Social Networks

Connecting with others
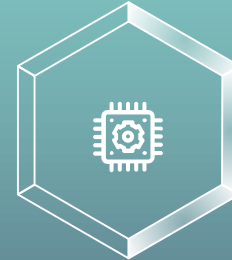
What is the difference?

Web 1.0

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

Web 2.0 and beyond

Twitter
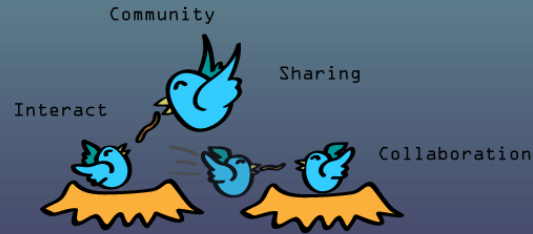Snapchat
Instagram
Pinterest
Reddit
Wikipedia
Facebook
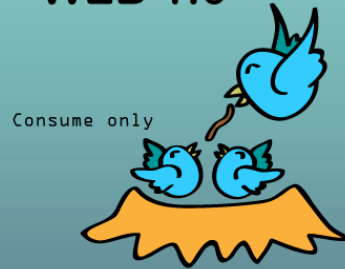
Get Fans

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

Lenovo
December 11, 2015 · 🌐

Meet Yolanda and her #Goodweird home. Walls move, rooms change and the house comes to life while adapting to her every need - just like the YOGA 900. Share your #Goodweird at www.goodweirdproject.com/global/

1.4m Views

👍 Like   💬 Comment   ➤ Share

17,148 people like this.   Top Comments ▾

3,500 shares

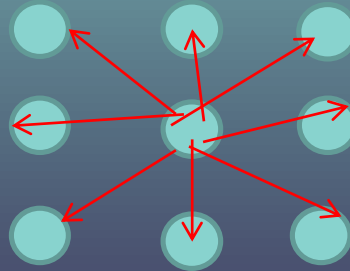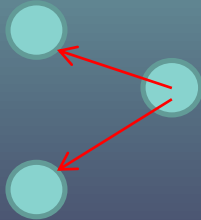Spread brand message across social network (i.e., newsfeed).

Organic word-of-mouth advertising.

Network can also be used for social advertising.

Amplification Ratio

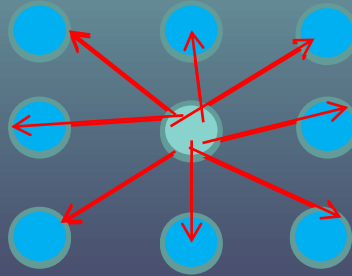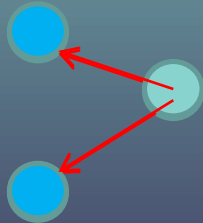Amplification ratio
= # Friends of Fans exposed / # Fans exposed

Amplification Ratio

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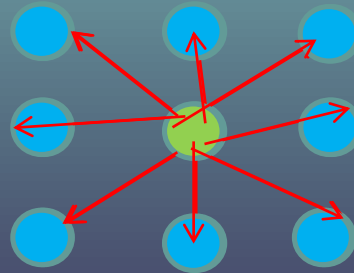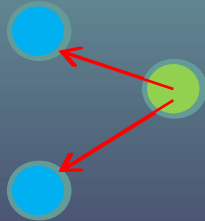
Amplification Ratio

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

SPENDING INDEX

	AMAZON	BEST BUY	TARGET	WALMART
FANS	209	231	197	160
FRIENDS OF FANS	108	204	151	116

■ FANS ■ FRIENDS OF FANS
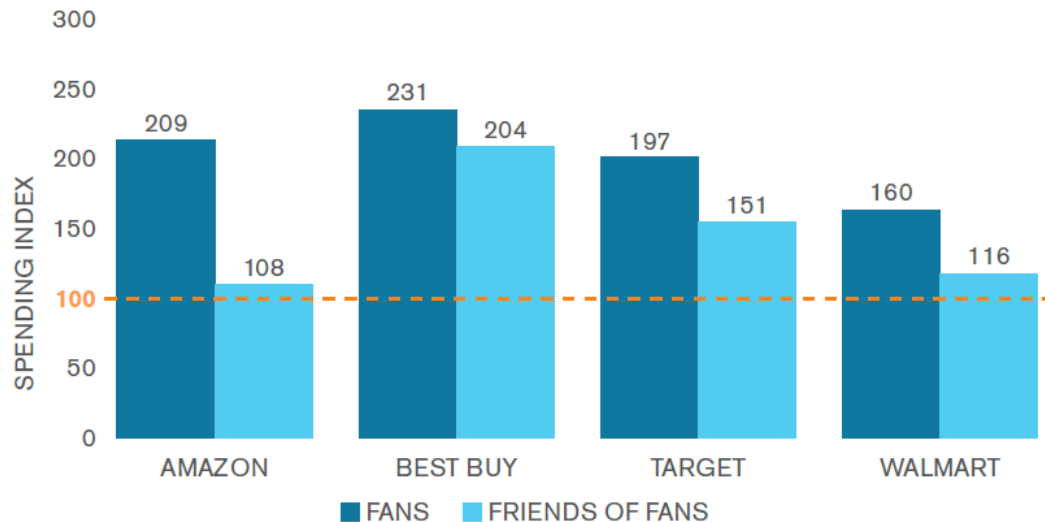
INDEX OF 100 = SEGMENT SPENT AS MUCH, ON AVERAGE,
AS THE GENERAL POPULATION

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?
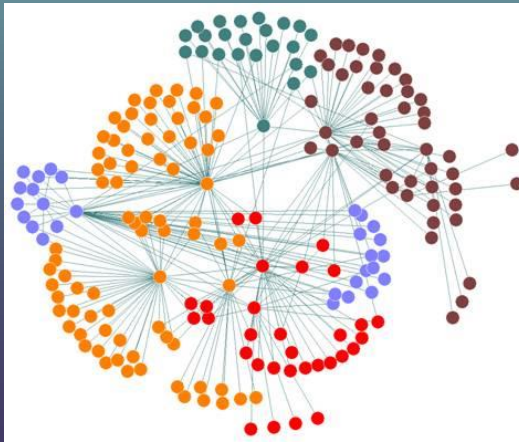   Strength of tie

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
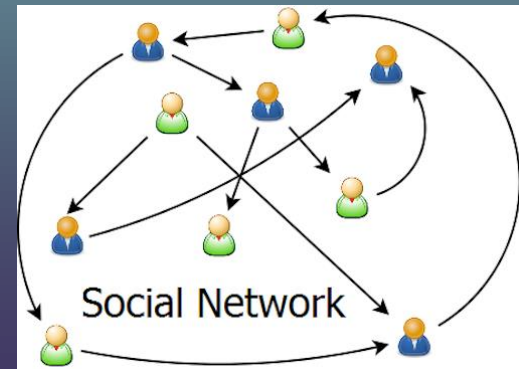> You live in Hong Kong island, HK

Connection
> You are close friends with 10 people at HKU

Whole Network
> On average, students know each other within 4 steps

Social Network

Edges

Person 1

Edges

Person 1

Person 2

Edges
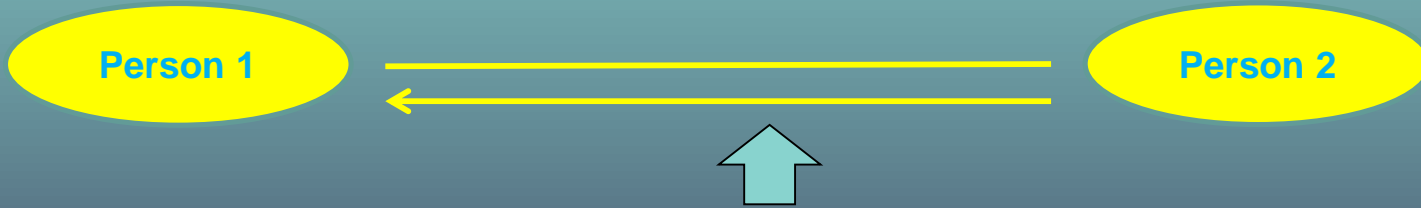
Undirected (e.g., study at HKU)

Person 1 ——————— Person 2

Edges

Person 1   ⟵   **Person 2**

Directed (e.g., 2 follows 1)

Edges

Person 1 → Person 2

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.
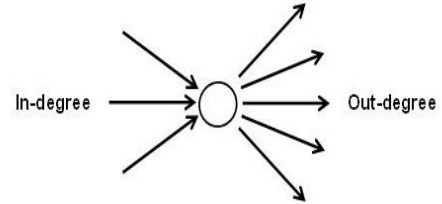
Edge Weight
  Sometimes edge can also carry weight
  Can capture how deep the relationships are
  E.g., frequency of interactions between two nodes.
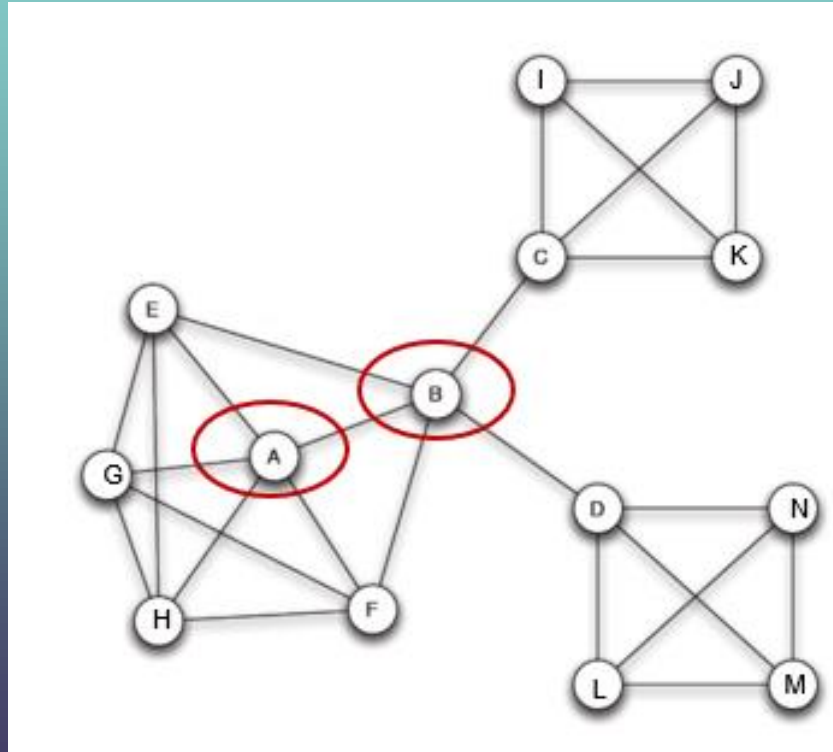
QUESTION

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
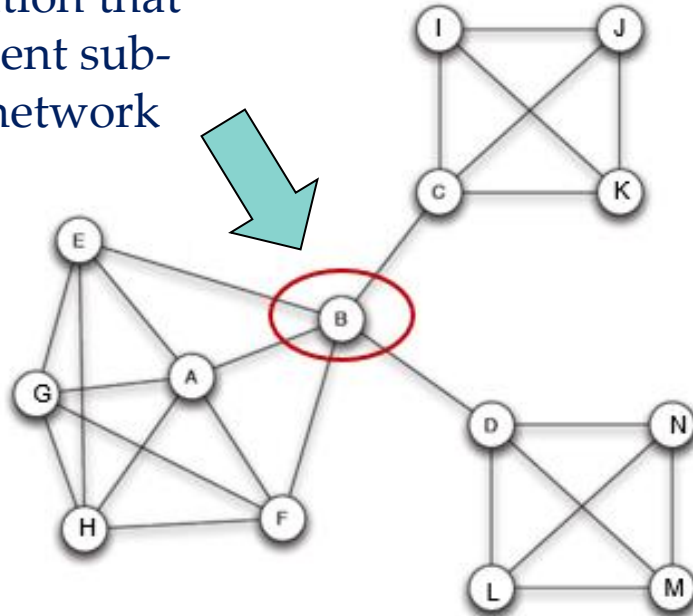
Who is most important? Why?
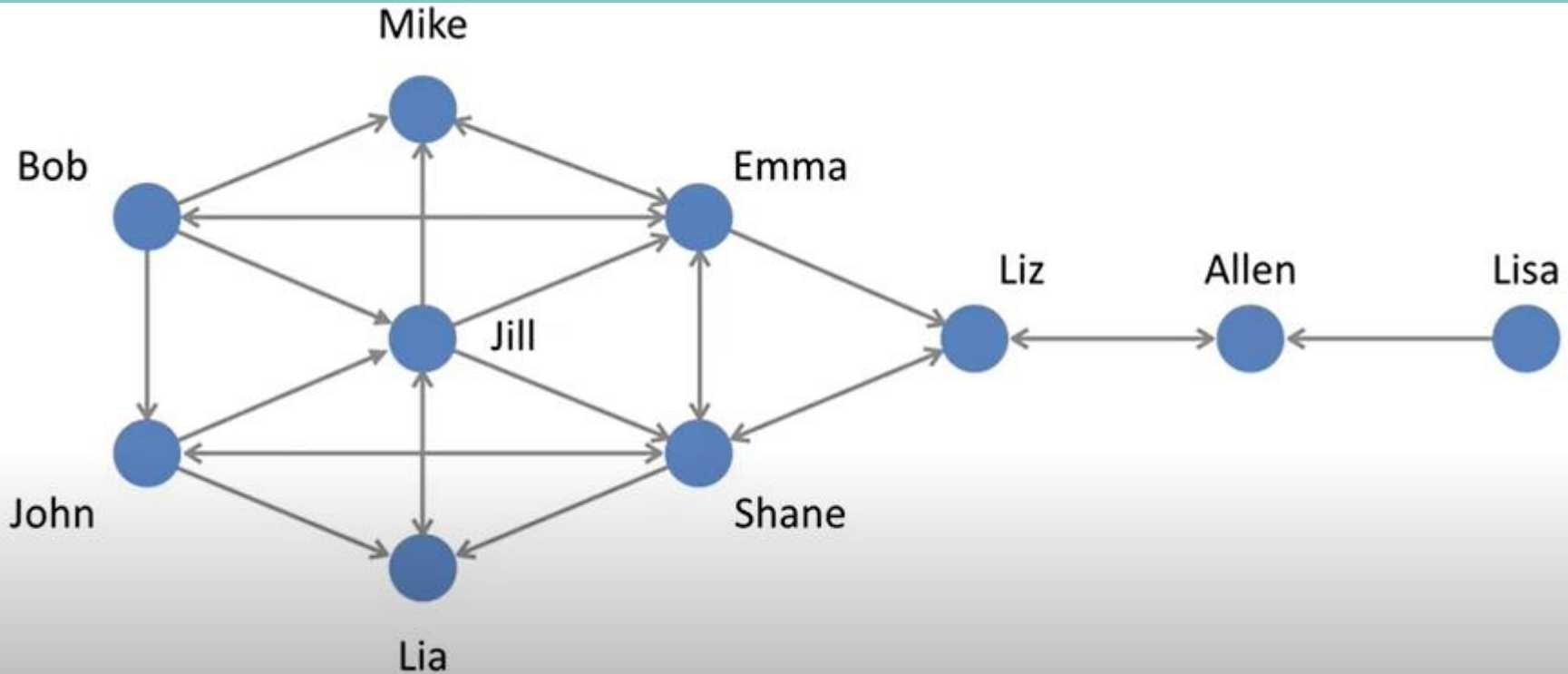
QUESTION

How to define the importance
of a node?

Closeness Centrality
& Betweeness Centrality

THE BASICS OF SOCIAL NETWORK ANALYSIS

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
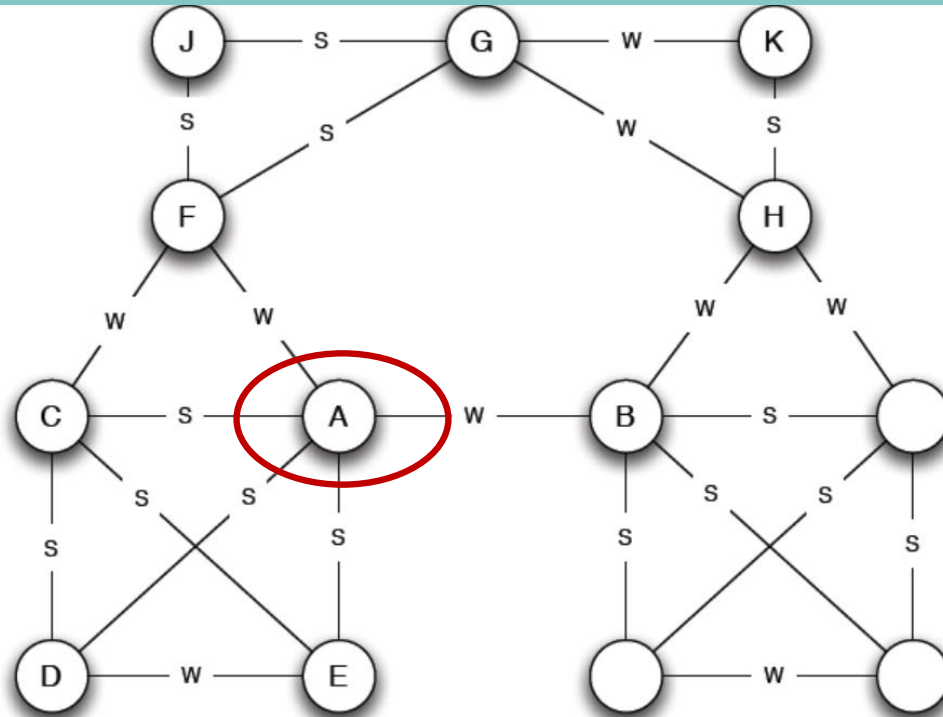
Strong vs. Weak Ties

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 <u>famous example</u> 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!

Donald Trump has a Tom Hanks number of 2.

Donald Trump
was in
Home Alone 2: Lost in New York
with
John Heard
was in
Big
with
Tom Hanks

Is a Network Well-Connected?

Graph/network density

Network Density

Potential Connections:

$$PC = \frac{n*(n-1)}{2}$$

Network Density:

$$\frac{\text{Actual Connections}}{\text{Potential Connections}}$$

Examples:

A
Nodes (n): 2
Potential Connections: 1 (2*1/2)
Actual Connections: 1
Network Density: 100% (1/1)
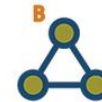
B
Nodes (n): 3
Potential Connections: 3 (3*2/2)
Actual Connections: 3
Network Density: 100% (3/3)

C
Nodes (n): 3
Potential Connections: 3 (3*2/2)
Actual Connections: 2
Network Density: 66.7% (2/3)

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/D
M//Actors.csv")
movies <-
read_csv("https://ximarketing.github.io/class/D
M/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

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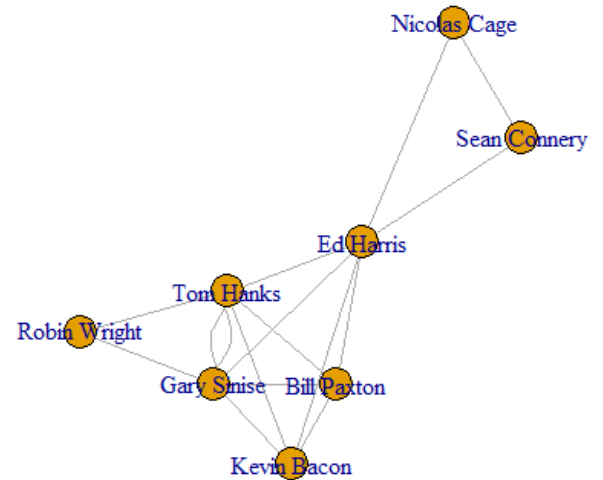
Visualize the Network

```
plot(actorNetwork)
```
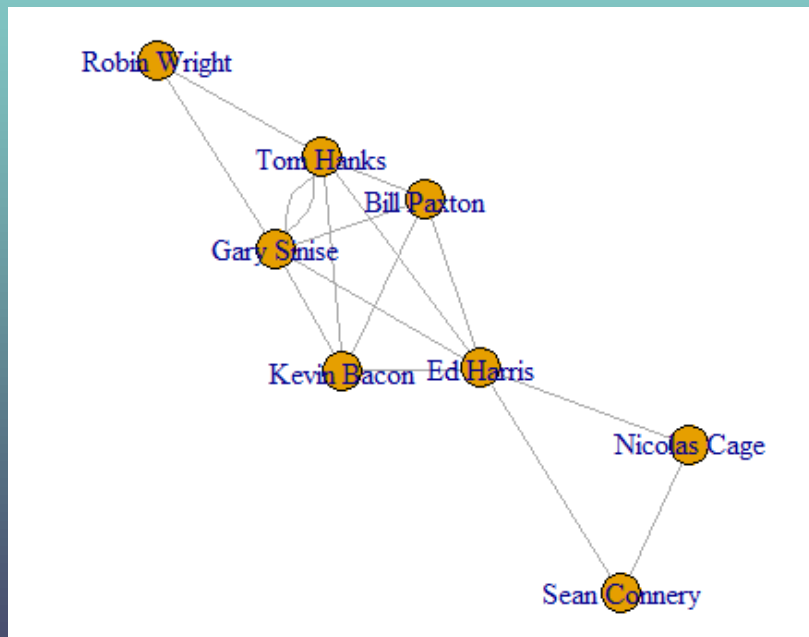
Visualize the Network

You can also add colors to your nodes:

```r
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
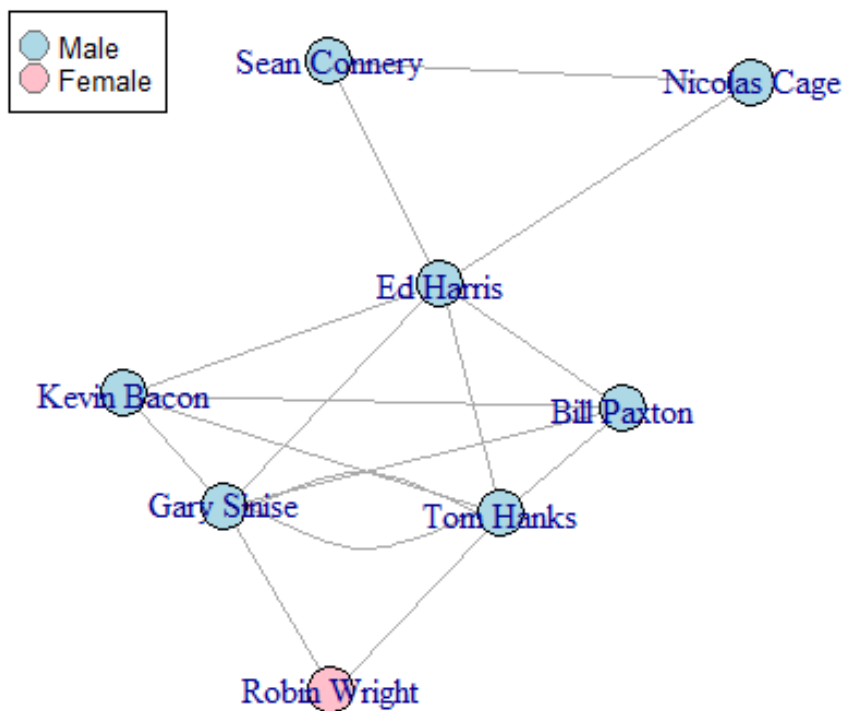
Degree of the nodes

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//ActorsExercise.csv")
movies <-
read_csv("https://ximarketing.github.io/class/DM/MoviesExercise.csv")
```
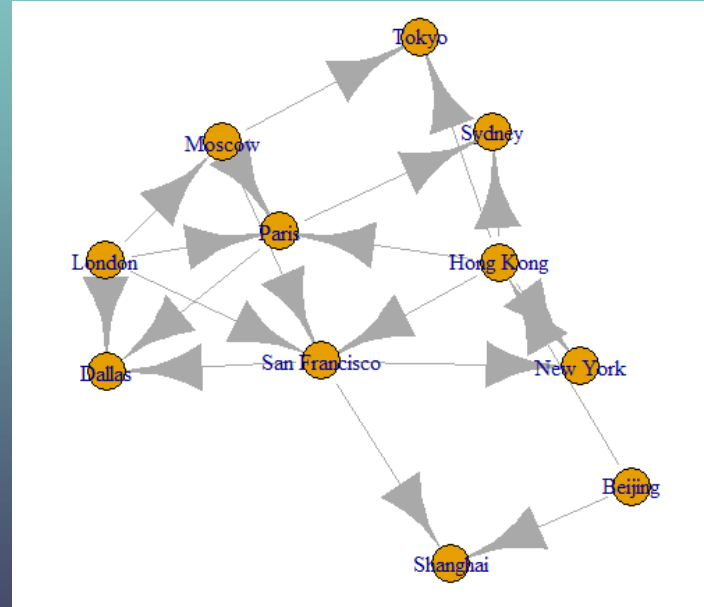
Directed Network

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	

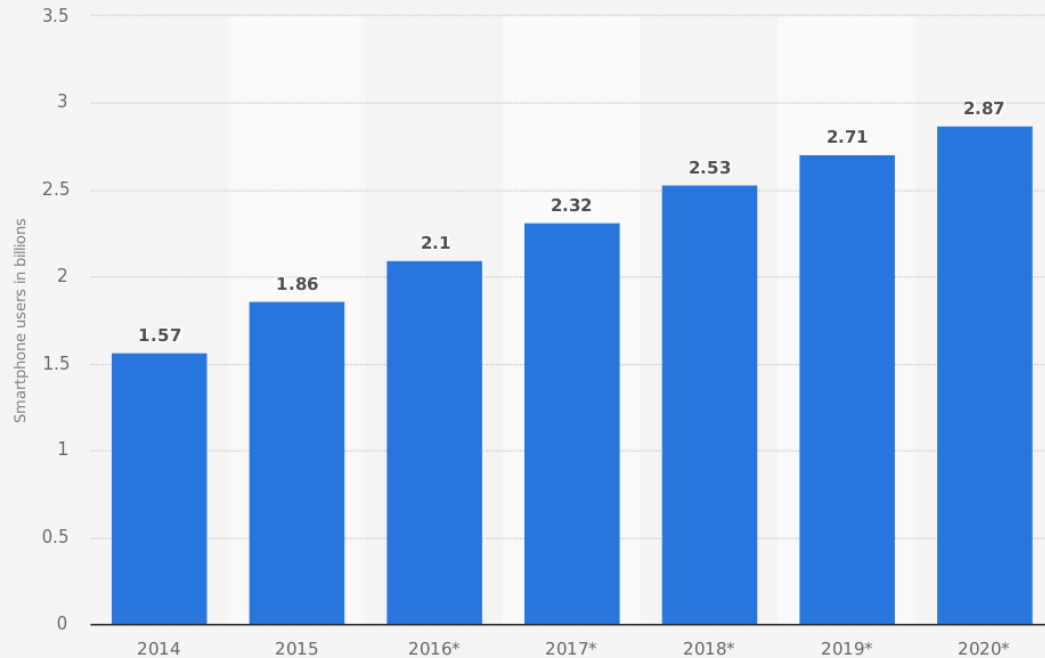# Mobile

Is mobile different?

The Rise of Mobile

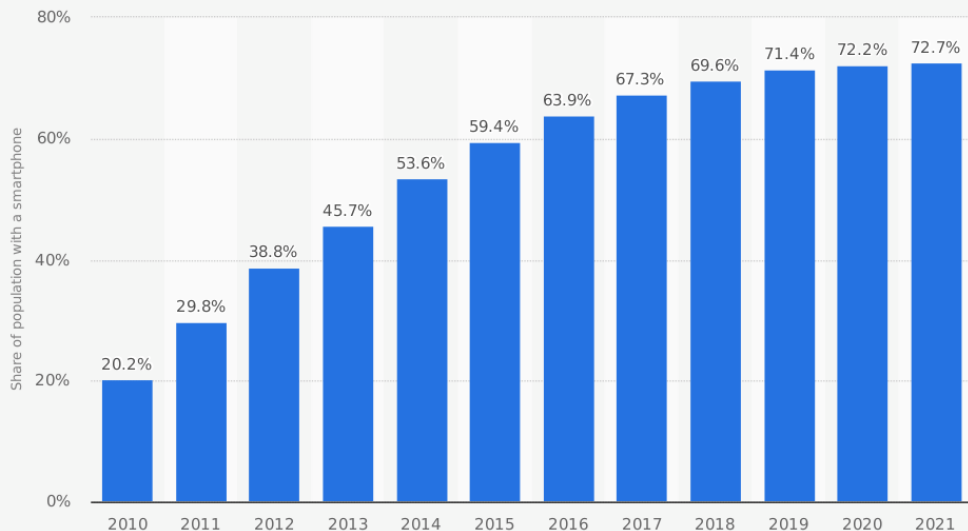**Number of smartphone users worldwide from 2014 to 2020 (in billions)**

Smartphone users in billions

Year	Value
2014	1.57
2015	1.86
2016*	2.1
2017*	2.32
2018*	2.53
2019*	2.71
2020*	2.87

statista

The Rise of Mobile

Smartphone penetration rate as share of the population in the United States from 2010 to 2021*

QUESTION

Which APPs are most
downloaded?

Most Downloaded APPs

Legend: App Store (blue), Google Play (green)

App	Total Downloads (approx.)
Zoom	~305M
TikTok	~305M
Facebook	~185M
WhatsApp	~175M
Instagram	~140M
Messenger	~140M
Aarogya Setu	~125M
Google Meet	~110M
Telegram	~80M
YouTube	~75M
Snapchat	~75M
Netflix	~72M
Microsoft Teams	~68M
Likee	~62M
Spotify	~58M
Google Classroom	~55M
Pinterest	~55M
PicsArt	~55M
Twitter	~55M
SHAREit	~55M

Source: SensorTower
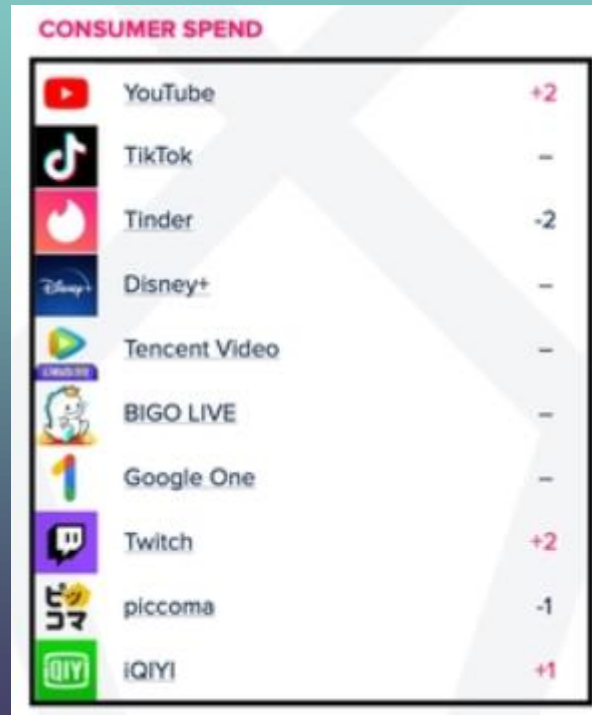
QUESTION

Which APPs do people spend
most money on?

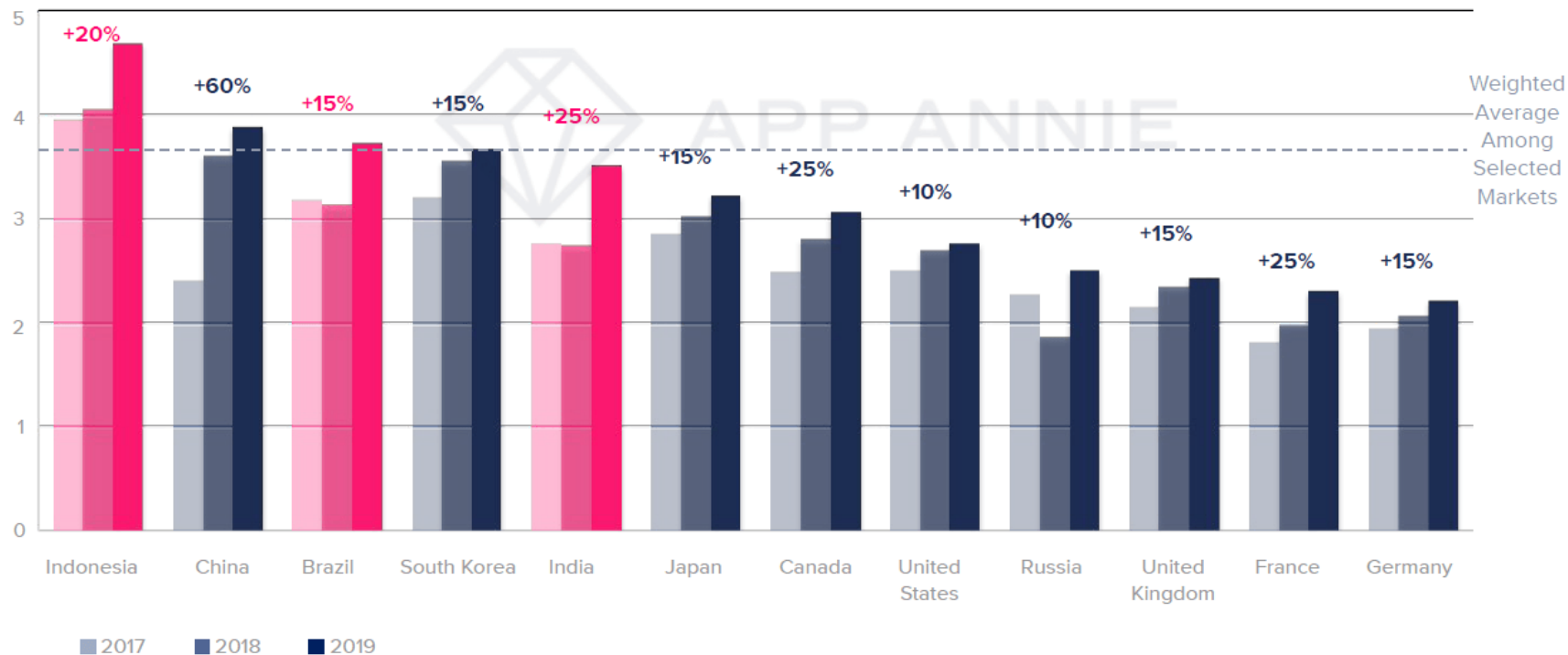# People Spend Money on these APPs

QUESTION

How many hours do people
spend on smartphones
everyday?

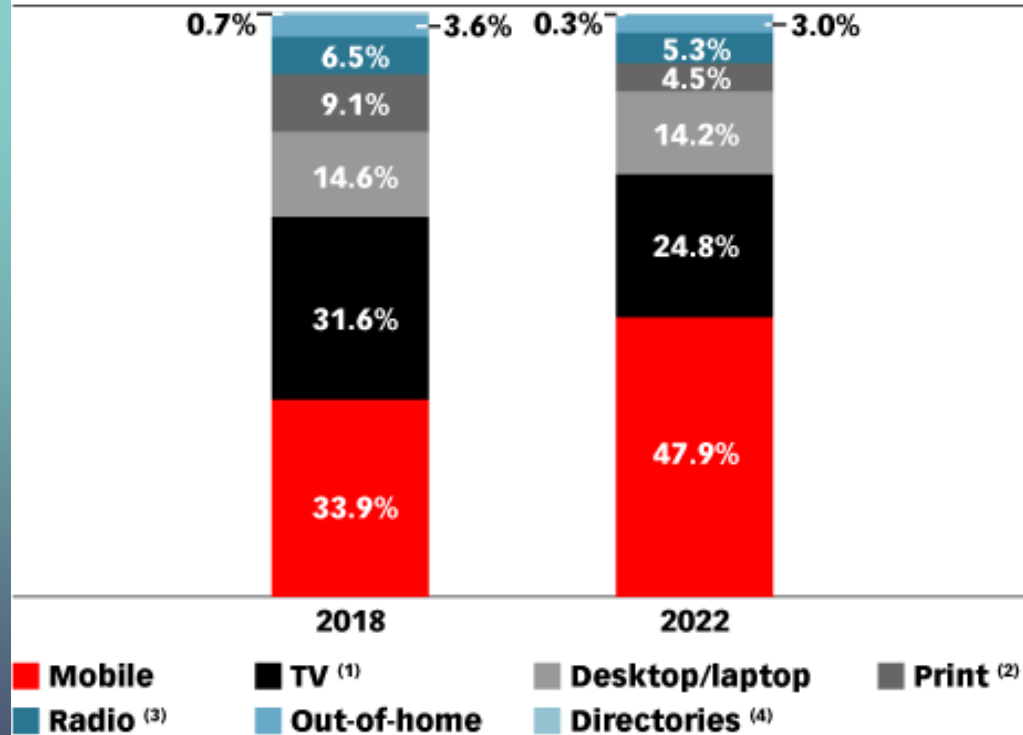Average Daily Hours Spent Per Device on Mobile

Emerging Markets   Mature Markets

Note: Android phones

US Total Media Ad Spending Share, by Media, 2018 & 2022
% of total

2018:
- 0.7%
- 3.6%
- 6.5%
- 9.1%
- 14.6%
- 31.6%
- 33.9%

2022:
- 0.3%
- 3.0%
- 5.3%
- 4.5%
- 14.2%
- 24.8%
- 47.9%

Legend:
- Mobile
- TV [1]
- Desktop/laptop
- Print [2]
- Radio [3]
- Out-of-home
- Directories [4]

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

235956

www.eMarketer.com

Motion Based Ads (on Pinterest)
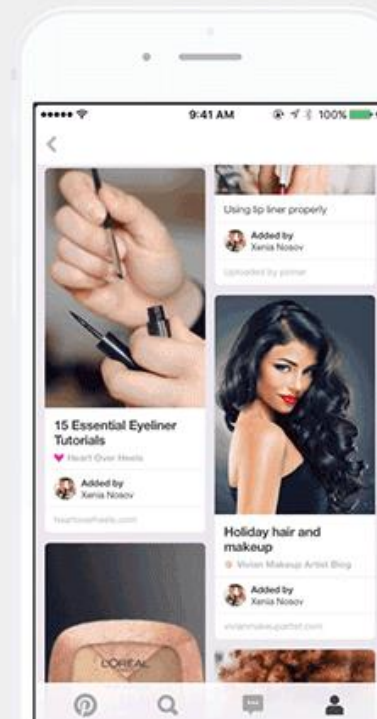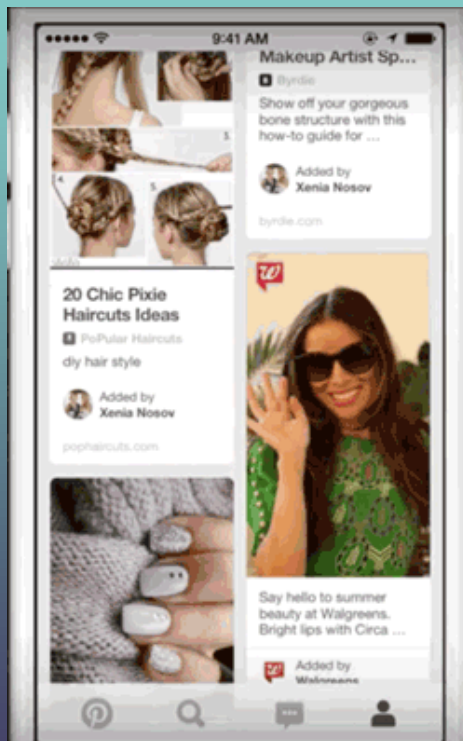
QUESTION

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.
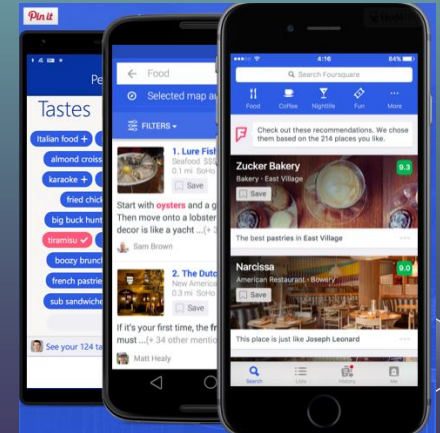
Proximity marketing: Geo–fencing

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.
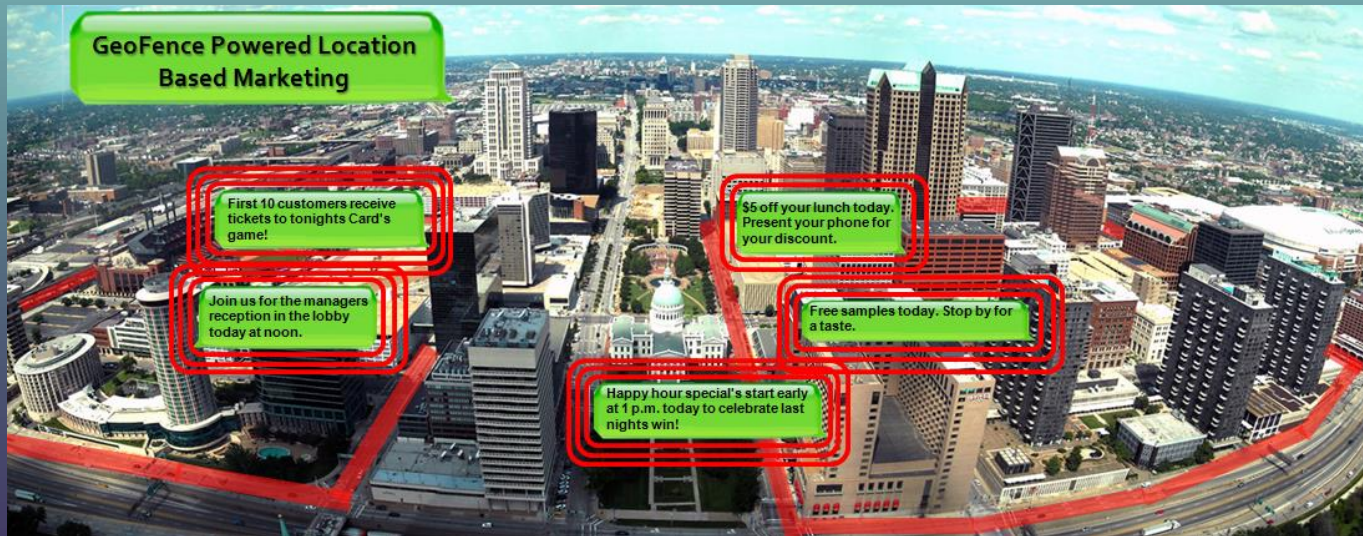
Proximity marketing: Beacons

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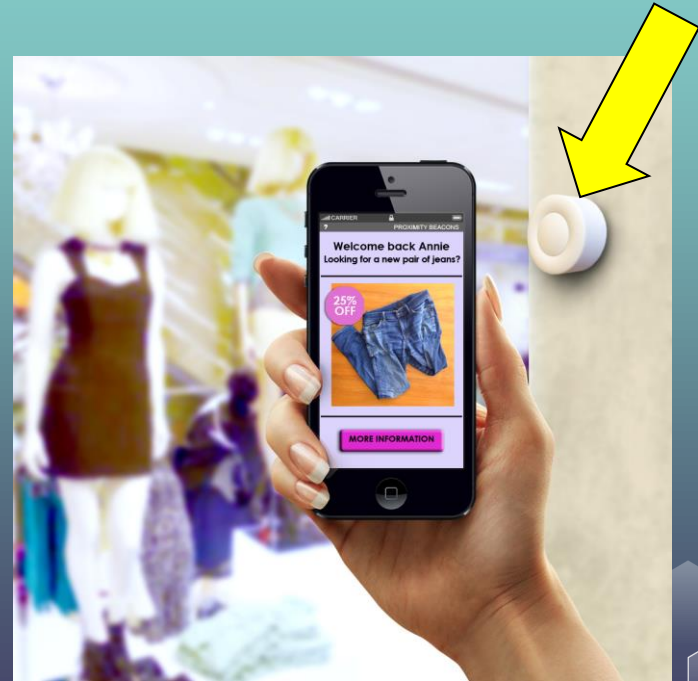
Via mobile apps, Beacons can communicate both behavioral data and social data to create more precise consumer profile

Traditional Location Targeting

Works: Unknown
Lives: Unknown
Shops: Unknown
Age: Unknown
Income: Unknown
Interests: Unknown

Mobile Targeting

Works: Iowa City, IA
Lives: Iowa City, IA
Shops: McDonald's, Wal-Mart
Age: 25-29
Income: $50-75k+
Interests: Concerts

Mobile Targeting

Works: Midtown Manhattan
Lives: Garden City, NY
Shops at: Costco, Macy's
Age: 35-44
Income: $150k+
Travels for business
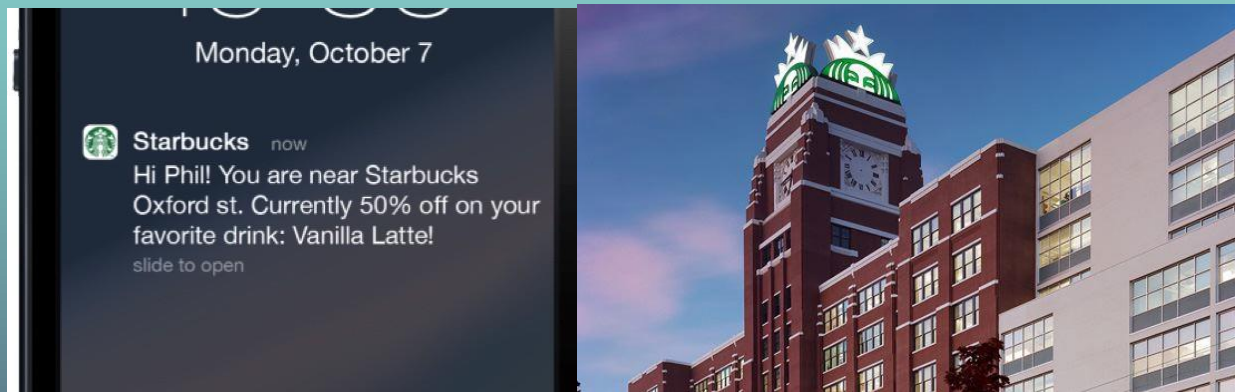
A smart use of beacons by Nivea

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