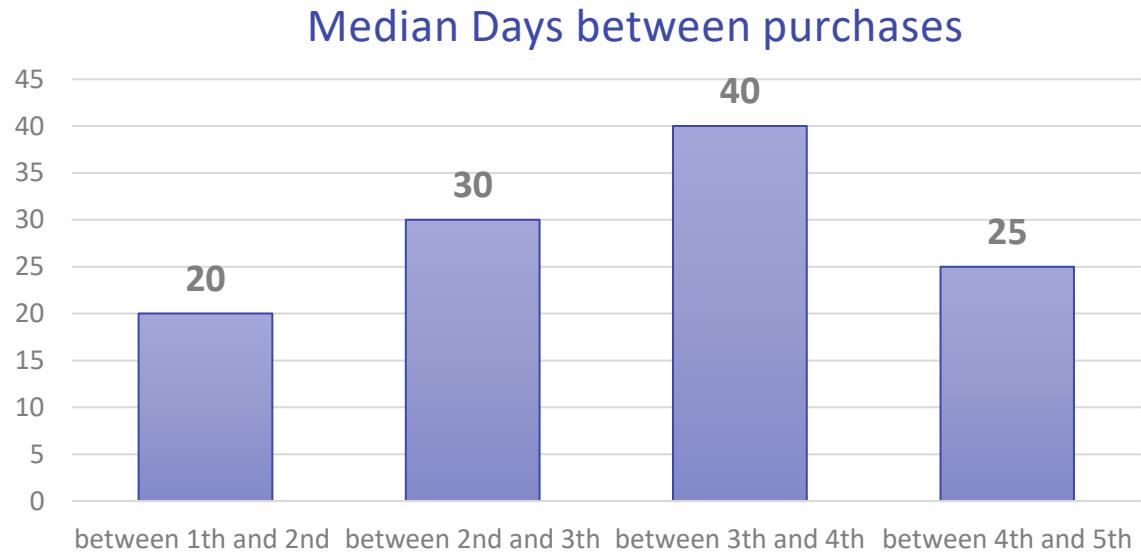
- Without knowing the Lifecycle, it's impossible to find Lifetime Value (LTV).



https://www.slideshare.net/LitmusApp/datadriven-lifecycle-email-for-ecommerce?from_action=save

Latency refers to the average time between different events or activities for different group of customers or cohorts

- Many small companies and marketers **intuitively use latency as a metric for retention campaigns**

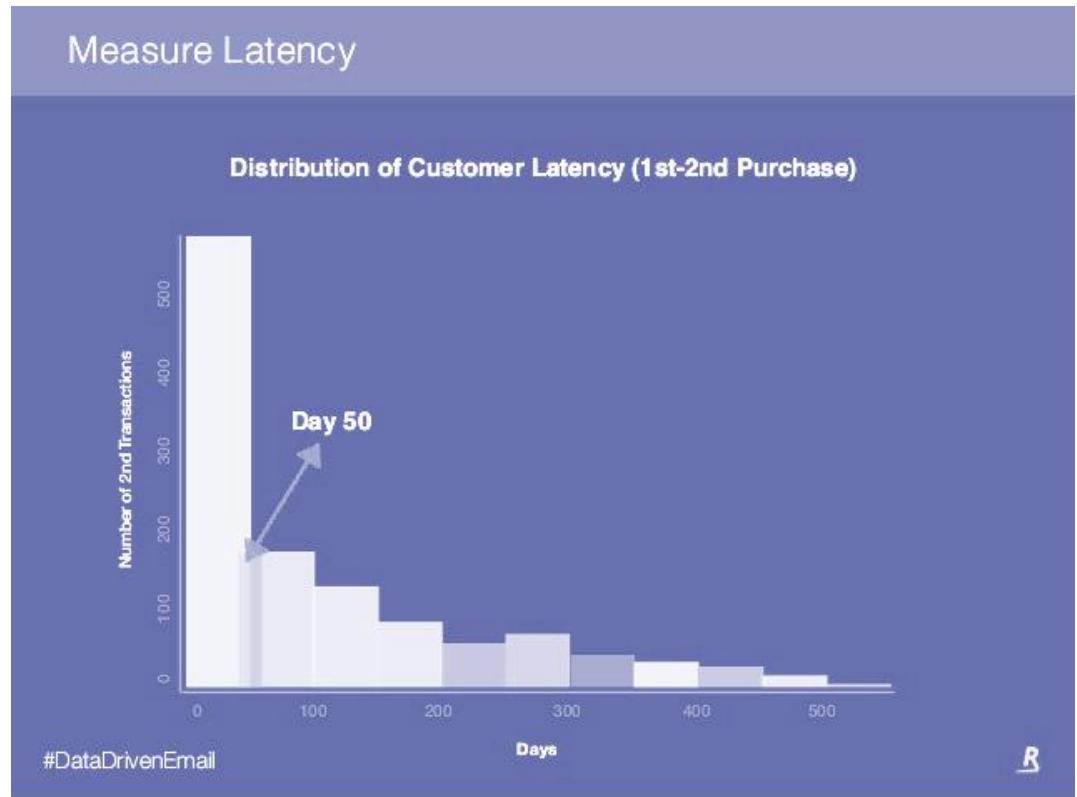


Example

- You don't go to your hair-stylist for a while and it took you longer than average to schedule your next appointment, **so your stylist will call you!**
- The longer the stylist waits to contact you after your average visit to your stylist passed, the more likely that you have been **churned (defected)**

In E-commerce one typical latency metric is the time between n th purchase and $(n+1)$ th purchases

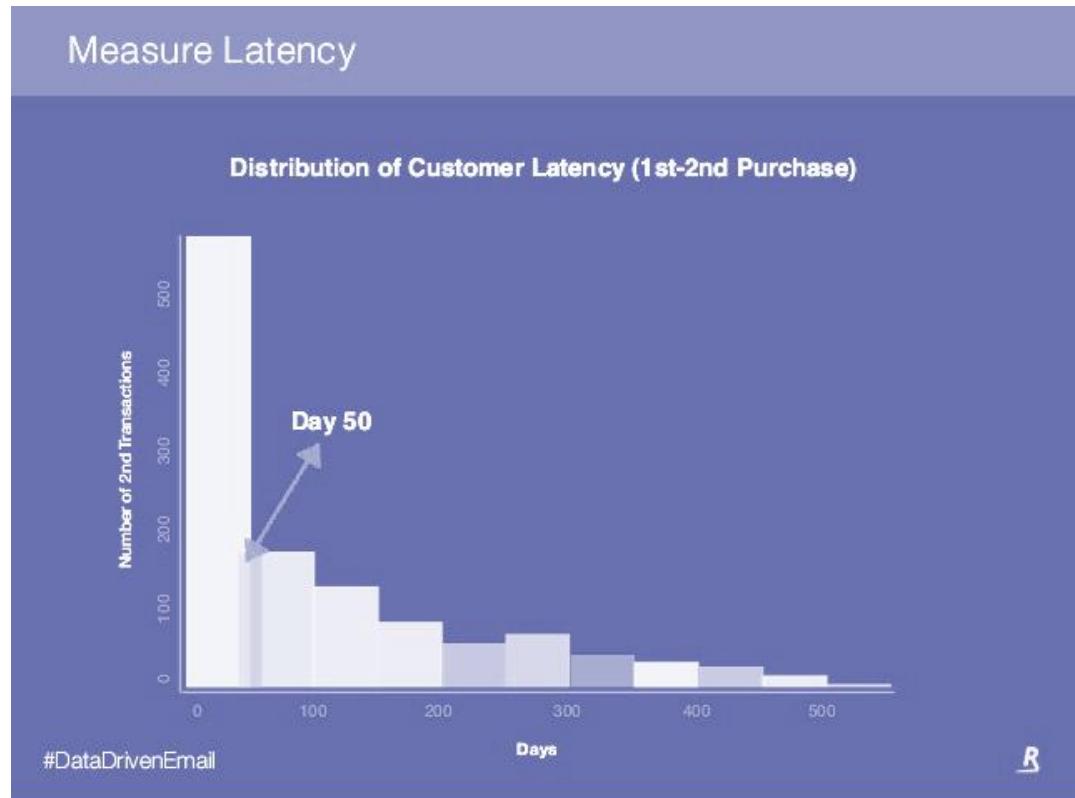
- Suppose that in below example, the avg time between first and second purchase is **around 50 days**.
- If you examine a customer and finds she goes beyond 50 days without making a second purchase, **what can we say about that customer?**



<https://www.slideshare.net/LitmusApp/datadriven-lifecycle-email-for-ecommerce>

In E-commerce one typical latency metric is the time between n th purchase and $(n+1)$ th purchases

- Suppose that in below example, the avg time between first and second purchase is **around 50 days**.
- If you examine a customer and finds she goes beyond 50 days without making a second purchase, **what can we say about that customer?**
- **Latency metrics** help marketers to apply the right triggers at the right time in customer life-cycle.



<https://www.slideshare.net/LitmusApp/datadriven-lifecycle-email-for-eCommerce>

Turning the latency data into profit

➤ Two ways to increase the value of customers

1

Extend the customer lifecycle

- Leaving more time for the customers to increase the value
- **Needs investment in loyalty program and can be expensive**
- If a loyalty program works, it can become extremely profitable

2

Increase the value of customers within existing lifecycle

- Do anything to increase their value before defection (churn)
- Needs anti-defection and retention program
- **Use customer Latency data and create Latency-based promotion**

Creating latency-based Promotion

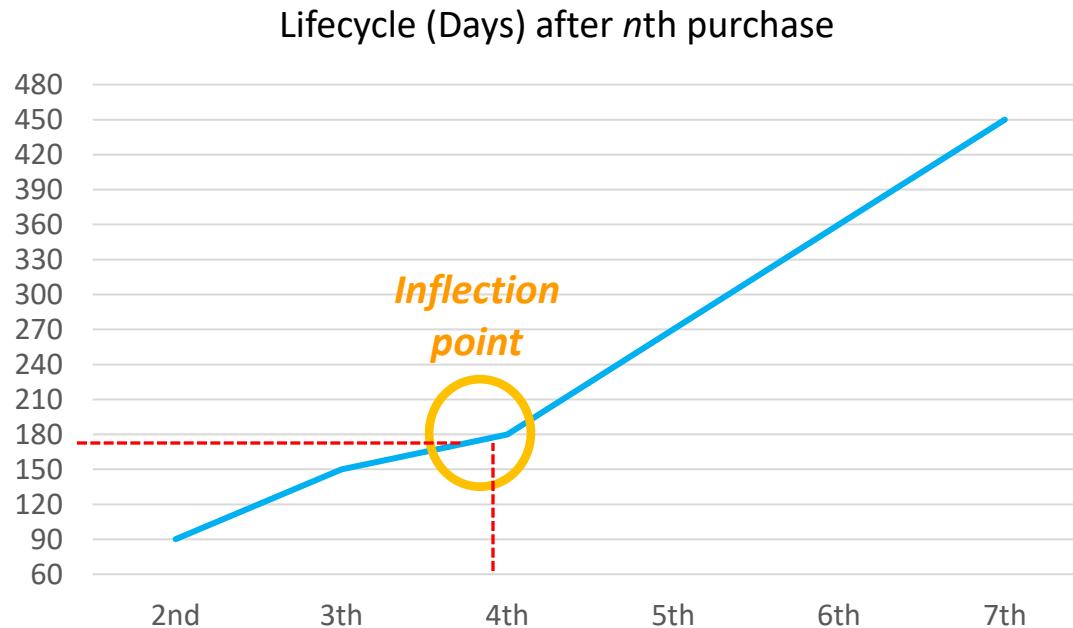
- Suppose that below is a customer **AVG life Cycle** for purchase event in a typical ecommerce site

Time between events (latency)		Time to date
Time between 1st and 2nd event	90 days	90
Time between 2nd and 3rd event	60 days	150
Time between 3rd and 4th event	30 days	180
Time between 4th and 5th event	90 days	270
Time between 5th and 6th event	90 days	360
Time between 6th and 7th event	90 days	450

- If you need to focus on a specific customers in their lifecycle and easiest segment to make them purchase faster, where do you focus on?
-

Creating latency-based promotion, cont'd

- Any customer who is 180 days old and has not yet make the 4th purchase **should be targeted!**
- Even if this can save just a small % of customers from churning, **ROI can be very high** since otherwise you would not have made a penny!



Calculating Marketing ROI

Marketing **ROI** enables companies to measure the degree to which marketing efforts contribute to revenue growth

- **Marketing ROI (Return on Investment) is the practice of attributing profit and revenue growth to the impact of marketing initiatives**

Why calculating marketing ROI?

- 1 **Justify Marketing Spend**
- 2 **Distribute Marketing Budgets (channel allocation optimization)**
- 3 **Measure Campaign Success and Establish Baselines**
- 4 **Competitive Analysis**

How to calculate the marketing ROI?

Marketing ROI=

(Sales Growth - Marketing Cost) / Marketing Cost

Assuming all sales growth is NOT tied to paid marketing efforts:

Marketing ROI=

(Sales Growth - Organic Sales Growth - Marketing Cost) / Marketing Cost

As a rule of thumb

- Marketing ROI more than 0 is considered profitable
- Marketing ROI bell curve is typically a **200%**
- Exceptional ROI being considered at around a **500%**.

In-class example

- You decide to run a mailing promotion campaign to as many people you can afford to make them purchase from your online site while making the campaign profitable.

Assumptions:

- It would cost \$300 to mail promotion per thousand customers
 - The average order value (AOV) on the site is \$40
 - Profit margin is 10%
 - Let's assume the response rate the mail is 3.5% (only 35 customers out of 1000 will come to the site and purchase)
-
- a) What would be the ROI of this campaign?
 - b) At which response rate would campaigns reach to break-even point?

Solution

Parameters	base model	mode 1	mode 2
1. Number Mailed	1000	1000	1000
2. Response Rate	3.50%	6%	8%
3. Responses	35	60	80
4. Net Margin @4\$	\$140	\$240	\$320
5. Mail Cost @0.3\$	\$300	\$300	\$300
6. ROI	-53%	-20%	7%

Break-even response rate is between 6%-8%, how to calculate the exact number?

Calculating Lifetime Value (LTV) or Customer Lifetime Value (CLV)

Customer Lifetime Value (CLV) revisited

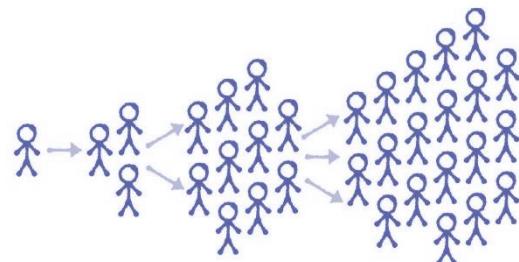
- **Total profit (net revenue) of entire relationship with a customer**



Total cost to attract, service and maintain



Total transactions and revenue (number and value)



Customer network effects (e.g., word-of-mouth)

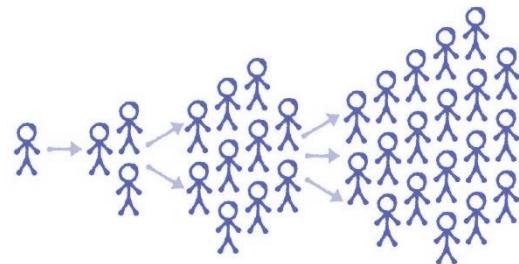
Customer lifetime value (CLV) is revisited

- **Total profit (net revenue) of entire relationship with a customer**



Total cost to attract, service and maintain

Total transactions and revenue (number and value)

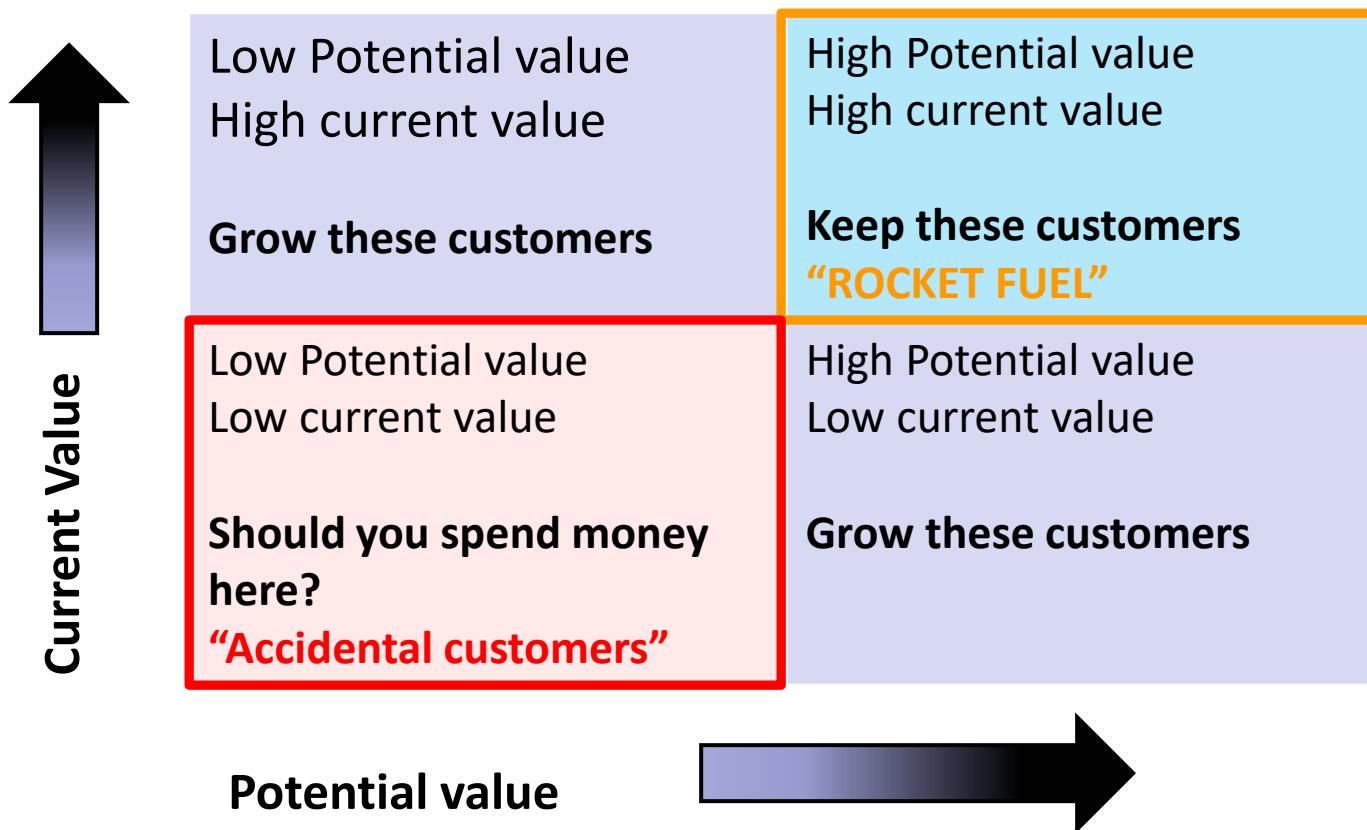


Customer network effects (e.g., word-of-mouth)

The focus of many CLV models is on the revenue side. The reason for this is that revenue is more difficult to forecast than the cost.

Portfolio approach for Customer Value Management

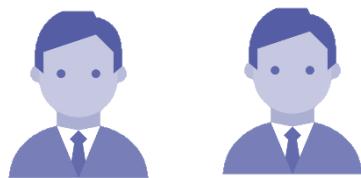
- The sum of current value and potential value is CLV
- Retention program should focus on upper left and lower right customers
- Win-back programs should focus on accidental and one-off customers



Why do we care about CLV?



- Customer segmentation to identify the **most profitable (loyal) customers**



- **Identify the common characteristics** and attributes associated to the most profitable customers



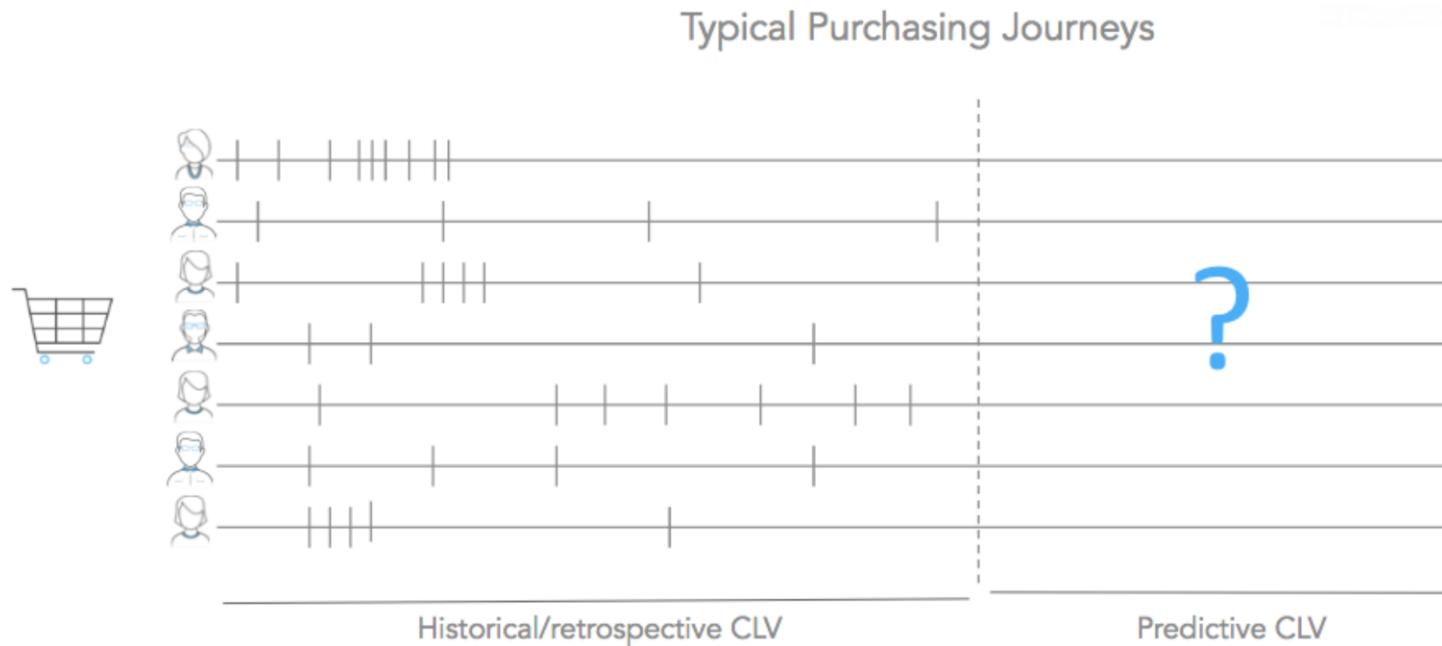
- To maximize the impact of marketing retention programs targeting the **right segment at the right time**



- Direction and guideline on how much a company should **pay at most for CAC**

There are two main class of CLV methodologies: **predictive** versus **historical**

- **Historical CLV** models look at past data and calculate the LTV only based on past transactions (*no prediction about future!*)
- **Predictive CLV** is to model the purchasing behavior of customers in order to infer what their future actions will be.



<https://www.datascience.com/blog/intro-to-predictive-modeling-for-customer-lifetime-value>

Predictive CLV across different business settings

Contractual model (membership model)

Customer death can be observed

Non-contractual model (E-commerce)

Customer death cannot be observed

Discrete purchases

Purchase happens at some fixed period or frequency

Continuous purchases

Purchase can happen at any given time

CLV across different business contexts

	Non-contractual Settings	Contractual Settings
Continuous Purchases	<ul style="list-style-type: none">● movie rentals● medical appointments● hotel stays● grocery purchases● amazon.com	<ul style="list-style-type: none">● Costco membership● credit cards
Discrete Purchases	<ul style="list-style-type: none">● prescription refills● charity fund drives● event attendance	<ul style="list-style-type: none">● magazine/newspaper subscriptions● fitness clubs● most insurance policies● streaming services: netflix, hulu, etc.● most cell phone plans

<https://www.datascience.com/blog/intro-to-predictive-modeling-for-customer-lifetime-value>

CLV across different business contexts

	Non-contractual Settings	Contractual Settings
Continuous Purchases	<ul style="list-style-type: none">• movie rentals• medical appointments• hotel stays• grocery purchases• amazon.com <p>Hardest to model</p>	<ul style="list-style-type: none">• Costco membership• credit cards
Discrete Purchases	<ul style="list-style-type: none">• prescription refills• charity fund drives• event attendance	<ul style="list-style-type: none">• magazine/newspaper subscriptions• fitness clubs• most insurance policies• streaming services: netflix, hulu, etc.• most cell phone plans

<https://www.datascience.com/blog/intro-to-predictive-modeling-for-customer-lifetime-value>

Predicting Customer Lifetime Value with “Buy ‘Til You Die” (BTYD) probabilistic models in non-contractual settings (e-commerce)

Transaction Flow Model

The probabilistic “Buy til you die” models (the most well-known and commonly used methodology in the industry) estimate the purchasing behavior of a consumer through **two stochastic** processes:

(1) drop-out process: Probability of a consumer quitting and never purchase again

- Each consumer has an unobserved dropout propensity
- Dropout propensity vary across different consumers

(2) Transaction process: the expected number of his future transactions

- Given a consumer stay alive. A consumer purchase randomly around his mean transaction rate
- Transaction rates vary across different consumers

Model inputs

- **Recency** (derived from t_x): the consumer’s age at the moment of his last purchase, equal to the duration between a consumer’s first purchase and their last purchase.
- **Frequency (x)**: the number of periods in which the consumer has made a repeat purchases
- **Monetary value (M)**: is the average monetary amount of each repeat purchase made by a consumer
- **Age of the consumer (T)**: duration between a consumer’s first purchase and the time of the analysis

<https://towardsdatascience.com/predicting-customer-lifetime-value-with-buy-til-you-die-probabilistic-models-in-python-f5cac78758d9>

CLV across different business contexts

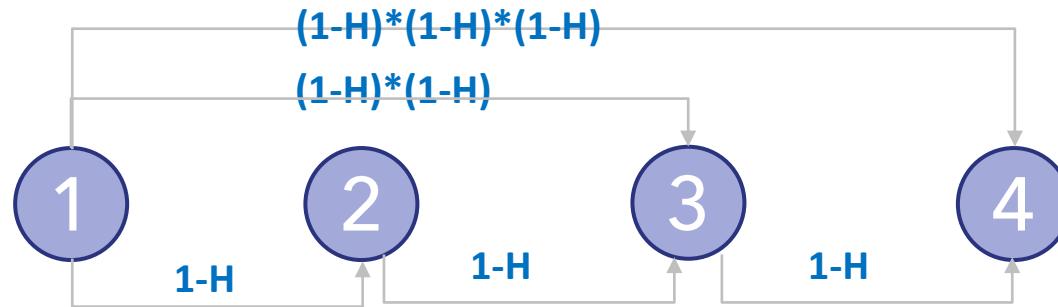
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<https://www.datascience.com/blog/intro-to-predictive-modeling-for-customer-lifetime-value>

Basic equation of CLV: Naïve model to calculate CLV for contractual setting

Things we need:

- The probability of a customer churn (leaving the platform) in a given period (t). This is also called constant Hazard rate (H)



Survival probability in period $t = (1 - H)^{t-1}$

- ν (Nu): Expected revenue per customer which is net profit in a given period (t)
- δ (Delta) is the stationary discount multiplier of capital for a given period
- *Discount multiplier in period $t = 1/(1 + \delta)^{t-1}$*

Basic equation of CLV: Naïve model to calculate CLV for contractual setting

➤ CLV for n periods

$$v + \frac{v(1-H)}{(1+\delta)} + \frac{v(1-H)^2}{(1+\delta)^2} + \frac{v(1-H)^3}{(1+\delta)^3} + \dots + \frac{v(1-H)^{n-1}}{(1+\delta)^{n-1}}$$

$$CLV_{1 \text{ to } n} = \sum_{t=1}^n v \frac{(1-H)^{t-1}}{(1+\delta)^{t-1}}$$

➤ CLV for infinite periods

$$CLV = \sum_{t=1}^{\infty} v \frac{(1-H)^{t-1}}{(1+\delta)^{t-1}} = v / (1 - X)$$

$$X = (1 - H) / (1 + \delta)$$

$$CLV = v(1 + \delta) / (H + \delta)$$

In-class CLV (LTV) example

Hazard rate (churn)	10%				
Discount Rate	10%				
Revenue (\$)	\$200				
Cost	\$100				
Year	Hazard Rate	Retention Rate	Survival Rate	Discount Multiplier	Discounted Expected Profit
1	0%	100%	100%	100%	\$100
2	10%	90%	90%	91%	\$82
3	10%	90%	81%	83%	\$67
4	10%	90%	73%	75%	\$55
5	10%	90%	66%	68%	\$45
6	10%	90%	59%	62%	\$37
7	10%	90%	53%	56%	\$30
8	10%	90%	48%	51%	\$25
9	10%	90%	43%	47%	\$20
10	10%	90%	39%	42%	\$16
		LTV after 10 yrs	\$476		
		LTV over infinite horizon	\$550		

$$CLV_{1 \text{ to } 10} = \sum_{t=1}^n v \frac{(1 - H)^{t-1}}{(1 + \delta)^{t-1}}$$

$$CLV = v(1 + \delta)/(H + \delta)$$

Limitation with Contractual Naïve CLV models

- We are treating all customers the same and all portions of time the same
- The Hazard Rate is considered to steady (constant)

A customer who has been with a company for 2 periods likely to have the same churn rate as one who has been with a company for 6 periods!

- All customers are treated the same in terms of their revenues at different points of time in their lifecycle

There is no differentiation based on spending habits over time.

- More sophisticated models (like Recency Frequency Monetary, Markov Chains, Hazard Functions, Survival Regression, and Supervised Machine Learning using Random Forest) should be used for accurate modeling.

RFM Scoring

RFM refers to a modelling technique that utilizes **Recency** **Frequency** and **Monetary** (RFM) data from client records

- **Recency:** Time since last purchase (or some valuable interaction).
- **Frequency:** How many purchases an individual made within a given period (every month, quarter or year)
- **Monetary:** Cumulative total spent by client during the given period

RFM is one of the most basic behavioral models ever developed, yet so powerful to predict the future behavior.

RFM model can be used as a predictor of LTV of the customer
[we saw that in “Buy ‘Til You Die” models]

RFM in actions: Individual Customer Scores

We group the data based on these metrics and give them scores

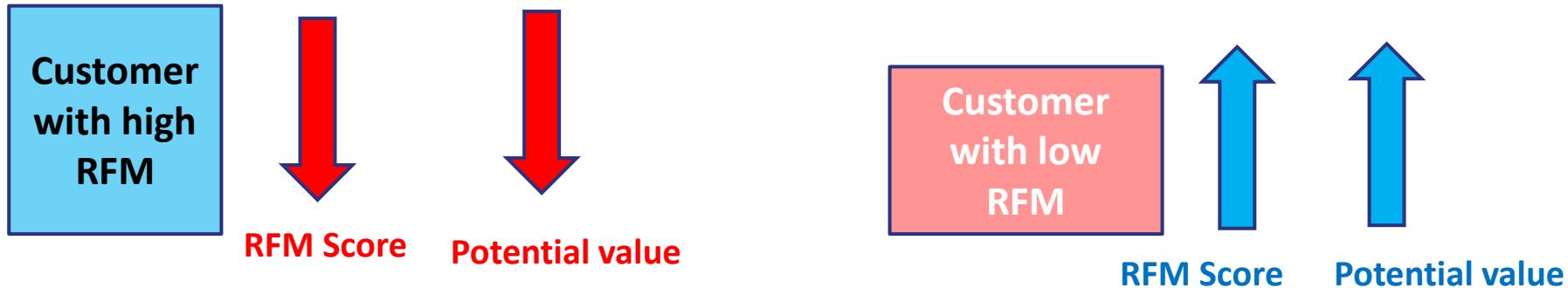
- Customers are split along each metric into quintiles (20% or 25% groupings) and assigned an ordinal label of 5 for the highest 20% of values, 4 to next highest etc.

Recency	Frequency	Monetary
=1 (highest 20%)	=1 (lowest 20%)	=1 (lowest 20%)
2	2	2
3	3	3
4	4	4
5 (lowest 20%) [most recent]	5 (highest 20%)	5 (highest 20%)

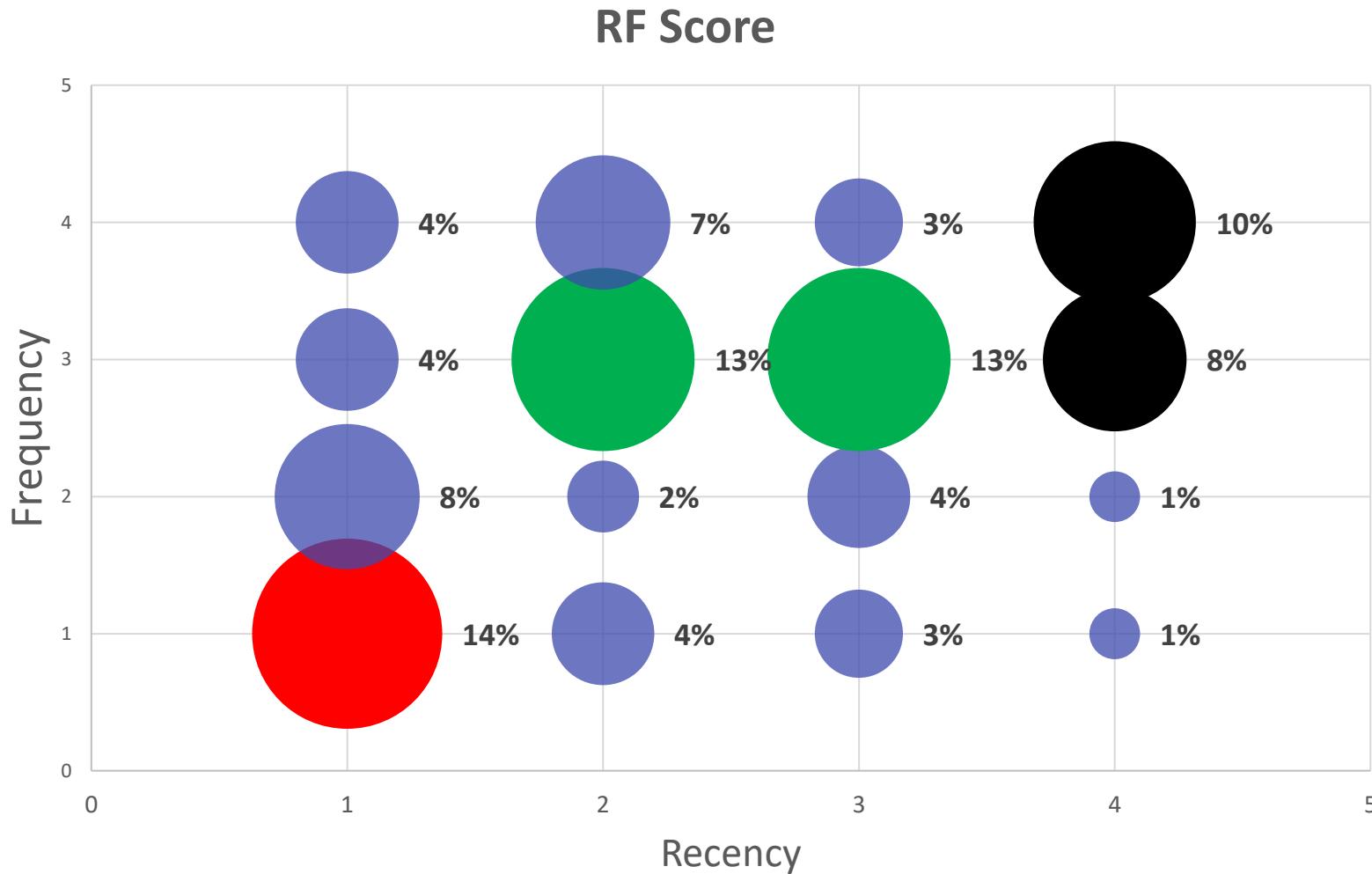
- These can then be concatenated (ex 454, 134, 555)
- **155** is a frequent purchaser who has spent a lot of money during this period but has not purchased in some time.

RFM can be used as a proxy for future profitability

- RFM scores can be used to assess the potential value of your business, *the higher RFM, the more likely the customers will repeat a behavior and respond to promotion*
- **RFM** can be used as a **proxy for future profitability** of your business: High RFM score customers will tend to have high LTV, and low RFM score customers will tend to have low LTV



RF can be also used to drive insights about CLV and customer future values



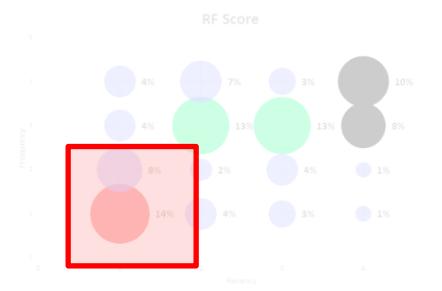
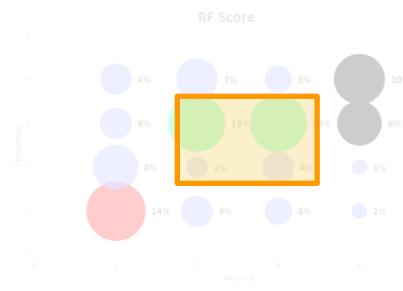
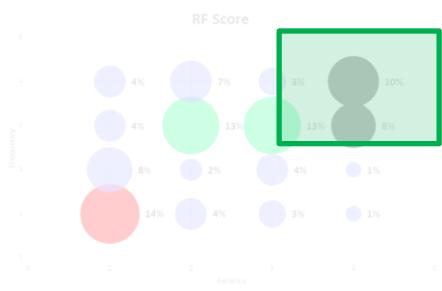
Now that we have identified different group of customers (111 to 555), what do we next?

- The next step will be to target them with marketing specific to their audience type.

Champions
Since these customers are literally your "Champions" why not email them asking for testimonials or feedback.
These customers will also be the easiest to sign up to an affiliate program.

At Risk
These customers used to be champions, investigate what happened. Or send an email to ask them, bringing them back will provide crazy ROI!

Lost
These are customers that have bought, but then abandoned you a while ago, these are almost as cold as cold leads. Send them a crazy offer that they can't refuse such as free account credit. Alternatively invite to webinar to re-warm the prospect to your brand.



<https://www.youtube.com/watch?v=Hv40TNfNPHY>

What is RFM Analysis?

And why you should be using it already!

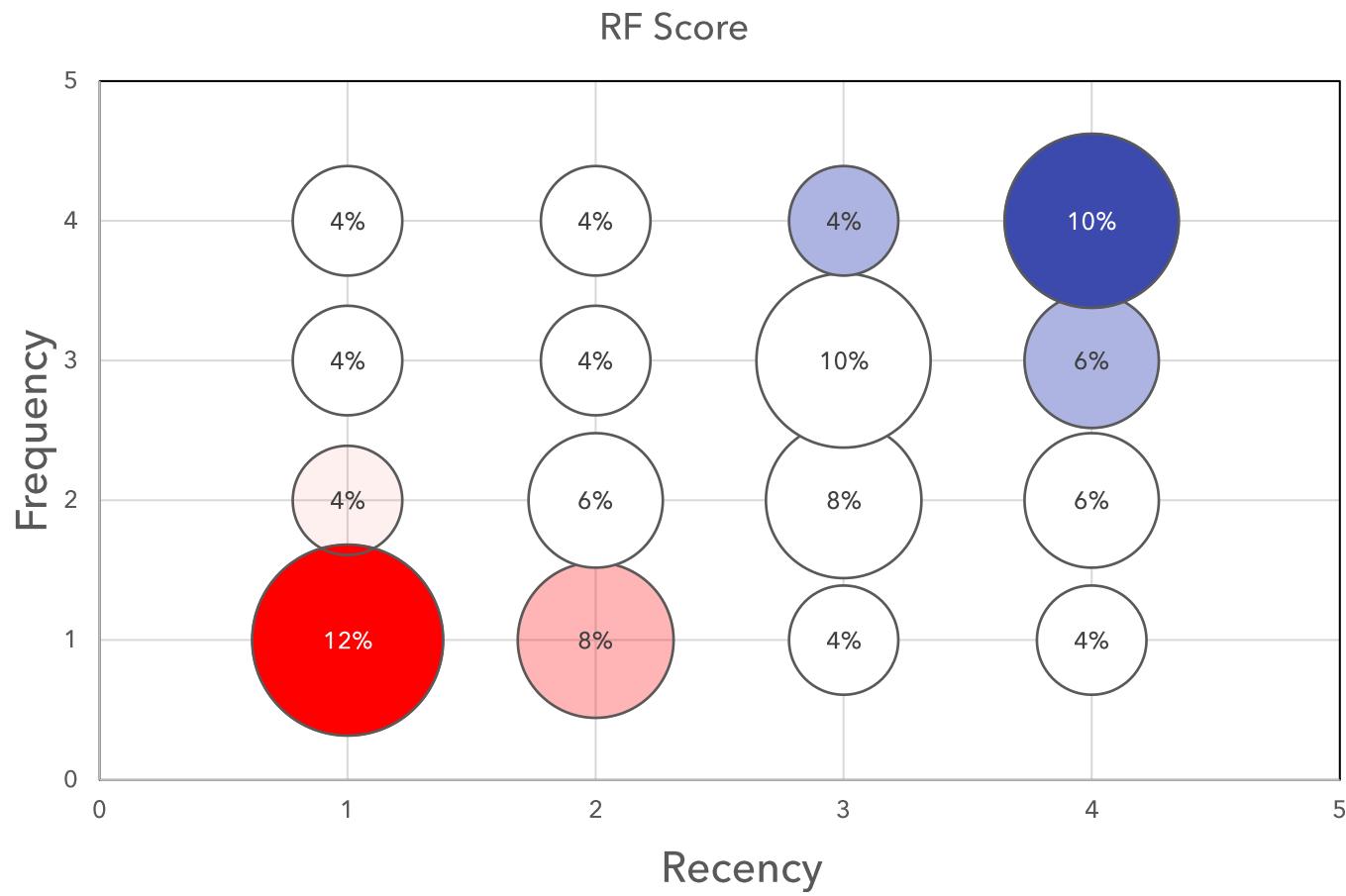
In-class Example

We have the RFM data of 49 customers over the course of 1 year:

[See in-class example file]

- a) Calculate the RFM score for all these 49 customers with 4 scores for each R, F, M based on 25%-50%-75% quantile
- b) Identify the highest RFM customer, and calculate what % of total revenue is contributed by them?
- c) If you only calculate the RF score, what % of customers has the lowest RF score (or 11)?

In-class Example



Case Study [a real deep dive into an actual business problem]

<https://towardsdatascience.com/yammer-investigating-a-sudden-drop-in-user-engagement-7c9c4093c038>

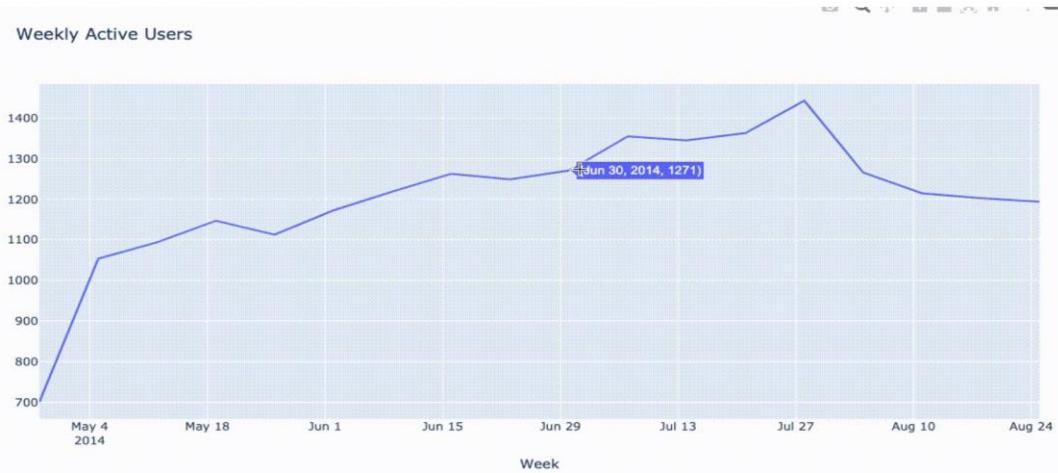
How did the weekly engagement drop 21% in a month?!

It's Monday morning...you sit down at your desk with a cup of coffee — your eyes barely open. Suddenly the head of product taps you on your shoulder and slams his laptop down on your desk.

“How did our weekly engagement drop 21% in a month?!”

Sighhhhhh

You crack your knuckles, and put down your coffee — “let’s take a look”.



<https://towardsdatascience.com/yammer-investigating-a-sudden-drop-in-user-engagement-7c9c4093c038>

Never forget about Segmentation!

Root Cause: Decline in email CTR In US



Course Project, 40 points

(Final presentation Oct 14th between 7:10-9:40)

Each group has 25 min to present

Group project (Presentation Oct 14)

	Group 1	Group 2	Group 3	Group 4
Member 1	Alex Coffin	Vi Pham	Haelim Kim	Calvin Ji
Member 2	Veta Dennis-Umoja	Peijia Wu	Dahyun Choi	Alexis Yang
Member 3	Peterson	Weike Zhou	Sunpil Howang	Chen
Member 4	Adeyemi			

Deadline to submit final presentation ppt is end of day Wednesday
Oct 13 2pm at the project folder on BB

25 min each group in Oct 14

7:25-7:50 7:55-8:20 8:25-8:50 9:00-9:25

Group Project

Avocci LLC. is a Canadian e-commerce company which acquires customers from multiple channels (examples include Search, Display Ads, Social Media etc.) across different device types.

As the customer analytics group, our focus is on providing the best customer experience to help them find the right product and make the purchase process easy.

Customer journey includes:

- Finding and viewing the products
- Adding product to cart
- Placing the order

Group project, cont'd

We should utilize customer data captured at different steps to build short term funnel improvement and long-term customer engagement strategies.

There are 2 attached tab in the (**find it in the project folder**)

Customer data	Customer Funnel and Spend data by category at monthly level
<ul style="list-style-type: none">• Customer ID – unique identifier at customer level.• Acquisition Date – date when customer was acquired via email capture.• Acquisition Channel – channel that was used to acquire customer.• Acquisition Device – customer's device at the time of acquisition.	<ul style="list-style-type: none">• Customer ID – unique identifier at customer level.• category Name – category for the product / SKU.• SKUs Viewed - # SKUs viewed in that month by the customer in that category• SKUs Added to Cart - # SKUs added to cart in that month by the customer in that category• SKUs Purchased - # SKUs purchased in that month by the customer in that category• Revenue Generated (\$) – total revenue generated from the sale of SKUs purchased in that month by the customer in that category

What is the ask?

Focusing to utilize customer acquisition, spend and funnel performance data across different channels and product category:

- What do you learn and derive from current status and trends?
- How do you propose potential long-term engagement strategies for different customer groups to the leadership team?

Some hints on analyzing the provided dataset

- Understand the underlying data and definitions.
- Describe specific metrics you would use to draw business insights and build strategy
- Build a narrative with proper visuals to communicate the information effectively.

Some hints on the flow of your presentation and grading

- Underlying data and metrics for the given problem [10 points]
- Acquisition channels and device Performance [10 points]
- Different product category Performance [10 points]
- **List of recommendations and next steps [10 points]**

Deliverable (power point presentation)

- **During 25 min group presentation**, you should present your analysis approach, metrics and trends you observed along with business insights to drive strategy.
- While no specific format is required, keep in mind that you will be assessed on the content, clarity, and conciseness of your presentation.
- **Presentation should be in power point and not more than 15 slides at the most.**
- **Finishing up the presentation on time is a MUST! You should be able to present your analysis, findings and recommendations within your allocated 25 min.**

Reading/listening

Last HW (HW4)

HW4 will be posted in the assignment section of BB, 9/30, 8pm
EST [Due 10/7, 7pm EST]

Relevant readings, articles, podcasts and videos

10-min round discussion for next week

- [Reading: Calculating CLV](#)
- [Reading: An Introduction to Predictive Customer Lifetime Value Modeling](#)
- [Video: The RFM Principal Template](#)
- [Podcast, RFM Modeling 101: Predict Churn, Purchase, & Retention with Simple Segmentation – Caren Carrasco](#)
- [Video: Peter Fader, Wharton, Customer lifetime value using BG/NBD model](#)

Extra interesting and relevant content

- [Reading: Latency and Loyalty in Retail Ecommerce](#)
- [Reading: Drilling Down: Turning Customer Data Into Profits with a Spreadsheet \[Chapters 5-27\]](#)
- [Reading: https://towardsdatascience.com/yammer-investigating-a-sudden-drop-in-user-engagement-7c9c4093c038](https://towardsdatascience.com/yammer-investigating-a-sudden-drop-in-user-engagement-7c9c4093c038)

Questions

Email me @ Alipilehvarm@GWU.edu

Lecture 6

Remaining Topics on Customer Analytics

Instructor: Ali Pilehvar, Ph.D.



10/7/2021

Agenda for today

- ▶ 10 min discussion from last week
- ▶ Final Tips for class Project and Q&A
- ▶ Customer Analytics at FLIPKART.com [in class case study]
- ▶ Ways to measure network effects?
- ▶ Web Competitive intelligence
- ▶ Data Visualization [Power Bi Example]
- ▶ A/B testing
- ▶ Review a typical Marketplace KPI Dashboard
- ▶ Questions on the group project

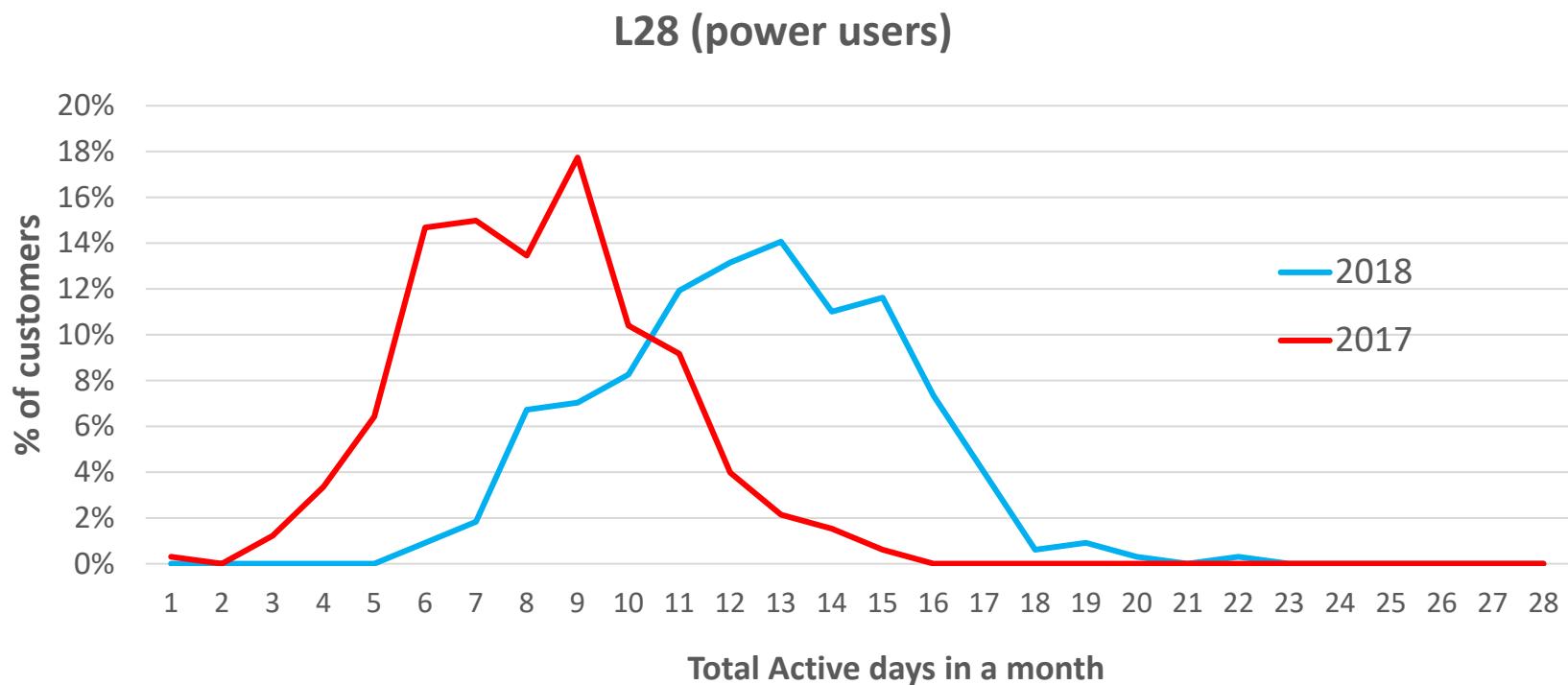
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- [Reading: Calculating CLV](#)
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- [Video: The RFM Principle Template](#)
- [Podcast, RFM Modeling 101: Predict Churn, Purchase, & Retention with Simple Segmentation – Caren Carrasco](#)

Office hour moving forward

- ▶ Wednesday 7pm-8 pm EST
- ▶ Monday 7:30-8:30 am EST

HW3-Q2



AVG DAU/MAU

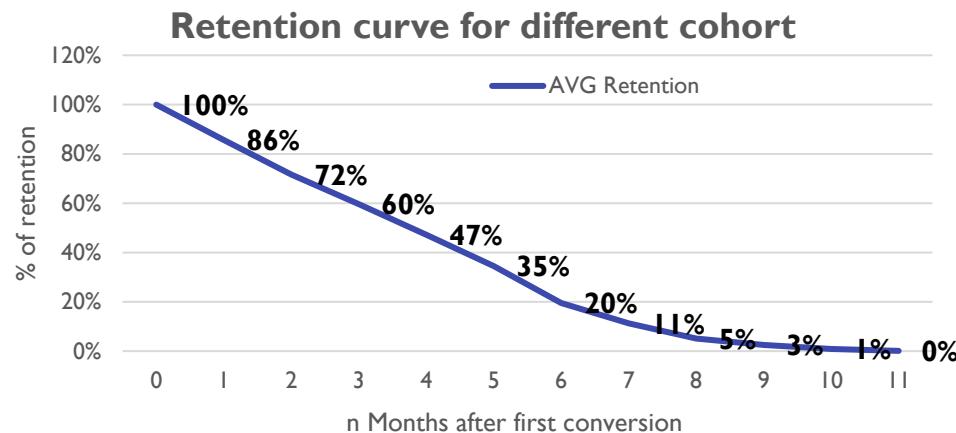
29%

in 2017

44%

in 2018

HW3-Q3 a)



Month of Acquisition	New acquired Customers	Number of Users Retained 'n' Month After Conversion											
		0	1	2	3	4	5	6	7	8	9	10	11
Jan-17	500	500	480	460	450	400	330	200	150	100	90	50	10
Feb-17	540	540	500	460	430	300	190	17	100	100	60	20	
Mar-17	650	650	600	590	550	500	460	300	200	100	50		
Apr-17	630	630	589	500	470	440	400	300	150	100			
May-17	590	590	570	550	520	500	400	350	290				
Jun-17	670	670	650	620	540	520	500	370					
Jul-17	640	640	620	580	550	510	440						
Aug-17	700	700	670	633	599	550							
Sep-17	720	720	700	660	590								
Oct-17	650	650	610	590									
Nov-17	790	790	760										
Dec-17	800	800											
SUM	7880	7880	6749	5643	4699	3720	2720	1537	890	400	200	70	10

b)
Total Monthly Active in 2917
34518
@\$10 per customer per month
\$345,180

Class Project final tips

- ▶ Data Preparation Question
 - ▶ Name of categories
- ▶ Rows with 0 viewed SKUs
- ▶ 3 recommendations at most
- ▶ Project PDF submission by end of WED 2pm EST (10/13)
- ▶ One **team member** from each team **should present** the project in 25 min
 - ▶ Other members can chime in for Q&A

Flipkart.com Case study

[an Indian E-commerce]

Measuring Customer lifetime value (CLV) is challenging

We have been analyzing our data to gain insights, but, do we know the value of our customers? I think it is important for us to differentiate our customers through metrics such as customer lifetime value, which will help us to manage them effectively. For example, we can make our promotions effective if we know the customers with high customer lifetime value.

Customer lifetime value (CLV) is the net present value (NPV) of future cash flows (or profit). CLV is usually calculated at a customer segment level. The main challenge in calculating the lifetime value of customers of e-commerce companies such as Flipkart is that the exact life of the customer is unknown owing to data truncation; that is, the actual point in time of customer churn, may not be identified in e-commerce, since there would be no prior communication from the customer about the churn. Hence,

Business question for Analytics team at Flipkart

In 2015, Flipkart wanted to understand its customers better and retain most of them through effective promotions, since customer retention is less expensive as compared to customer acquisition. Unlike the churn in the telecom sector, which was clearly defined and captured (in the instance of postpaid customers), churn for e-commerce companies was difficult to define and capture, as these events were unobserved. Across e-commerce companies, the customer churn may be very high owing to reasons such as need fulfilment, cessation of demand, competition, and so on. However, it was important to capture customer churn and identify which customers should be retained.

Ways to measure network effects?

Network effect can act as the growth engine in two-sided marketplace business

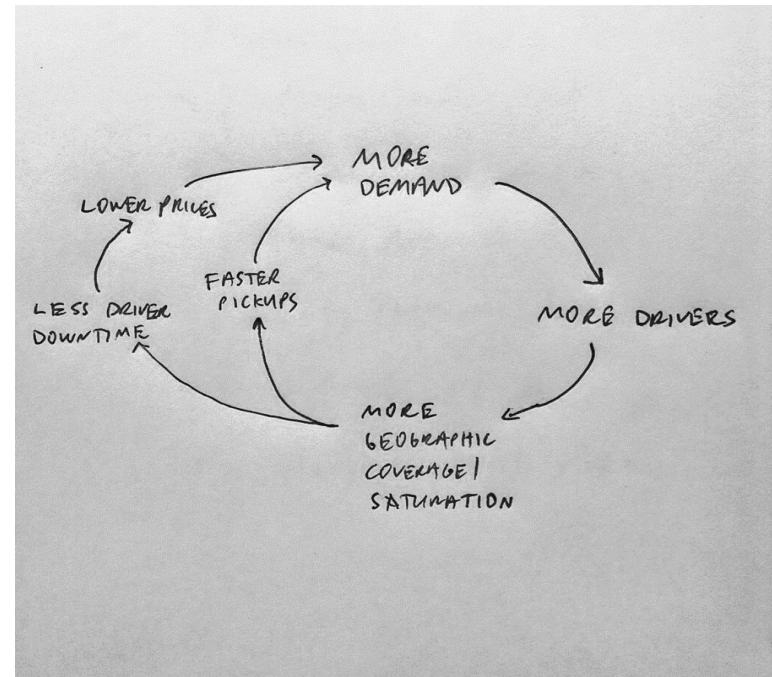
- When your product becomes more valuable as more people use it, we would have network effect business.

Amazon's Flywheel effect



amazon-flywheel-to-your-online-business/

Uber's weak network effect



Source:

<https://twitter.com/davidsacks/status/475073311383105536?lang=en>

There are some list of metrics which could measure and tease apart network effects

➤ **5 main categories to measure network effects:**



#1. Acquisition



#3. Engagement



#2. Competitors



#4. Marketplace



#5. Economics-related

Source: <https://a16z.com/2018/12/13/16-metrics-network-effects/>

Acquisition-Related Metrics

#1 Organic vs. paid users

- The share of organic users relative to paid users (the ones you spend to acquire) should increase over time.
- This is because as the network grows and becomes more valuable to join

2. Sources of traffic

- As the network grows, how much traffic/transactions on the network are generated internally, arising from the network itself vs. from external sources?
- More traffic coming directly suggests users are finding the network more valuable over time as it grows.

#3. Time series of paid CAC

- How much do you need to spend to acquire supply?
- While paid CAC (customer acquisition cost) should theoretically decline over time in a business once the network effects “flywheel” starts accelerating.

Source: <https://a16z.com/2018/12/13/16-metrics-network-effects/>

Competitor Metrics

#1 Prevalence of multi-tenancy

- How many of your users also use other similar services? How many users are active on similar services?

2. Switching or multi-homing costs

- How easy is it for users to join a new (and even a non-existent) network?
- How much value can users get as a new user from joining a different network?

Source: <https://a16z.com/2018/12/13/16-metrics-network-effects/>

Engagement-Related Metrics

#1 User retention cohorts

- Is your user retention improving for newer cohorts?
- Newer cohorts should have better retention for any given time period than older cohorts that joined when the network was smaller.

2. Dollar retention & paid user retention cohorts

- Are newer cohorts retaining better on a dollar basis, for every given time period, than older cohorts?
- Subscription and paid products need to pay attention to dollar retention and paid user retention

#3. Power user curves (aka L7 & L30 charts)

- Are users shifting to the right side of the power user curve? In other words, are they becoming more engaged over time?

Source: <https://a16z.com/2018/12/13/16-metrics-network-effects/>

Marketplace-Related Metrics

#1 Match rate (aka utilization rate, success rate)

- How successfully can the two sides of the marketplace find each other?
- Driver utilization time for ridesharing — what % of the time are drivers driving around with a passenger, vs. empty?
- How often are employers filling their posted role in job marketplaces? And how often are job seekers finding jobs?

2. Market depth

- Is there enough supply and does it fit users' needs?
- One of the primary jobs of any marketplace business is to reduce search costs making it easy for participants to find and match with the other side. Failing to do this can result in a marketplace with negative network effects.

#3. Time to find a match

- How long does it take for supply and demand to match?

Economics-Related Metrics

#1 Pricing power

- As participants receive greater value from the network, they are willing to pay more to have access to network, in the form of subscriptions, listing fees, take rates, or other monetization mechanisms.

2. Unit economics

- Improved network effects often appear in improved unit economics over time. This is a result of declining incentives that businesses need to offer to different sides of the market, lower share of paid users, and overall improvement in pricing power.
- CAC should decrease and the organic share of users should grow over time.

Source: <https://a16z.com/2018/12/13/16-metrics-network-effects/>

Web Competitive Intelligence

Web Competitive intelligence is gathering information about Competitors' Customer Analytics

Get insight into the performance of your competitors' websites traffic. Does their site receive more traffic with different marketing mix than yours? Are visitors staying on their website longer than yours?....

➤ [SimilarWeb](#)



➤ [Quantcast](#)



➤ [Ahrefs](#)



➤ [SpyFu](#)



➤ [SEMrush](#)



➤ [Alexa](#)



SEMrush, a free competitive intelligence tool

<https://www.semrush.com/>

Domain Overview: gwu.edu

PDF

Database: United States | Device: Desktop | Date: Oct 1, 2019 | Currency: USD

● ORGANIC SEARCH		● PAID SEARCH		● BACKLINKS		● DISPLAY ADVERTISING	
1.1M	+2% TRAFFIC	3.7K	-51% TRAFFIC	15.5M TOTAL BACKLINKS		24.4K TOTAL ADS	
SEMrush Rank	2.7K	Keywords	545 -23%	Referring Domains	79.2K	Publishers	38.9K
Keywords	554K +1%	Traffic Cost	\$77.1K -32%	Referring IPs	88.1K	Advertisers	167
Traffic Cost	\$3.4M +2%						

● ENGAGEMENT METRICS Worldwide | Aug 2019

Pages / Visit	6.71 +19.91%	Avg. Visit Duration	09:33 -2.88%	Bounce Rate	68.29% +7.31%	Show all metrics
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ORGANIC KEYWORDS US CA UK AU MOBILE-US OTHER

PAID KEYWORDS US MOBILE-US OTHER

● ORGANIC ● PAID ♦ Notes ▾ 1M 6M 1Y 2Y All Time

Jan'12 Jan'13 Jan'14 Jan'15 Jan'16 Jan'17

Have a Suggestion?

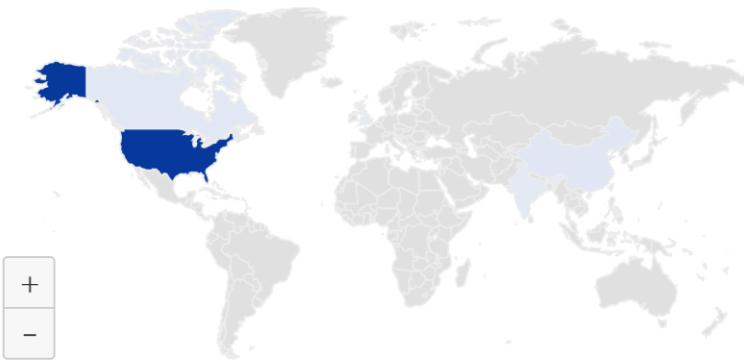
Similarweb another competitor intelligence tool

www.Similarweb.com



Geography

Jun 2019 - Aug 2019, Desktop Only



Top 5 Countries

Country	Share
United States	86.07%
China	1.13%
Canada	1.09%
India	1.04%

Data Visualization,

A picture is worth a thousand words

The power of data visualization

- Data visualization represents data in a visual context by making explicit the trends and patterns inherent in the data.



- Most tools allow the application of filters to manipulate the data as per user requirements
 - With interactive visualization, you can drill down into charts and graphs for more detail, interactively changing what data you see and how it's processed.
-

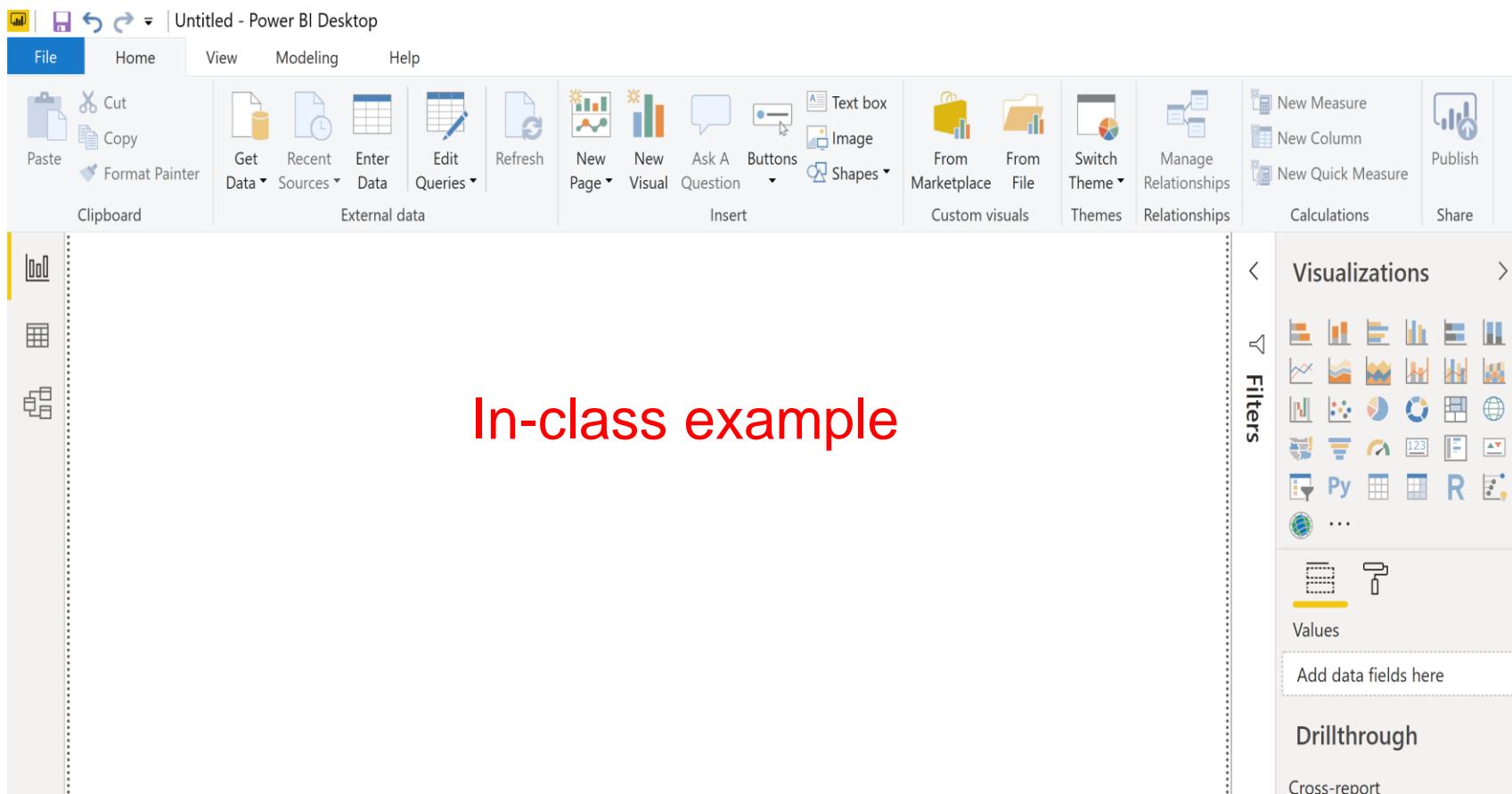
Data visualization and Business intelligence (BI) market is very competitive

How to choose the right BI partner:

- What type of questions are your business users asking?
- What is the skill level of your business users?
- What technical resources do you have ready access to?



You can use a free desktop version of Power BI (Microsoft Power BI)



A/B testing

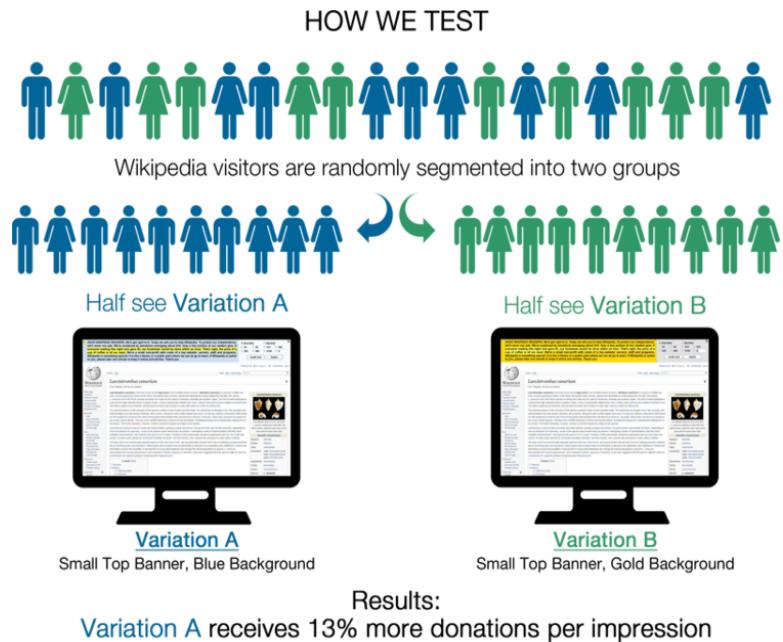
What is A/B Testing?

A/B testing is a method for testing different versions of the same page/call to action (CTA) at the same time to see which one produces the best outcome.

Running an experiment in comparing the performance of a control group to one or more test groups by randomly assigning each group a specific treatment.

Examples:

- Changing the subject line of a marketing email to increase number of people who open it.
 - Using an image instead of a blank background.
 - Redesigning mobile application to increase user activities.
-



How to calculate the conversion rate?

Example: You want to experiment on adding a FAQ box to the product's page to see if you can improve the conversation rate (i.e., in this example, percentage of people who purchase the product). The conversion rate for the page is defined as:

$$\text{conversion rate} = \frac{\# \text{ users who purchase the product}}{\# \text{ total visitors to the page}}$$

For example, if 100 users visit the product page and 30 of them buy the product, the conversion rate is 30%.

Experiment is run in parallel: treatments are randomly assigned to visitors.

- More uniform distribution across treatments.
 - Controlling for time-dependent variables.
-

A/B testing example 1 [conversion: filling out the forms]

CONTROL

OBAMA • BIDEN

DINNER WITH BARACK
Your chance to meet the President

GET STARTED

DINNER WITH BARACK
YOU'RE INVITED.
WE'LL COVER YOUR AIRFARE.

No purchase, payment, or contribution necessary to enter or win. Contributing will not improve chances of winning. Void where prohibited. Entries must be received by September 20, 2012. You may enter by contributing to Obama Victory Fund 2012 here or click here to enter without contributing. Three winners will each receive the following prize package: round-trip tickets for winner from within the fifty U.S. States, DC, or Puerto Rico to a destination to be determined by the Sponsor; hotel accommodations; and dinner with President Obama on a date to be determined by the Sponsor (approximate retail value of all prizes \$4,800). Odds of winning depend on number of entries received. Promotion open only to U.S. citizens, or lawful permanent U.S. residents who are legal residents of 50 United States, District of Columbia and Puerto Rico and 18 or older (or age of majority under applicable law). Promotion subject to Official Rules. Official rules and additional restrictions on eligibility. Sponsor: Obama for America, 130 E. Randolph St., Chicago, IL 60601.

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IMAGE VARIATION

OBAMA • BIDEN

DINNER WITH BARACK
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GET STARTED

DINNER WITH BARACK
You're invited.
We'll cover your airfare.

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↑ +19%

<http://kylerush.net>

A/B testing example 2

CALL: 888-369-9255 | 9AM - 5PM EST | Contact MY ACCOUNT | MY WISHLIST | LOG IN MY CART

Free Shipping On All Orders Over \$50.00 Within The U.S.!

Search over 20 million images for your decal! Search

Wall Monkeys CATALOG | BEST SELLERS | CUSTOM WALLMONKEYS | BUSINESS | FAQ

Control

Choose From Our Vast Collection of Wall Decals and Murals

SHOP NOW

Test (less distraction)

Choose from 20 Million Decal Designs:

Search over 20 million images for your decal! Search

+ 27%

A/B testing example 3

- The initial banner had a lot of text. There was a number in the headline
- The second variation reduced the copy significantly. Additionally, the CTA changed from “Shop Medicare Plans” to “Get Started Now.”

The image shows two versions of a banner for Humana Medicare plans. The left version, labeled 'Control', features a headline 'Save on prescription drugs - over \$3,637* a year!' followed by descriptive text about savings and coverage options, and a 'Shop 2014 Medicare Plans' button. The right version, labeled 'Treatment', has a simplified headline 'Explore Humana's Medicare plans', includes a call-to-action button 'Get started now', and ends with a '1 2 3' navigation bar. A large blue arrow points from the Control banner to the Treatment banner, accompanied by the text '+ 433%', indicating a significant increase in performance.

Save on prescription drugs - over \$3,637* a year!

Last year, Humana's Medicare Advantage plan members saved, on average, \$3,637* on prescription drugs! Choose your Humana Medicare Advantage plan and you could enjoy savings on prescription drugs, plus:

- Hospital, doctor AND drug coverage combined into one easy-to-use plan
- Extra benefits not offered by Original Medicare
- Affordable or no monthly plan premiums

[Shop 2014 Medicare Plans](#)

Control

Explore Humana's Medicare plans

Let us help you determine the Humana plan that's best for your needs.

[Get started now](#)

Treatment

+ 433%

A/B testing conclusion, example 1

- We ran an experiment for few days with two treatments A and B:

	Total Visitors	Total Converted	Conversion Rate
Control	1202	278	23.12 %
Treatment A	1160	322	27.75 %
Treatment B	1254	301	24.00 %

Do we have a winner?

A/B testing conclusion, example 2

- What if the data looked like this?

	Total Visitors	Total Converted	Conversion Rate
Control	10	2	20.00 %
Treatment A	9	3	33.33 %
Treatment B	12	3	25.00 %

Do we still have a winner?

Test Hypothesis

In general, the larger the sample size, the more certain you can be about the results of the sample.

- True differences rather than just randomness/chance

How to get larger sample sizes?

- Run the experiment for longer
- Decrease the number of treatments

A test hypothesis

One-tailed test: $H_a: p_{treatment} - p_{control} > 0$

Two-tailed test: $H_a: p_{treatment} - p_{control} \neq 0$

Different Steps to run for a A/B test

Steps	Explanation	Team
Step 1: Research	Use quantitative and qualitative research to make discovery about customer experience and site friction	UX and PM
Step 2: Observe and Formulate Hypothesis	Get closer to your business goals by logging research observations and creating data-backed hypotheses aimed at increasing conversions or revenue.	PM and analytics
Step 3: Create Variations	Create a variation based on your hypothesis, and A/B test it against the existing version (control)	PM, UX, Eng
Step 4: Test planning and Run	Explore how many kinds of testing methods are there and when to use which method (A/B Testing, Multivariate Testing, Split URL Testing)	Analytics
Step 5: Result Analysis	Once your test concludes, analyze the test results by considering metrics like percentage increase, confidence level, direct and indirect impact on other metrics (cut by different segments)	Analytics
Step6: Deployment or re-test	If the test succeeds, deploy the winning variation. If the test remains inconclusive, draw insights from it, and implement these in your subsequent tests.	PM and Eng

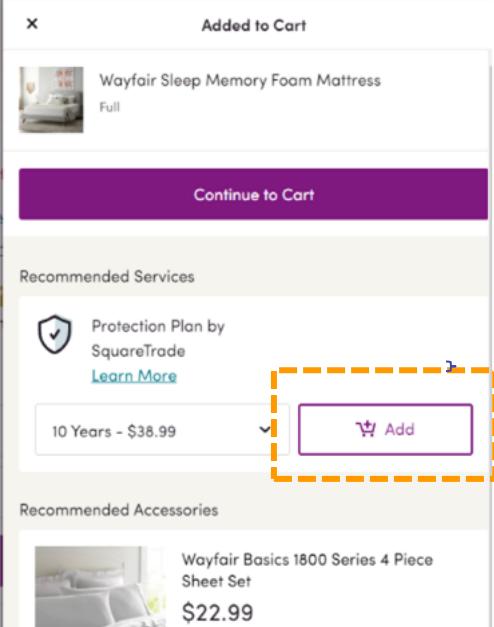
<https://vwo.com/ab-testing/>

A/B test hypothetical example in an E-commerce- Hypothesis

Formulate hypothesis and create variation(s)

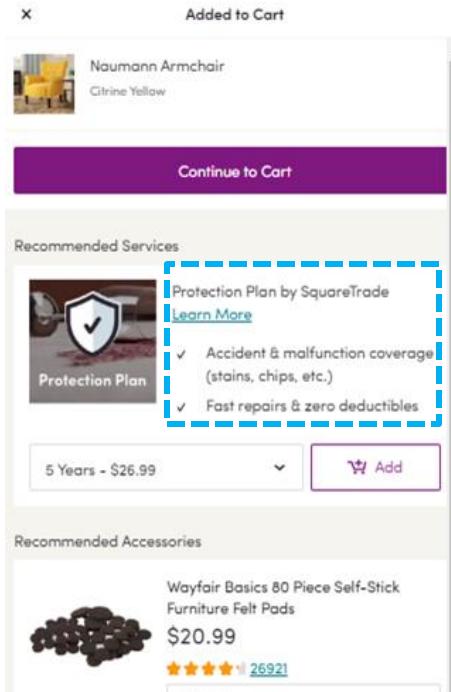
- **Hypothesis:** offer **value propositions** for protection service might increase the confidence among customers to purchase protection plan more frequently.

Control



CTA of attaching warranty to the product

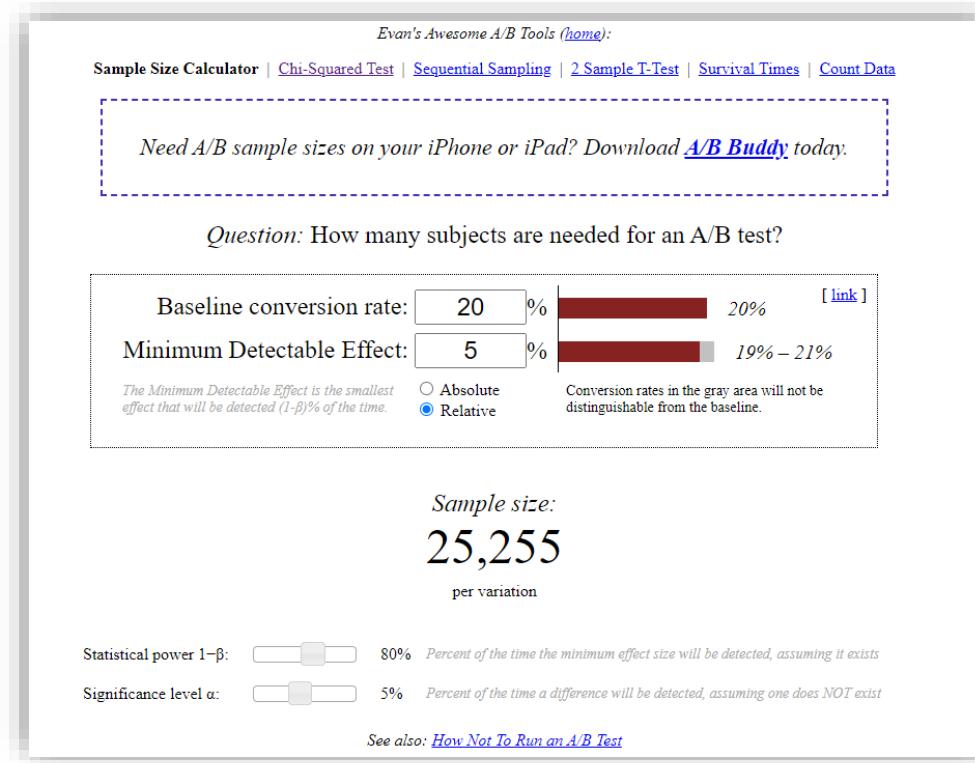
Variation 1



Offering value prop

A/B test hypothetical example in an E-commerce- *Test Planning*

Test planning: estimate the minimum number of days (or site visits) needed to reach statistically significant for primary KPI (e.g., warranty attach rate) based known parameters



<https://www.evanmiller.org/ab-testing/sample-size.html>

A/B test hypothetical example in an E-commerce- *Results*

Conversion Metrics (yellow color is 95% sign.)	Base value (control)	Lift% V1
Site Session conversion	9.52%	0.2%
Users conversion	39.2%	0.2%
Warranty Eligible SKU, Add to Cart rate	18.1%	0.0%
Warranty Attach Rate (primary KPI)	1.6%	9.9%

Offering value propositions will increase the warranty attach rate by 10%



This can translate into \$XXX revenue and \$YYY profit annually!

A/B test Example for Homepage conversion

A "Visit" is an instance of a person coming to a website

A "visitor" is a person who conducts a visit on a website

An "Order" is an instance of someone making a purchase

"Conversion rate" is defined as the number of orders per visit

The home page of a web site can be "split" into two versions ("A" and "B") that have different characteristics (e.g., layout, products, etc.)

- These different versions can then be shown to different visitors on a random basis

Problem: You are determining which home page version is the best choice for the site to maximize the number of orders.

A/B test Example for Homepage conversion, Cont.

- **Note 1:** A two-week split test was set up where visitors were randomly (but not necessarily equally) assigned to one home page or another, and the number of visitors to each homepage and the related orders were accurately recorded by day.
- **Note 2:** The additional traffic on the 7th and 14th is due to some banner ads running on Facebook on those particular days.

	Homepage Version A		Homepage version B	
	Visits	Orders	Visits	Orders
06/04/07	7,823	796	2,910	289
06/05/07	5,611	541	3,049	262
06/06/07	5,092	533	2,775	280
06/07/07	16,407	1,001	3,266	191
06/08/07	4,072	416	1,980	188
06/09/07	2,802	268	1,512	129
06/10/07	3,277	323	1,408	134
06/11/07	8,159	808	2,709	258
06/12/07	5,331	517	2,802	258
06/13/07	5,217	542	2,720	272
06/14/07	15,922	1,099	3,119	205
06/15/07	4,360	415	2,091	182
Totals:	84,073	7,259	30,341	2,648

A/B test Example for Homepage conversion, Cont.

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	Homepage Version A		Homepage version B		
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	06/15/07	4,360	415	2,091	182
Totals:		84,073	7,259	30,341	2,648

A/B test Example for Homepage conversion, Cont.

	Daily		
	CVR- A	CVR- B	lift%
06/04/07	10.2%	9.9%	-2.4%
06/05/07	9.6%	8.6%	-10.9%
06/06/07	10.5%	10.1%	-3.6%
06/07/07	10.2%	9.5%	-7.1%
06/08/07	10.2%	9.5%	-7.1%
06/09/07	9.6%	8.5%	-10.8%
06/10/07	9.9%	9.5%	-3.4%
06/11/07	9.9%	9.5%	-3.8%
06/12/07	9.7%	9.2%	-5.1%
06/13/07	10.4%	10.0%	-3.7%
06/14/07	10.4%	9.5%	-8.6%
06/15/07	9.5%	8.7%	-8.6%
Totals:	8.6%	8.7%	1.1%

Directionally A is better than B, without calculating the p-value (significance for AB test)

	Cumulative		
	CVR- A	CVR- B	lift%
06/04/07	10.2%	9.9%	-2.4%
06/05/07	10.0%	9.2%	-7.1%
06/06/07	10.1%	9.5%	-5.7%
06/07/07	10.1%	9.5%	-5.7%
06/08/07	10.1%	9.5%	-6.0%
06/09/07	10.1%	9.4%	-6.6%
06/10/07	10.0%	9.4%	-6.3%
06/11/07	10.0%	9.4%	-5.8%
06/12/07	10.0%	9.4%	-5.8%
06/13/07	10.0%	9.5%	-5.4%
06/14/07	10.0%	9.5%	-5.4%
06/15/07	10.0%	9.4%	-5.7%
Totals:	10.0%	9.4%	-5.7%

Chart 1, Daily Conversion Rate

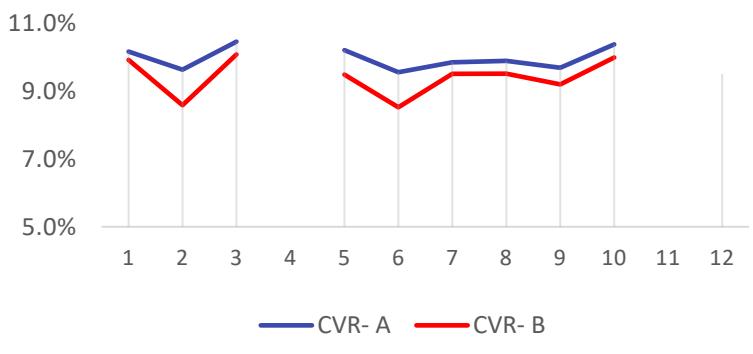
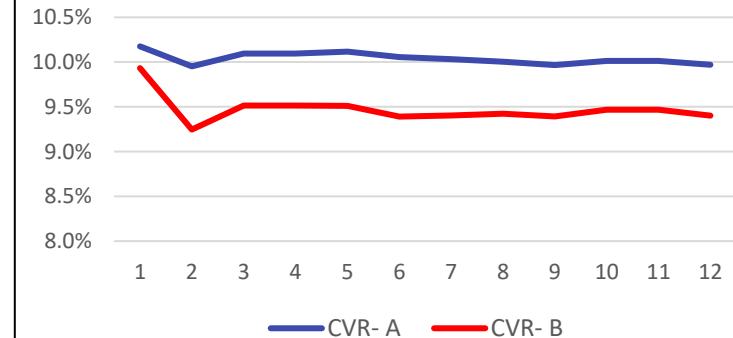


Chart 2, Cumulative Conversion Rate



A/B test Example for Homepage conversion, Cont.

What is a little strange about this data? Why is this happening?

- This is a very clean data where Home page A is winning regardless. Anything else you can think of?
- Anything else you would do to increase your confidence?

A Marketplace KPI Dashboard

Tracking the marketplace KPIs on monthly/quarterly basis

Overall Marketplace Metrics	Buyer Metrics	Seller / Supplier Metrics
Gross Merchandise Volume (GMV) (\$)		
# of Transactions	Total # of Buyers	Total # of Sellers or Suppliers
Average Order Value (AOV) (\$)	# of New Buyers	# of New Sellers or Suppliers
GMV Growth Rate, M-o-M (%)	Buyer Growth Rate, M-o-M (%)	Seller or Supplier Growth Rate, M-o-M (%)
GMV Growth Rate, Y-o-Y (%)	Buyer Growth Rate, Y-o-Y (%)	Seller or Supplier Growth Rate, Y-o-Y (%)
Take Rate (%)	Percentage of Buyers who have purchased more than once (%)	Percentage of Sellers or Suppliers still active after 1 month (%)
Revenue (\$)	Percentage of GMV from Buyers who purchased in previous months (%)	Percentage of Sellers or Suppliers still active after 1 year (%)
Revenue from transaction fees (\$)	Percentage of Buyers whose second purchase is in a different category (%)	Average revenue generated per Seller or Supplier (\$)
Revenue from listing fees (\$)	Average amount purchased per Buyer (\$)	Average percentage of Month 1 GMV generated by Sellers or Suppliers in Month 12 (%)
Revenue from supplier or seller services (\$)	Average # of Orders per Buyer	Percentage of revenue generated by Top 20% Sellers or Suppliers (%)
Buyer-to-Seller Ratio	Average Order Growth per Buyer, Y-o-Y	Seller or Supplier NPS
Total CAC as a percentage of Revenue (%)	Average percentage of Month 1 GMV generated by Buyers in Month 12 (%)	Seller or Supplier CAC (paid and organic) (\$)
	Percentage of revenue generated by Top 20% Buyers (%)	Seller or Supplier CAC (paid) (\$)
	Buyer NPS	Percentage of Sellers or Suppliers acquired through paid acquisition (%)
	Buyer CAC (paid and organic) (\$)	Total # of Listings
	Buyer CAC (paid) (\$)	# of New Listings
	Percentage of Buyers acquired through paid acquisition (%)	Listings Growth Rate (%)

https://docs.google.com/spreadsheets/d/1MJFOOV_pBahXVgPXNC5T9LoQlyYxyNawpt7MTWFp97k/edit#gid=1569059121

Sample for SAS Metrics Dashboard

SaaS Metrics Dashboard

A simple KPI sheet for early-stage SaaS startups with a low-touch sales model.

	Jan-13	Feb-13	Mar-13	Apr-13	May-13	Jun-13	Jul-13	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Total 2013
VISITORS & SIGNUPS													
Visitors 1)	2,456	2,687	2,986	2,897	3,012								
m/m growth visitors		9.41%	11.13%	-2.08%	3.97%								
Signups beginning of the month 2)	245	388	566	752	919								
New signups													
Organic	61	122	97	75	121								
Paid	82	56	89	92	78								
Total new signups	143	178	186	167	199								
m/m growth new signups		24.48%	4.49%	-10.22%	19.16%								
Visitor-to-Signup Conversion Rate	5.82%	6.62%	6.23%	5.76%	6.61%								
Signups end of month	388	566	752	919	1,118								
PAYING CUSTOMERS 3)													
Customers beginning of the month	35	54	74	95	119								
New customers	20	22	24	26	23								
Conversion rate 4)		15.38%	13.48%	13.98%	13.77%								
Lost customers	-1	-2	-3	-2	-3								
Churn rate	2.86%	3.70%	4.05%	2.11%	2.52%								
Net new customers	19	20	21	24	20								
Customers end of month	54	74	95	119	139								
m/m growth customers		37.04%	28.38%	25.26%	16.81%								
MRR													
MRR beginning of the month	\$3,000	\$5,127	\$7,499	\$9,905	\$13,067								
New MRR													
New MRR from new customers	\$1,980	\$2,209	\$2,450	\$2,889	\$2,560								
New MRR from account expansions 5)	\$245	\$343	\$230	\$459	\$389								
Total new MRR	\$2,225	\$2,552	\$2,680	\$3,348	\$2,949								
Lost MRR 6)	-\$98	-\$180	-\$274	-\$186	-\$256								
MRR churn rate 7)	3.27%	3.51%	3.65%	1.88%	1.96%								
Net new MRR	\$2,127	\$2,372	\$2,406	\$3,162	\$2,693								
MRR end of month	\$5,127	\$7,499	\$9,905	\$13,067	\$15,760								
m/m growth MRR		46.26%	32.08%	31.92%	20.61%								

https://docs.google.com/spreadsheets/d/19Rm_tNMTJ9vucTFleS_ojWyudlSuND-bNTYRMHvT64/edit#gid=0

<https://davidcummings.org/2013/11/04/cohort-analysis-for-analyzing-saas-churn/>

Reading/listening

Relevant readings, articles, podcasts and videos

10-min round discussion for next week

- [Reading: 16 Ways to Measure Network Effects](#)
- [Reading: The Network Effects Bible](#)
- [Reading: Your Step-by-Step Guide to A/B Testing with Google Optimize](#)
- [Reading: The Complete Guide To A/B Testing](#)
- [Reading: 16 Startup Metrics](#)

Extra interesting and relevant content

- [Reading: 3 A/B Testing Examples That You Should Steal \[Case Studies\]](#)
- [Video: SEMRush Review: Step-By-Step Guide to Using SEMRush + 30-Day Free Trial](#)
- [Reading: calculating CLV](#)

Questions

Email me @ Alipilehvarm@GWU.edu