Social Networks

Connecting with others

Q1

What are the benefits of leveraging online social networks?

Q2

How to describe the structure of social networks?

Q3

How to find important influencers in a social network?

What is the difference?

Web 1.0

Expedia
Google
eBay
Amazon.com
CNN.com
WSJ.com

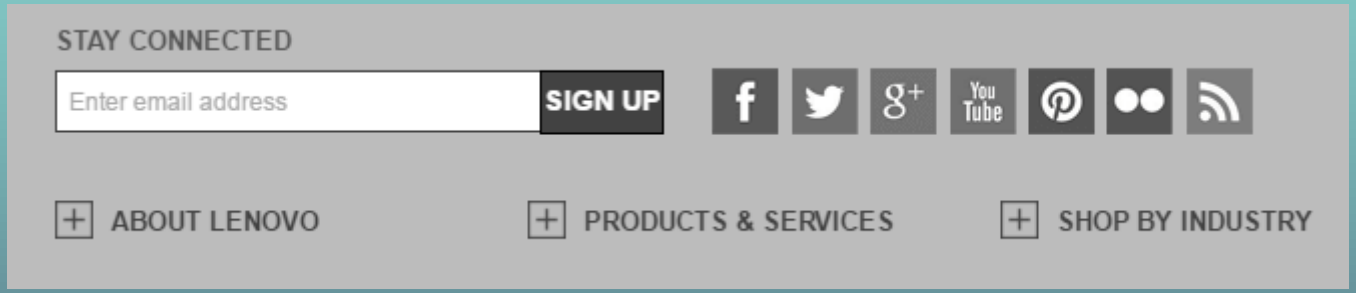
Web 2.0 and beyond

Twitter
Snapchat
Instagram
Pinterest
Reddit
Wikipedia
Facebook

Customer-to-Customer Interactions

Leveraging Online Social Networks

Get Fans



The vast majority of large brands today have an active social media presence, such as FB fan page. For brands to resonate on Facebook, the first step is to accumulate your fan base.

Engage

Brand messages only reach subset of fans.

Users that engage in fan page more likely to receive messages on news feed.

Users can engage by *liking, sharing, posting, commenting and checking in*.

Amplify

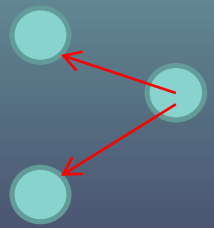
Spread brand message across social network (i.e., newsfeed).

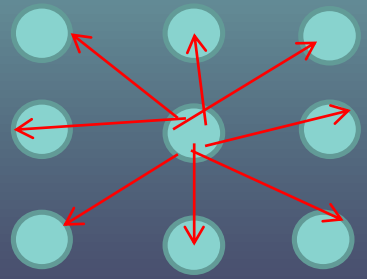
Organic word-of-mouth advertising.

Network can also be used for social advertising.

Amplification Ratio

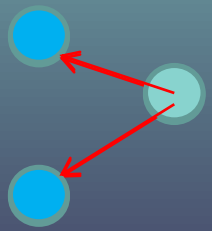
Amplification ratio
= # Friends of Fans exposed / # Fans exposed

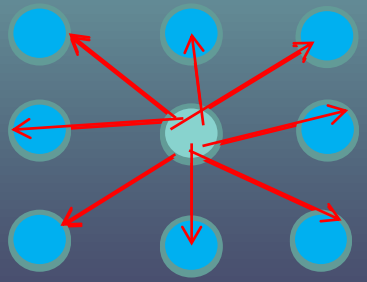




Amplification Ratio

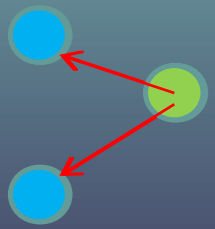
Amplification ratio
= # Friends of Fans exposed / # Fans exposed

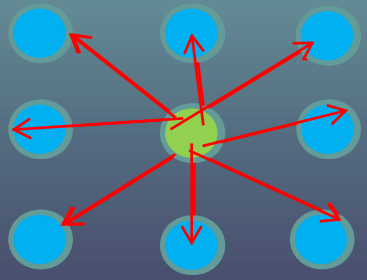




Amplification Ratio

Amplification ratio
= # Friends of Fans exposed / # Fans exposed
= 10/2 = 5.





AMPLIFICATION RATIO

Here are some facts. According to FB:

The top ten corporate brands had an average Amplification Ratio average of 1.05 (Range: 0.42 to 2.18).

The top 100 brands (excluding Celebrities & Entertainment) had an average Amplification Ratio of 0.84 (Range: 0.06 to 2.87).

CASE STUDY: Holiday Sales

Case study focused on Amazon, Best Buy, Target and Walmart.

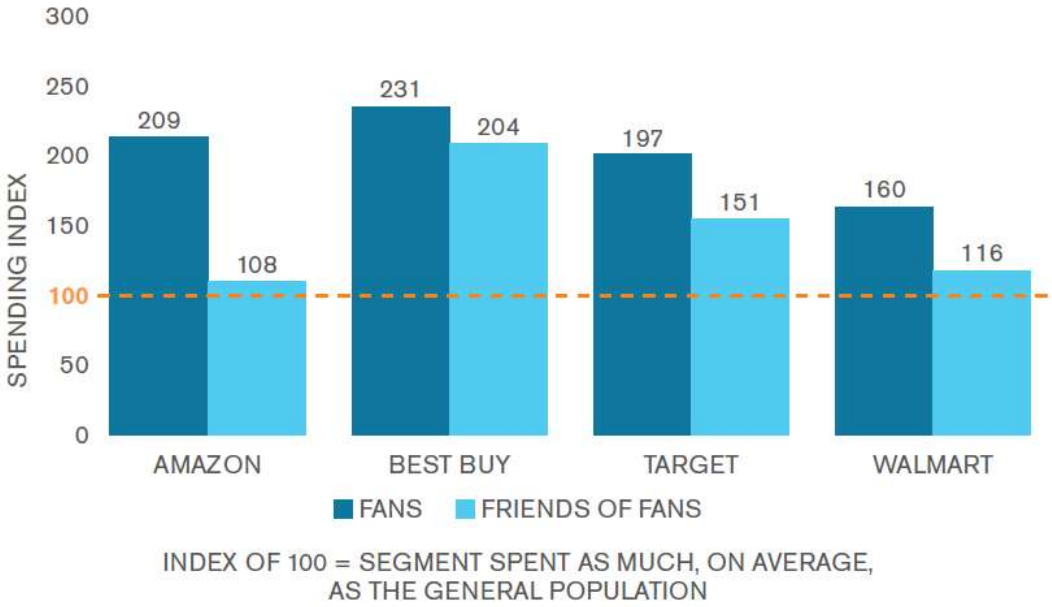
Retailers offered Facebook fans Black Friday deals.

Friends of Fans received notifications about their friends becoming fans, which lead to increased amplification.

Online and offline purchases of exposed fans and Friends of Fans compared to typical week.

CASE STUDY: Holiday Sales

Figure 3 Fans & Friends of Fans: Spending Index for Leading Retail Brands
Online & In-Store Purchase Behavior
Source: comScore Social Essentials, U.S., November-December 2011

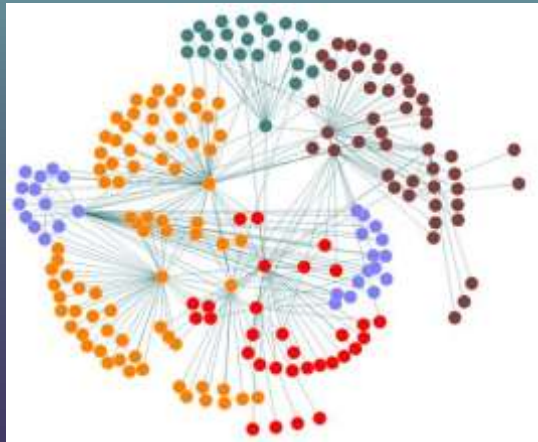


Social Networks Analysis: Theory

Social Network Analysis Useful for…

Spotting influential people
- Who has a lot of linkages?
- Who is vital at linking people up?
- Why not just looking at no. of friends/followers?
  - Strength of tie

Understanding how connected the network is
- How many people are connected?
- What is the longest path between people?
- How to measure the density of a network?



Metrics

Individual

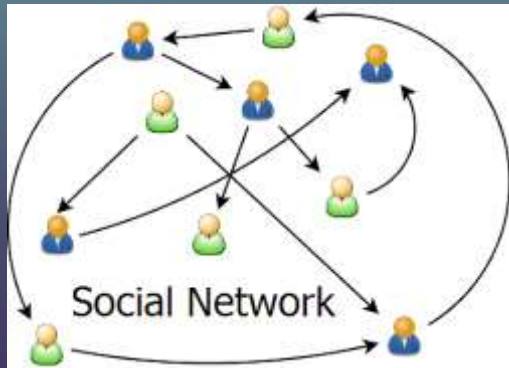
Has meaning independently of social network
You live in Hong Kong island, HK

Connection

You are close friends with 10 people at HKU

Whole Network

On average, students know each other within 4 steps

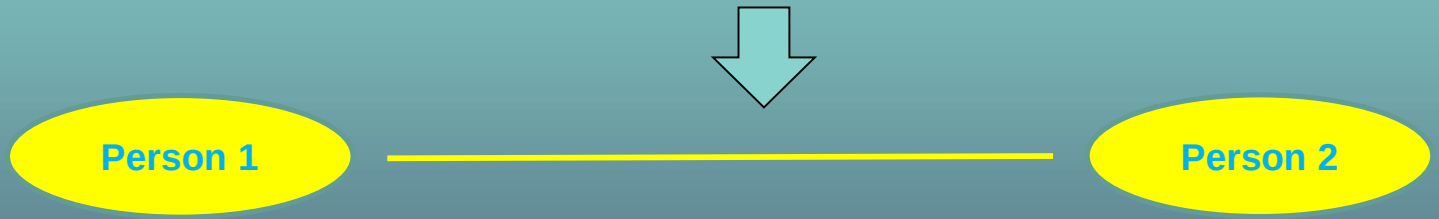


Edges

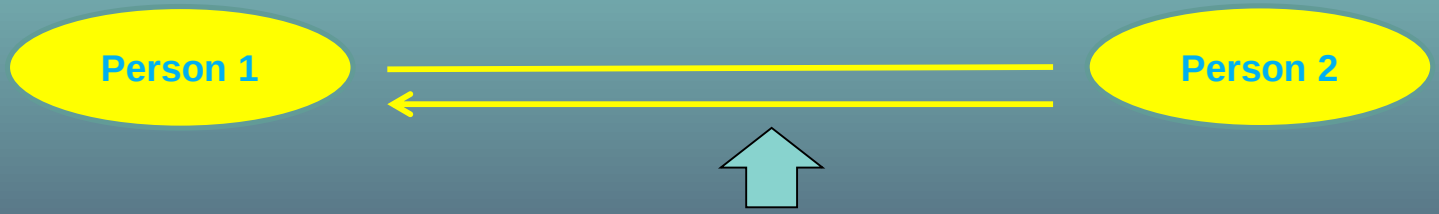
Edges

Edges

Undirected (e.g., study at HKU)



Edges



Directed (e.g., 2 follows 1)

Edges

Edges are also called links or ties.

Nodes and Edges

Vertex/Node: an end point
    Often a person

Edge/Link: What connects up the Nodes
    A relationship

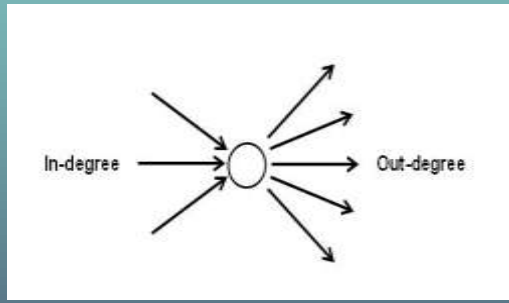
Maximum number of edges in group of size $N(N-1)/2$.
    Where everyone connects to everyone else
    If undirected (my friends also have me as a friend)

Who is well-connected?

Degree (centrality): The number of linkages you have.

"In-degree", e.g., someone that follows me.

"Out-degree", e.g., I follow someone else.



Edge Weight

Sometimes edge can also carry weight

Can capture how deep the relationships are

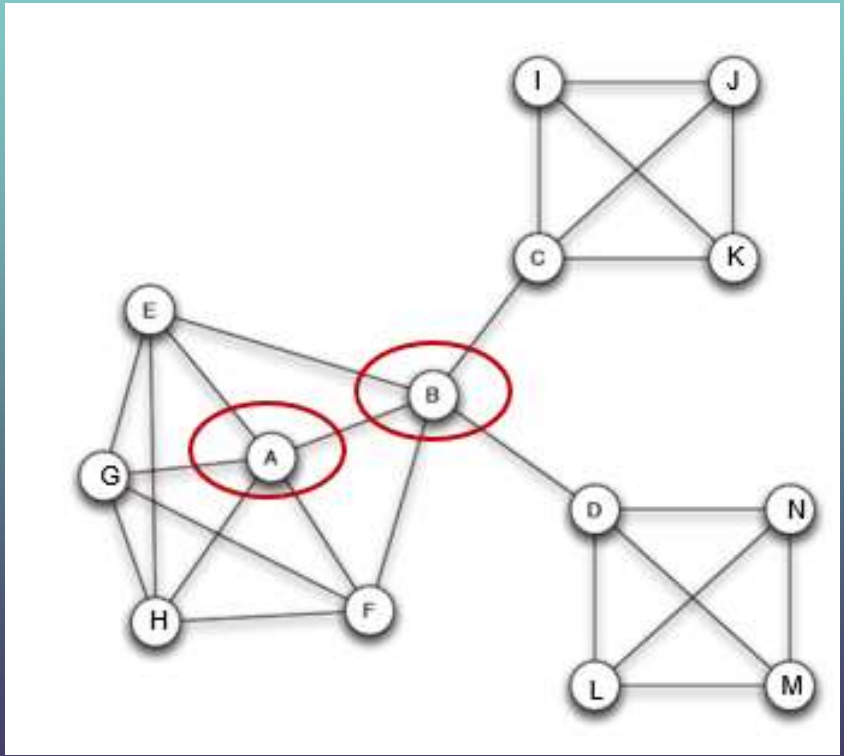
E.g., frequency of interactions between two nodes.

China's Lockdown Policy

QUESTION

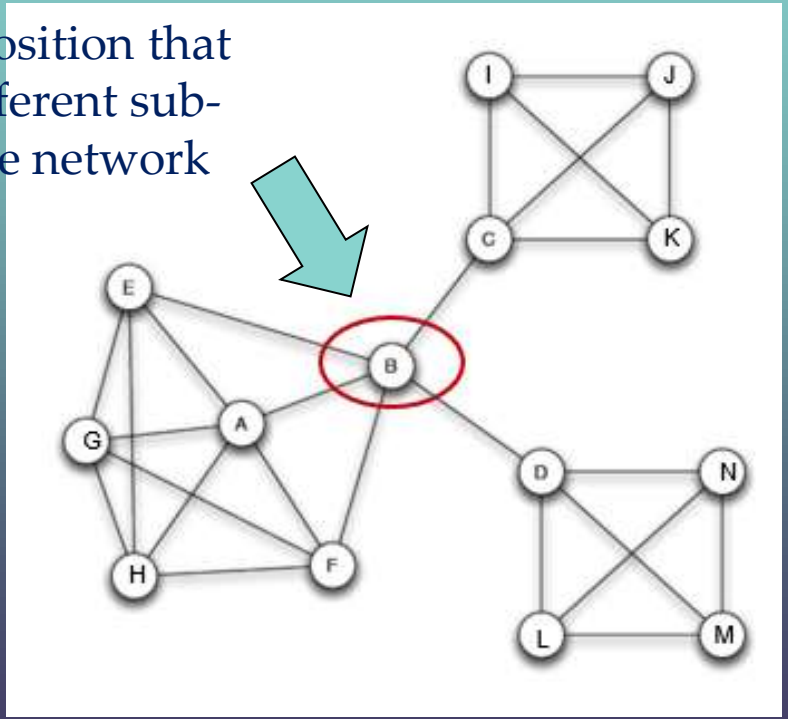
How to determine the influential person (i.e., node) in a social network?

Who is more important? Why?

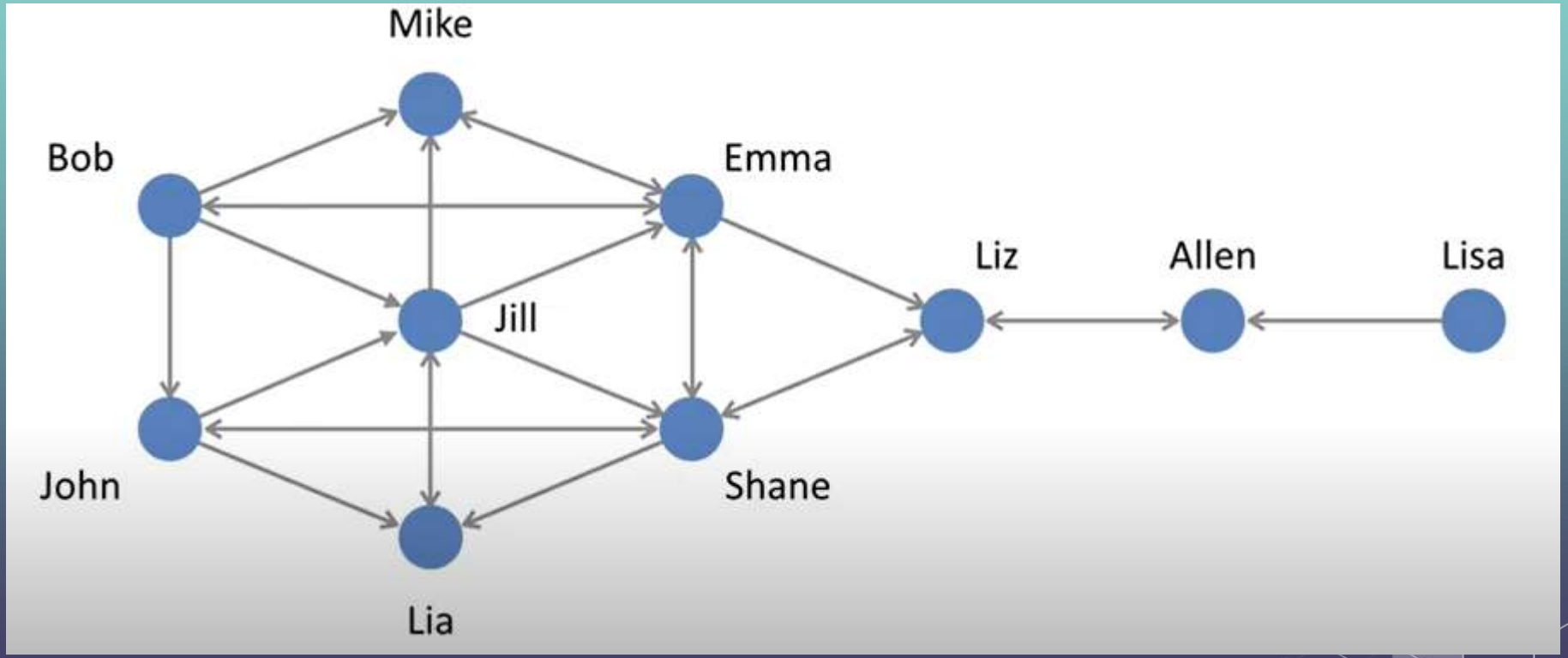


Social Hole

A node or position that connects different sub-groups of the network



Who is most important? Why?



QUESTION

How to define the importance of a node?


Closeness Centrality
& Betweeness Centrality

Closeness Centrality

Only applies to a fully connected network (i.e., a path exists between any pair of nodes).

$$\text{Closeness Centrality}(x) = \frac{N - 1}{\sum_y d(x, y)}$$

N: number of nodes in the network
d(x, y): the shortest distance between nodes x and y.

Betweenness Centrality

Applies to disconnected networks as well.

$$\text{Between Centrality(x)} = \sum_{y,z} \frac{\sigma_{yz}(x)}{\sigma_{yz}}$$

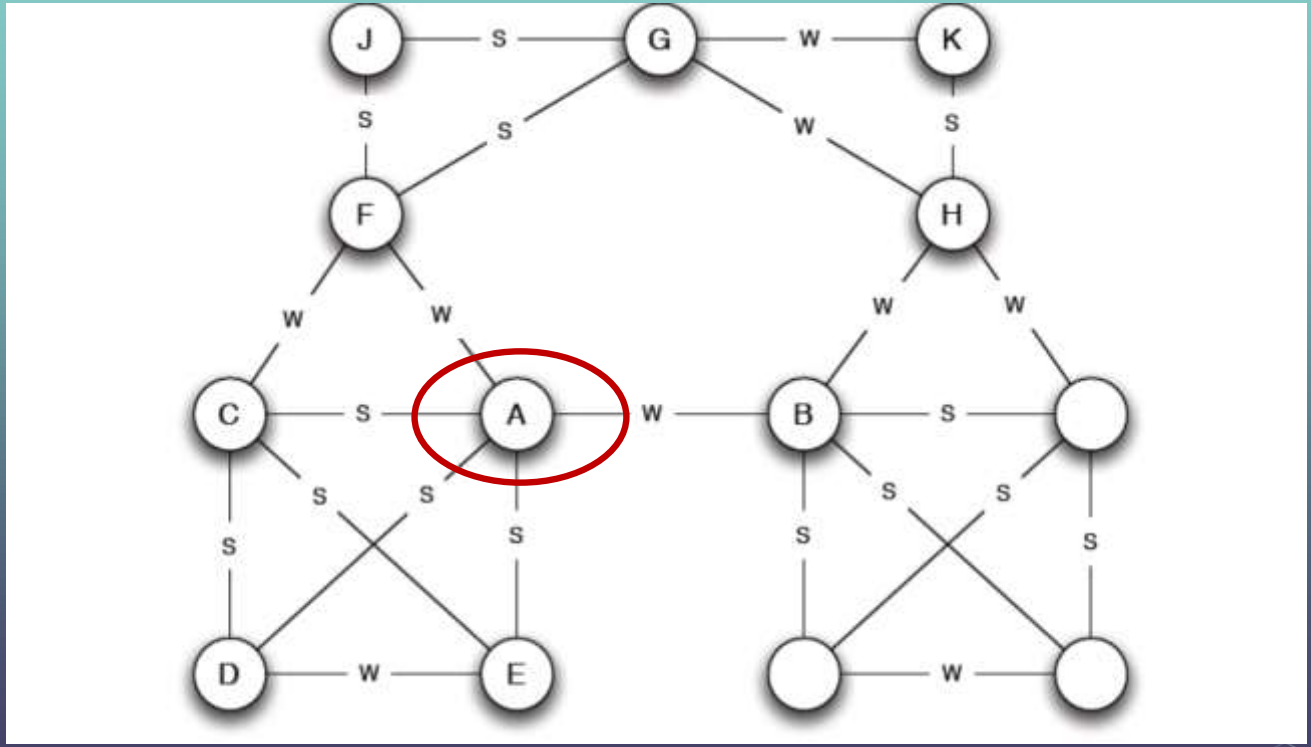
σ_{yz} is the total number of shortest paths from y to z.
$\sigma_{yz}(x)$ is the number of shortest paths from y to z that go through x.

Strong vs. Weak Ties

Suppose that two individuals are connected in a social network (i.e., they know each other).

However, the strength of their connection may differ: It may be a strong tie (i.e., they are friends) or a weak tie (they are acquaintances).

Strong vs. Weak Ties



Strong vs. Weak Ties

A, B and C are currently iPhone users.

C has recently switched to Android system, and B still uses iPhone.

A is more likely to switch or stay, follow your friend or acquaintance?

Strength of strong ties.

Strong vs. Weak Ties

A has recently changed job.

Is A more likely getting a lead from friend C or acquaintance B?

Strength of weak ties (Mark Granovetter's famous example in 1960).

Strong vs. Weak Ties

Although strong ties generally exert more normative influence, weak ties often have more informational influence.

Why?

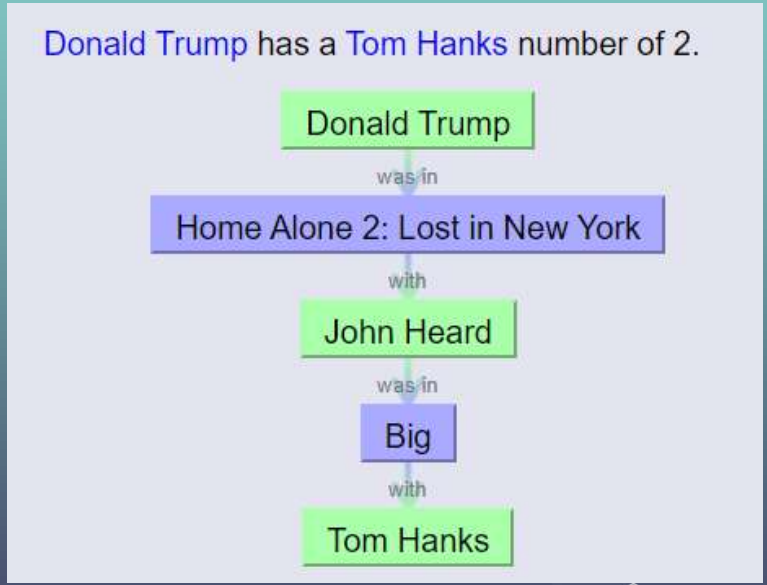
Because different social circles have different info, i.e., you probably know what your good friends know. Most jobs are found through weak connections.

Degrees of Separation

Path of how many people are needed to connect people up
Technical name: Geodesic distance

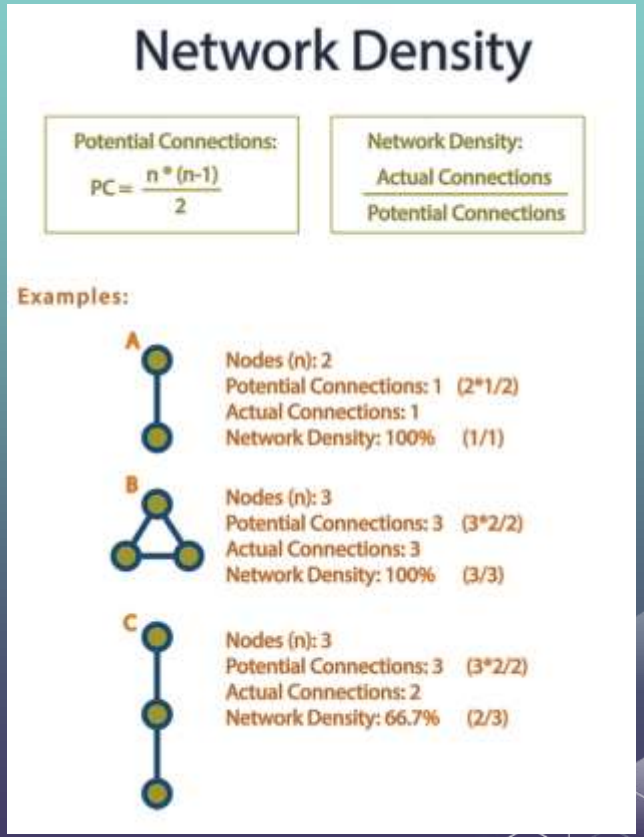
6 is the magical number: Kevin Bacon game (Link)

Don't fixate on 6! It does not apply to all networks!



Is a Network Well-Connected?

Graph/network density



Networks Analysis in R

Preparing Packages

```
library(igraph)
library(readr)
```

The “igragh” package provides you tools for network analysis while the “readr” facilitates reading data.

Reading Data

```
actors <-
read_csv("https://ximarketing.github.io/class/DM//Actors.csv")
movies <-
read_csv("https://ximarketing.github.io/class/DM/Movies.csv")
```

Here, the first file contains the nodes information, whereas the second file contains the edge information. Each actor/actress is a node, and if two actors/actresses appear in a same movie, there is an edge between them.

Reading Data

Actor Information (nodes):

```
> head(actors)
# A tibble: 6 x 3
  Actor         Gender BestActorActress
  <chr>         <chr>  <chr>
1 Tom Hanks     Male   Winner
2 Gary Sinise   Male   None
3 Robin Wright  Female None
4 Bill Paxton   Male   None
5 Kevin Bacon   Male   None
6 Ed Harris     Male   Nominated
```

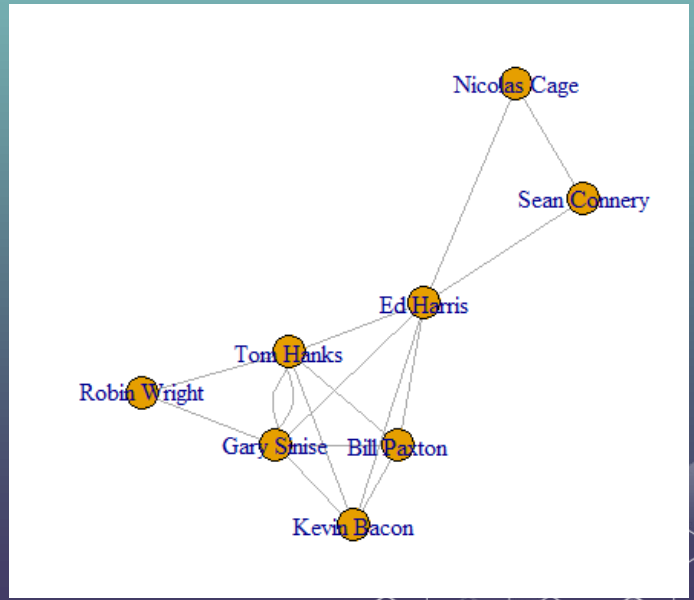
Reading Data

Movie Information (edges):

```
> head(movies)
# A tibble: 6 x 3
  `Actor 1`    `Actor 2`     Movie
  <chr>        <chr>         <chr>
1 Tom Hanks    Gary Sinise   Forest Gump
2 Tom Hanks    Robin Wright  Forest Gump
3 Gary Sinise  Robin Wright  Forest Gump
4 Tom Hanks    Gary Sinise   Apollo 13
5 Tom Hanks    Bill Paxton   Apollo 13
6 Tom Hanks    Kevin Bacon   Apollo 13
```

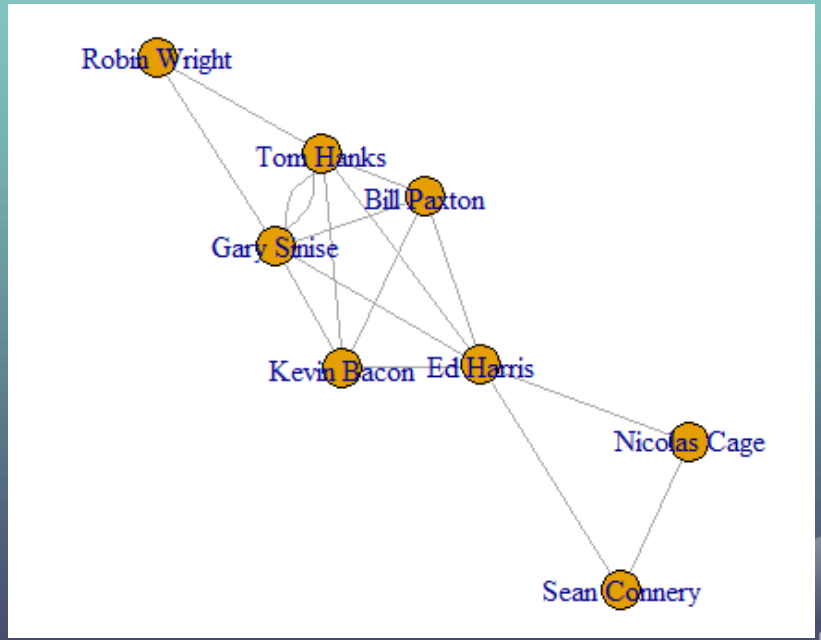
Visualize the Network

```
actorNetwork <-
graph_from_data_frame(d=movies,
vertices=actors, directed=F)
plot(actorNetwork)
```



Visualize the Network

```
plot(actorNetwork)
```

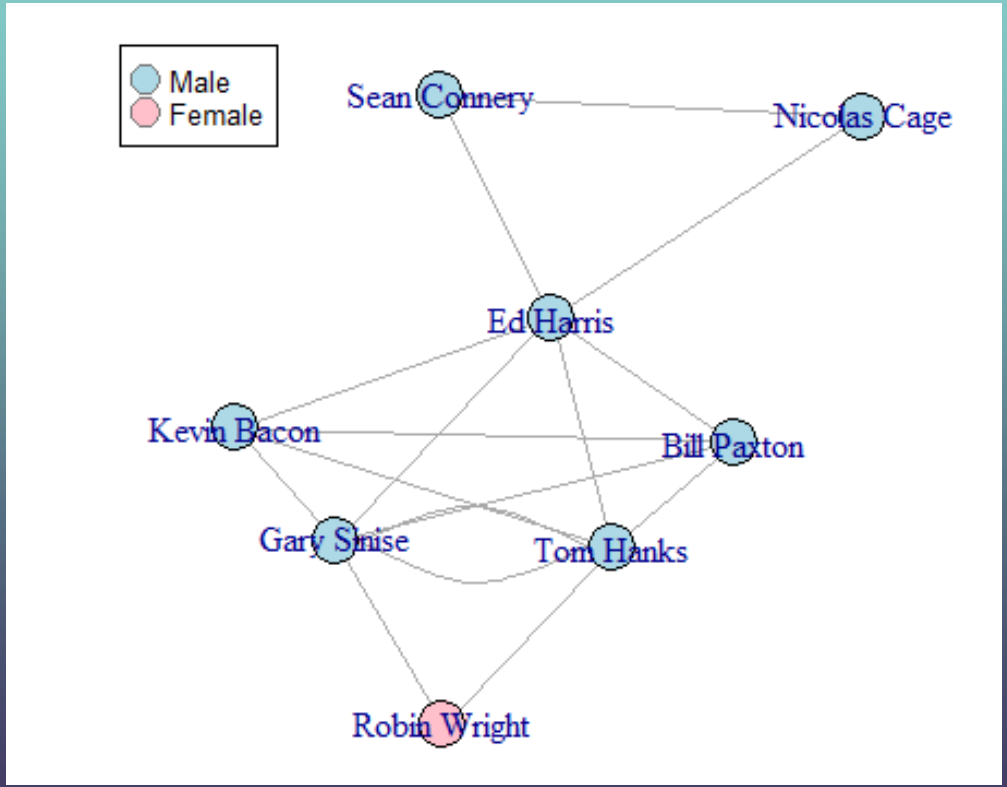


Visualize the Network

You can also add colors to your nodes:

```
V(actorNetwork)$color <-
ifelse(V(actorNetwork)$Gender == "Male",
"lightblue", "pink")
plot(actorNetwork)
legend("topleft", c("Male","Female"),
pch=21,
  col="#777777",
pt.bg=c("lightblue","pink"), pt.cex=2,
cex=.8)
```

Visualize the Network



Degree of the nodes

To check the degree of nodes in the network:

```
degree(actorNetwork, mode="all")
```

```
   Tom Hanks  Gary Sinise Robin Wright  Bill Paxton  Kevin Bacon     Ed Harris
           6            6            2            4            4             6
Sean Connery Nicolas Cage
           2            2
```

Closeness/Betweenness Centrality

```
closeness(actorNetwork, mode="all",
weights=NA, normalized=T)
```

```
   Tom Hanks  Gary Sinise Robin Wright  Bill Paxton  Kevin Bacon     Ed Harris
   0.7777778    0.7777778    0.5000000    0.7000000    0.7000000    0.8750000
Sean Connery Nicolas Cage
   0.5384615    0.5384615
```

```
betweenness(actorNetwork, directed=F,
weights=NA, normalized = T)
```

```
   Tom Hanks  Gary Sinise Robin Wright  Bill Paxton  Kevin Bacon     Ed Harris
   0.1190476    0.1190476    0.0000000    0.0000000    0.0000000    0.4761905
Sean Connery Nicolas Cage
   0.0000000    0.0000000
```

Network Density

```
edge_density(actorNetwork)
```

Exercise

There are another two files containing social networks of movie actors and actress. Play with these files yourselves! The files are downloadable here:

```
actors <-
read_csv("https://ximarketing.github.io/class/DM//Ac
torsExercise.csv")
movies <-
read_csv("https://ximarketing.github.io/class/DM/Mov
iesExercise.csv")
```

Directed Network

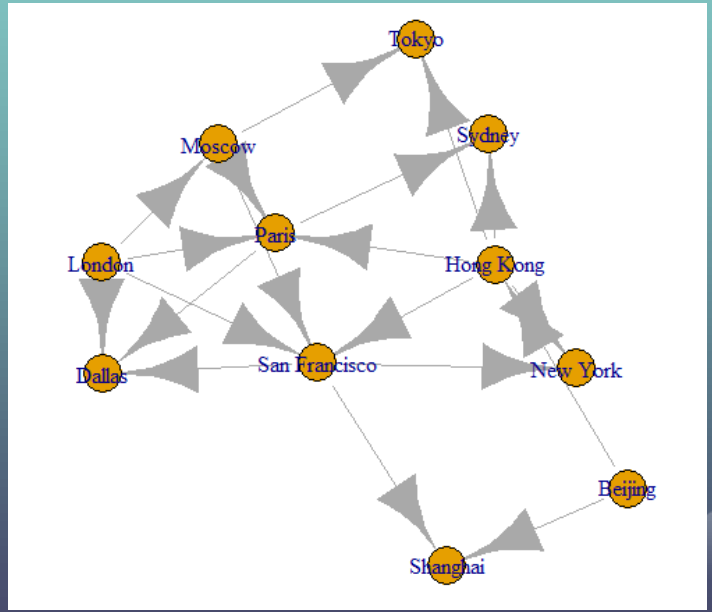
In the following exercise, we play with directed network. This is not much difference.

```
cities <-
read_csv("https://ximarketing.github.io/class/DM/Dir
ectedNodes.csv")
routes <-
read_csv("https://ximarketing.github.io/class/DM/Dir
ectedEdges.csv")
flightNetwork <- graph_from_data_frame(d=routes,
vertices=cities, directed=T)
```

Directed Network

Plot the directed network:

```
plot(flightNetwork)
```



Directed Network

We can distinguish between in-degrees and out-degrees:

```
degree(flightNetwork, mode="in")
```

```
    Beijing     Shanghai     Hong Kong        Tokyo     New York       London
          0            2            1            2            2            0
     Sydney San Francisco        Paris       Moscow       Dallas
          2            3            4            1            3
```

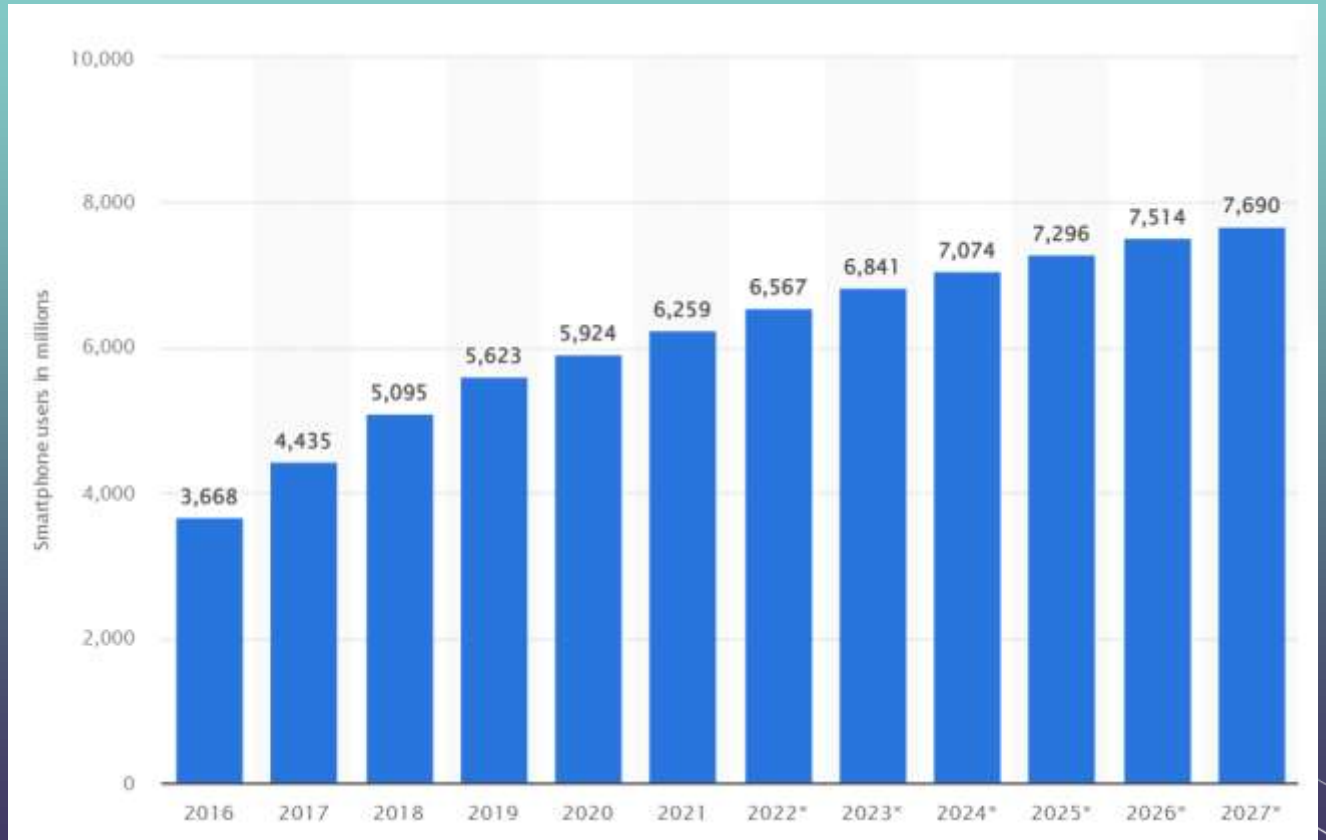
```
degree(flightNetwork, mode="out")
```

```
    Beijing     Shanghai     Hong Kong        Tokyo     New York       London
          2            0            5            0            0            5
     Sydney San Francisco        Paris       Moscow       Dallas
          0            3            2            3            0
```

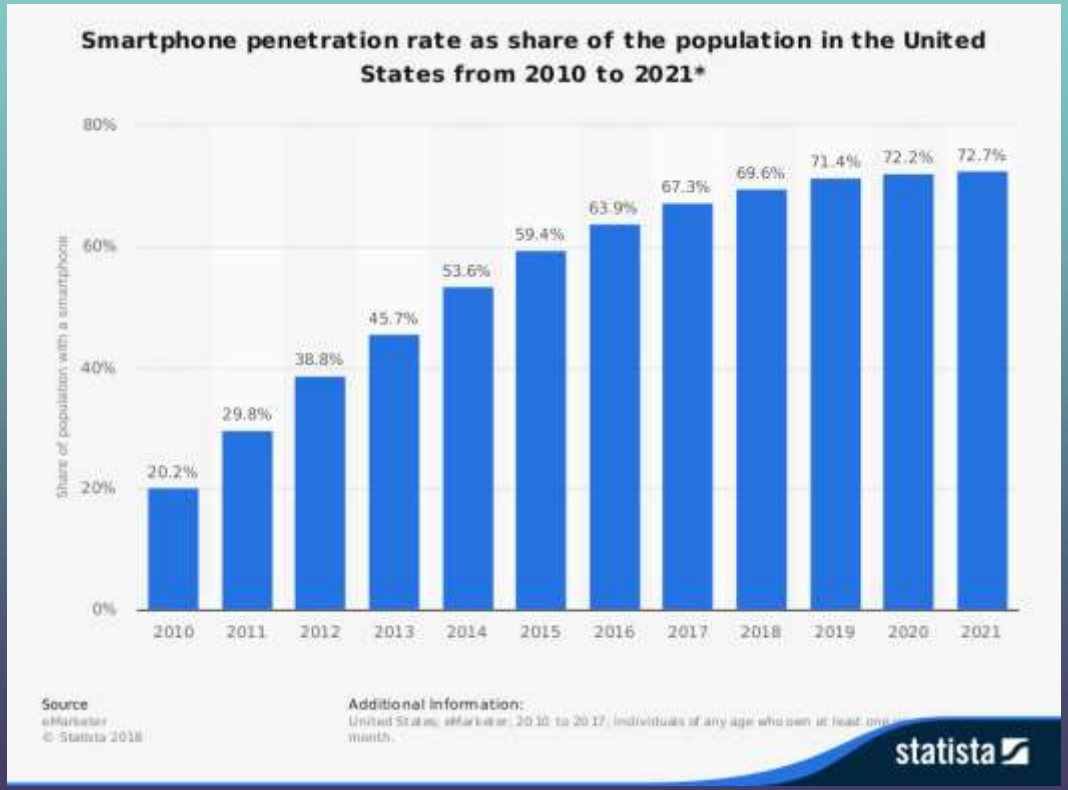
Mobile

Is mobile different?

The Rise of Mobile



The Rise of Mobile



QUESTION

Which APPs are most downloaded?

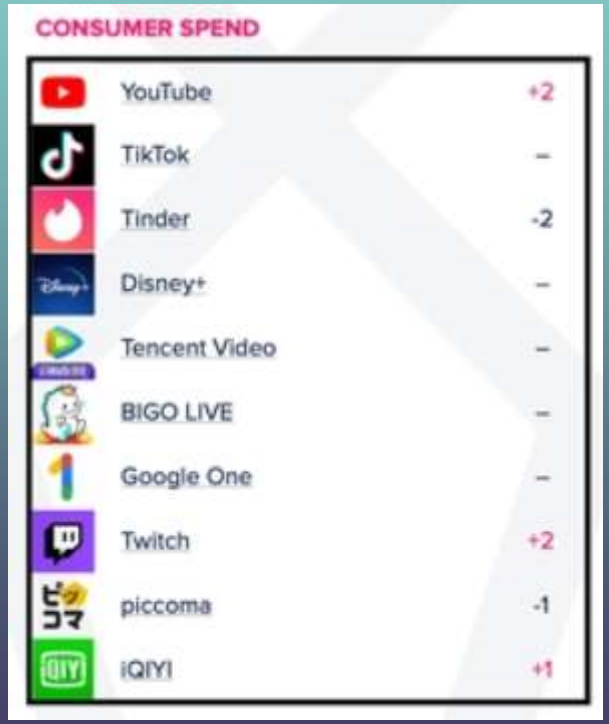
Most Downloaded APPs

Name	Best for	No. of Downloads in 2021 (Forbes)	Rating-Play Store (Google/Apple)
TikTok	Creating and sharing short creative video clips	656 million	4.5/4.9
Instagram	Sharing ideas and thoughts across social media through photos and videos	545 million	4.1/4.7
Facebook	Connecting with friends, families, and people with similar interests	416 million	3.2/2.2
WhatsApp	Communicating seamlessly using internet data	395 million	4.3/4.7
Telegram	Messaging and sending photos, videos, and other documents	329 million	4.5/4.3

QUESTION

Which APPs do people spend most money on?

People Spend Money on these APPs

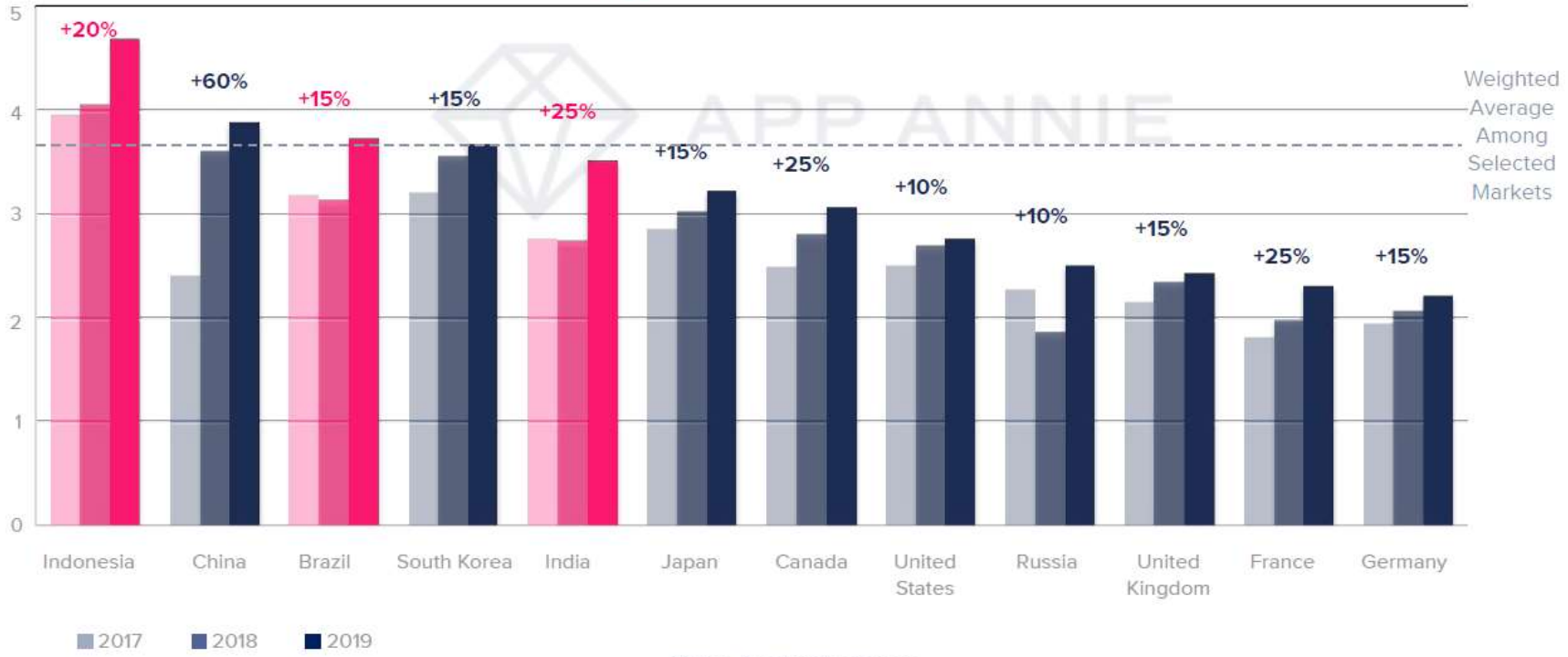


QUESTION

How many hours do people spend on smartphones everyday?

Average Daily Hours Spent Per Device on Mobile

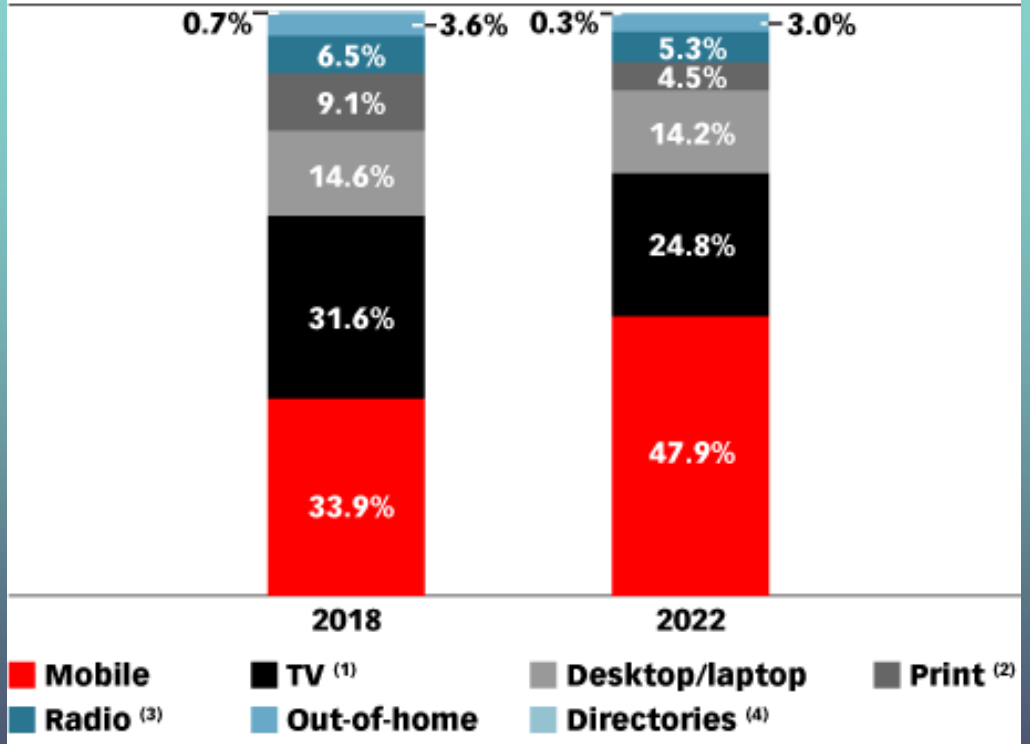
Emerging Markets **Mature Markets**



Note: Android phones

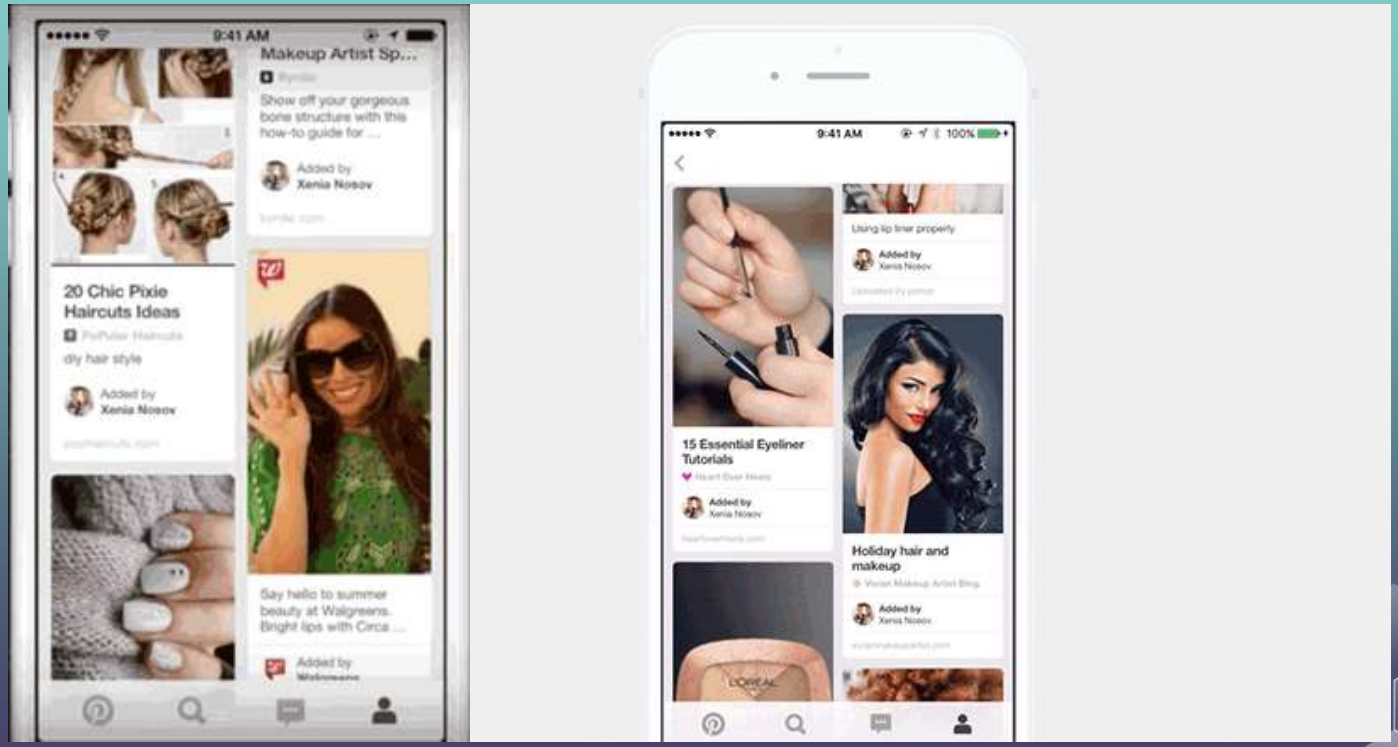
US Total Media Ad Spending Share, by Media, 2018 & 2022

% of total



Note: numbers may not add up to 100% due to rounding; (1) excludes digital; (2) includes newspapers and magazines; excludes digital; (3) excludes off-air radio and digital; (4) print only; excludes digital
Source: eMarketer, March 2018

Motion Based Ads (on Pinterest)



QUESTION

How is mobile different from PC? What new marketing opportunities are brought by mobile?

How is Mobile Different

Omnipresence

Always carried and always on.

Reduced targeting errors

Unlike cookies, phone number and device ID cannot be deleted; mobile phones are usually not shared among households.

Location awareness

Location provides both proximity data and contextual information.

Built-in payment system

Easily purchase at offline stores

Mobile is not just your phone

Location Based Targeting

Consumers search with their location and proximity in mind

88% of consumers conduct local searches on smartphones.

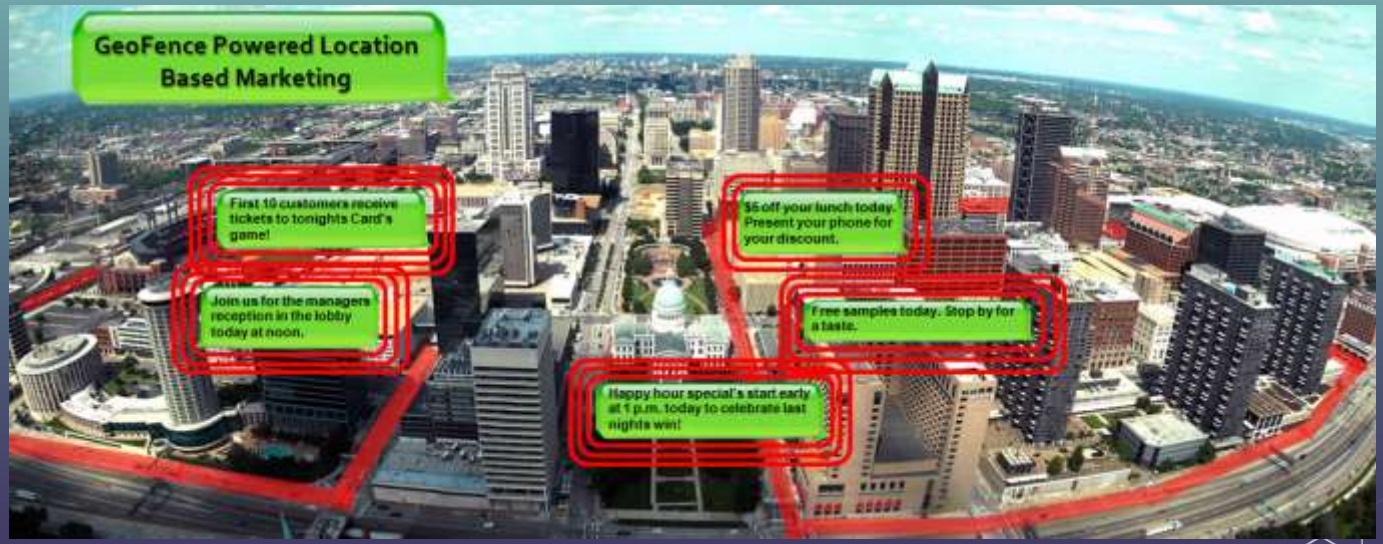
Local searchers are more likely to take actions

50% of consumers who conducted a local search on their smartphone visited a store within a day.

18% of local searches on smartphone lead to a purchase within a day vs. 7% of non-local searches.

Proximity marketing: Geo-fencing

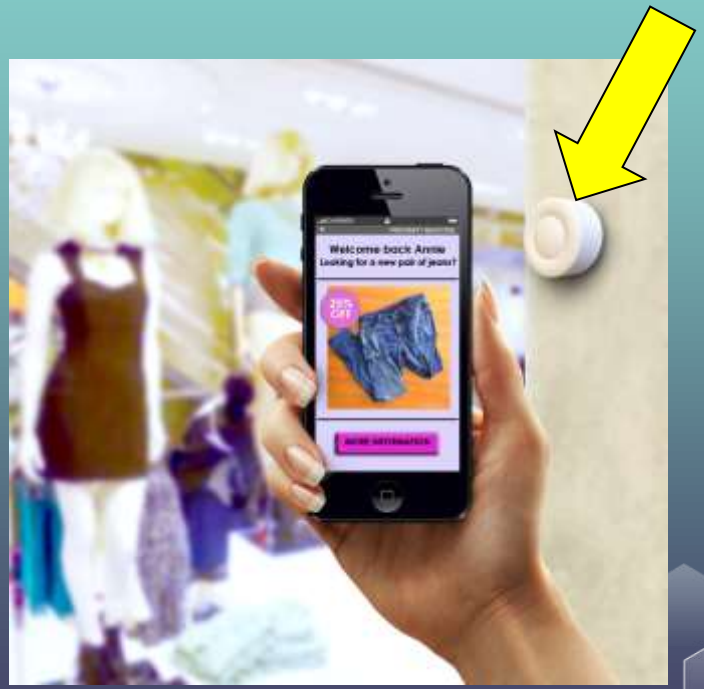
Geofencing is a location-based service that sends promotional messages to smartphone users who enter a defined geographic area such as a hotel, a mall, or a conference center.



Proximity marketing: Beacons

Beacons are small, often inexpensive devices that use Bluetooth to enable more accurate location within a narrow range than GPS, cell tower triangulation and Wi-Fi proximity.

Geo-fencing is optimized for larger and outdoor locations, between 50 and 50,000 meters while beacons have a maximum range of 30 meters and are better used indoors.



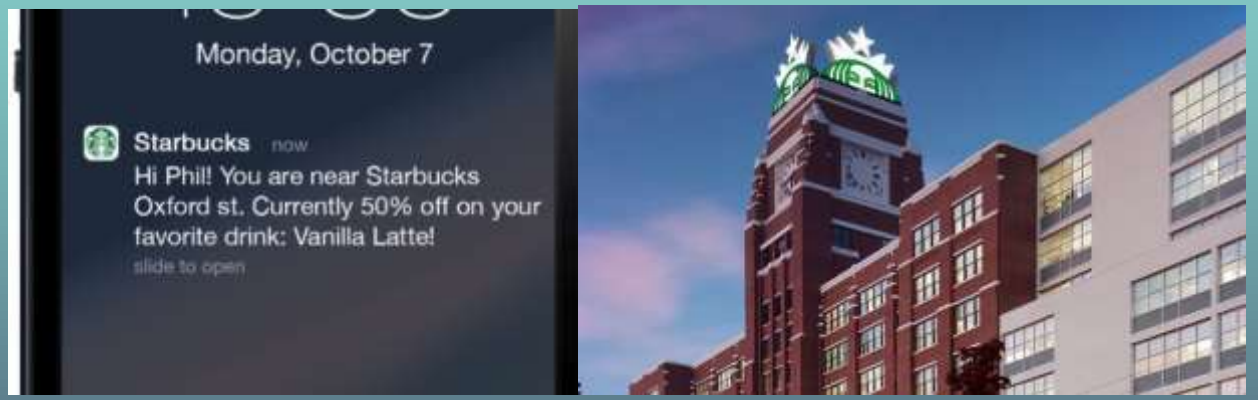
Via mobile apps, Beacons can communicate both behavioral data and social data to create more precise consumer profile

A smart use of beacons by Nivea

QUESTION

How are Geo-fencing and Beacons different from traditional outdoor and in-store ads?

How are Geo-fencing and Beacons different from traditional outdoor and in-store ads?



Personalize user experience
Send mobile coupons
Have high targetability such as demographics, timing, etc
Be non-intrusive by giving users opt-out options
Link with loyalty program