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Social networking as a platform for innovative ICT services

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Outline

- Global proliferation of social networking phenomena
- From a service to a platform
  - Social (ir)responsibility
  - Social media marketing
  - Social recommender
  - A switch from Customer Relationship Management (CRM) to Customer-Managed Relationship (CMR)
    - Implicit social networks
  - Corporate social networking

Global proliferation of social networking phenomena

Networks, the evolution of social networking, the importance of social networking in everyday life, the most popular social networks

Networks are everywhere…

Computer network

Electrical network

Television network

Innovation network

Social network

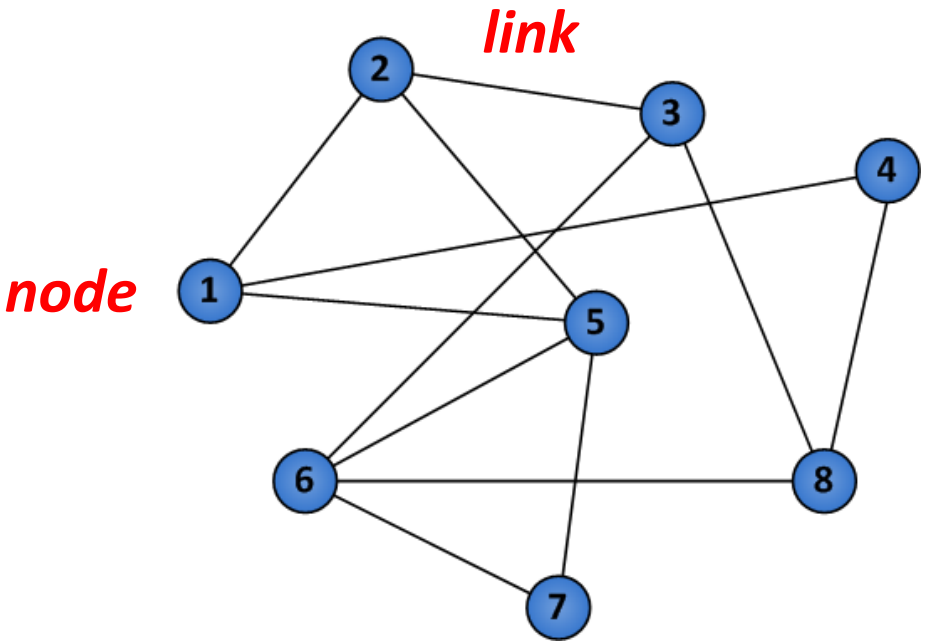
Networked economy

Universities network

Communication network

What is a Network?

- A set of nodes interconnected via links
  - The purpose of exchange
  - Various topologies

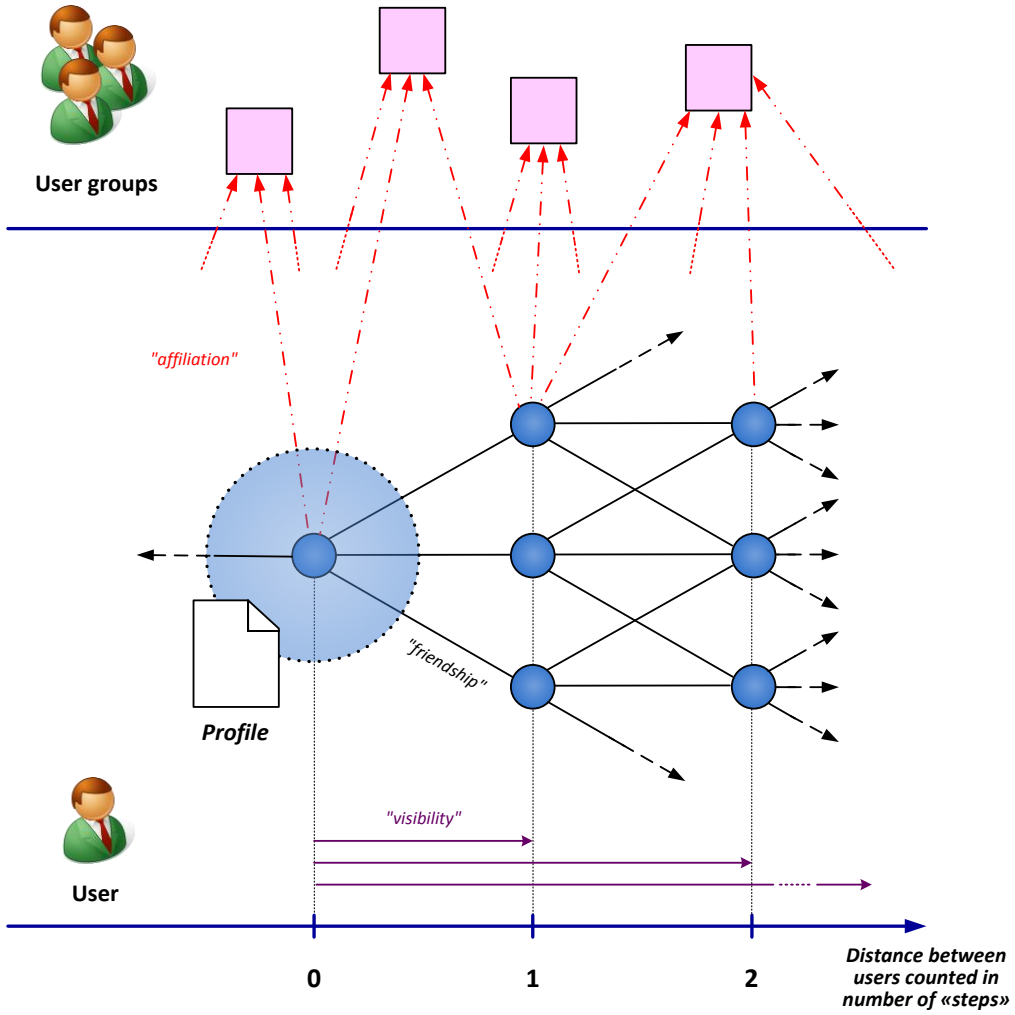


What is a Social Network?

- A set of actors interconnected via relationships
  - Actors: *people, organisations, brands*
  - Relationships: *acquaintance, collaboration, dislike, …*
- Common interest connects involved actors
- Based on actor profiles
- Creating principle
  - explicit
  - implicit

Foundation of all social networks

(Semi-)public user profiles



- „friendship"
- „visibility"
- „affiliation"

The history of social networking (1)

1960s: Milgram's "small world experiment" demonstrated the idea of "six degrees of separation"

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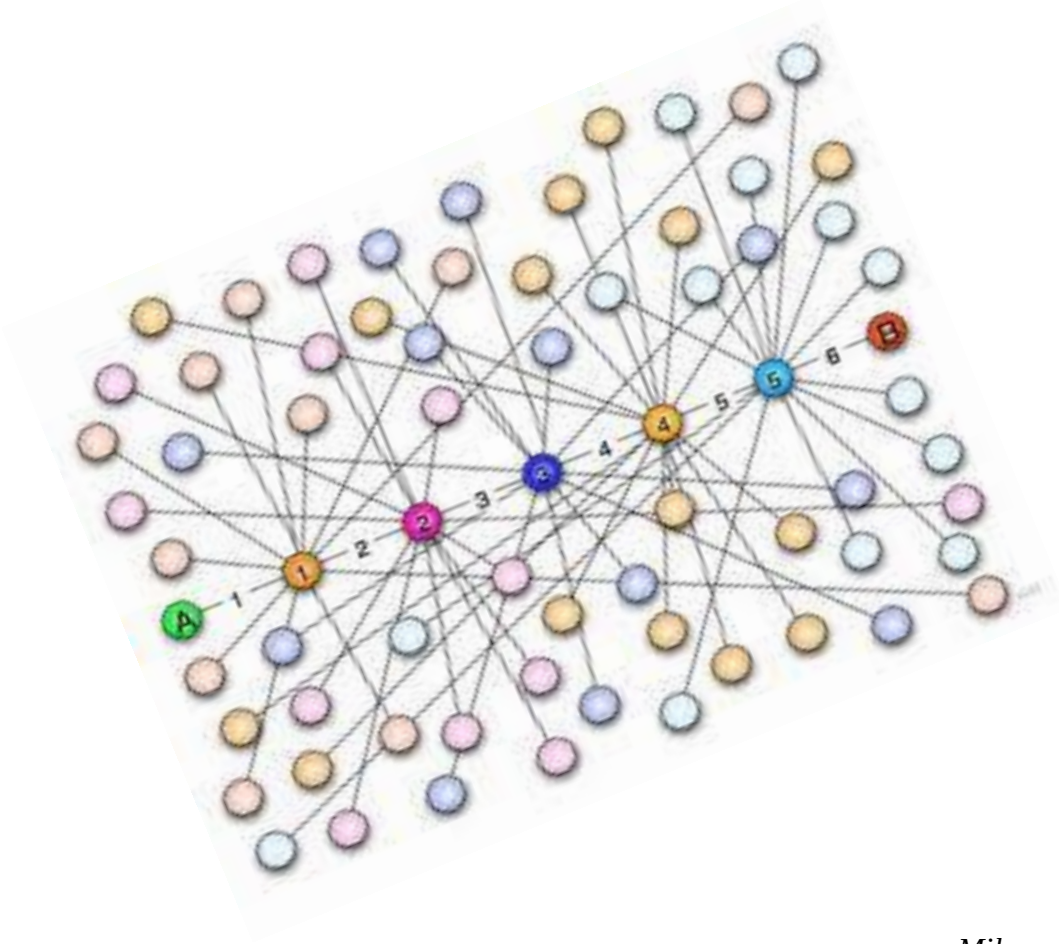

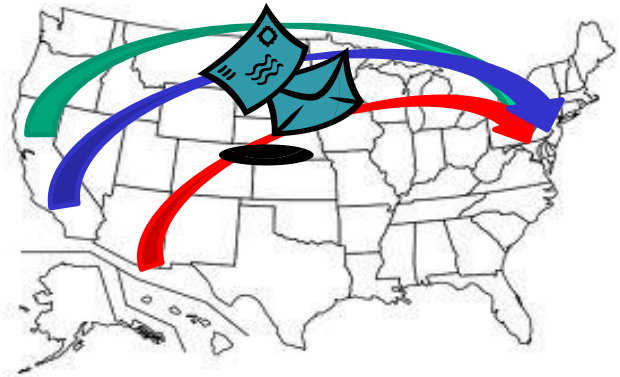

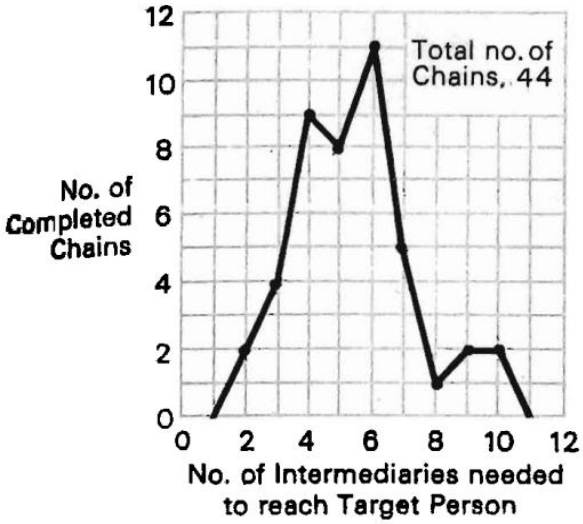

Milgram, S.: The Small-world Problem. Psychology Today 1(1), 61-67 (1967)

The history of social networking (2)

However, there were social networks before Milgram: marriages among the Florentine aristocracy in the 15th century

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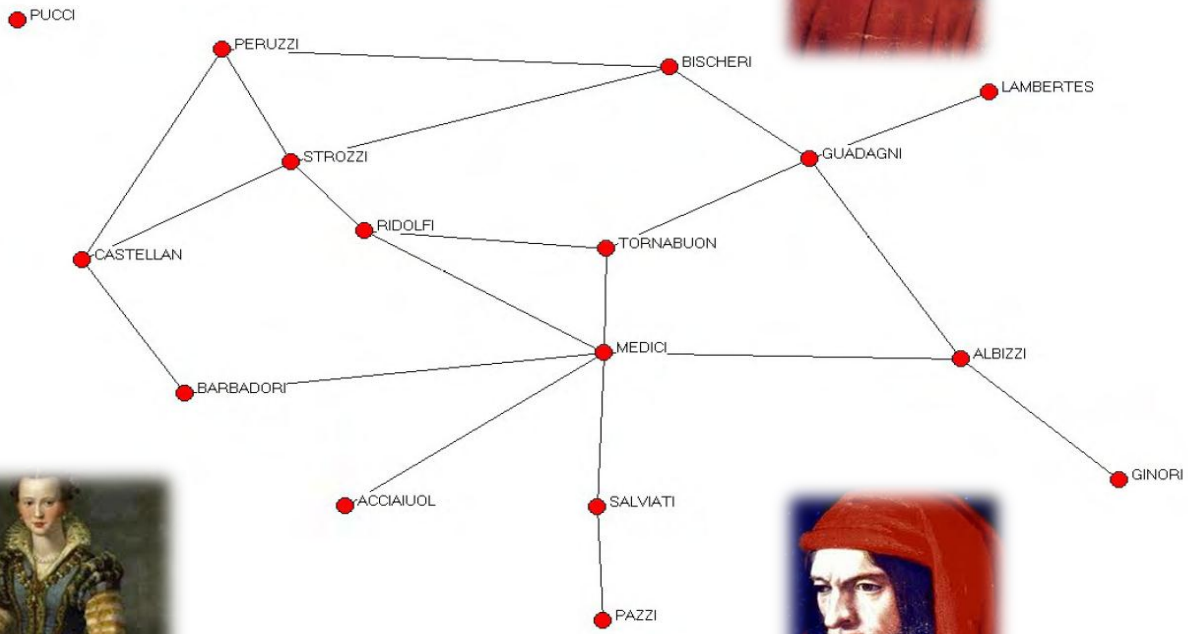


Jackson, M.O. : Social and Economic Networks. Princeton University Press, 2008

The history of social networking (3)

Became a global phenomenon in 2000s with an advent of ICT-enabled social networking sites

- Web 2.0 ("the Social Web")
  - No longer simply about connecting information
  - About connecting people to collaborate in ad-hoc groups
    - Groups are created and dismantled with minimal overhead

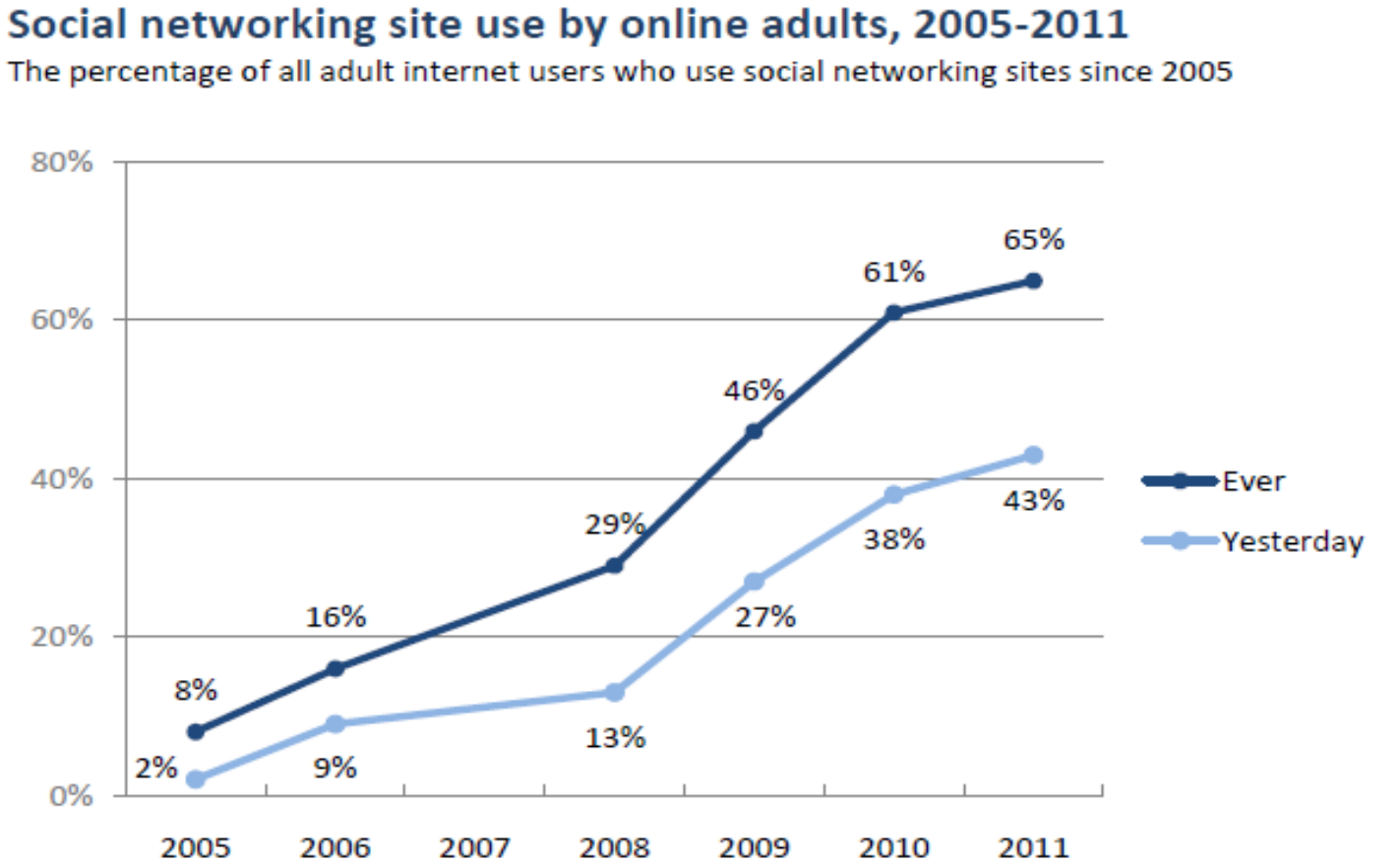
The importance of social networking (1)

Just eight years ago, Zuckerberg's Facebook did not even exist

"For connecting more than half a billion people and mapping the social relations among them, for creating a new system of exchanging information and for changing how we live our lives", **Mark Zuckerberg** was named TIME's 2010 Person of the Year

The importance of social networking (2)

Social networking in peoples' everyday lives



Source: Pew Research Center's Internet & American Life Project surveys: February 2005, August 2006, May 2008, April 2009, May 2010, and May 2011.

The importance of social networking (3)

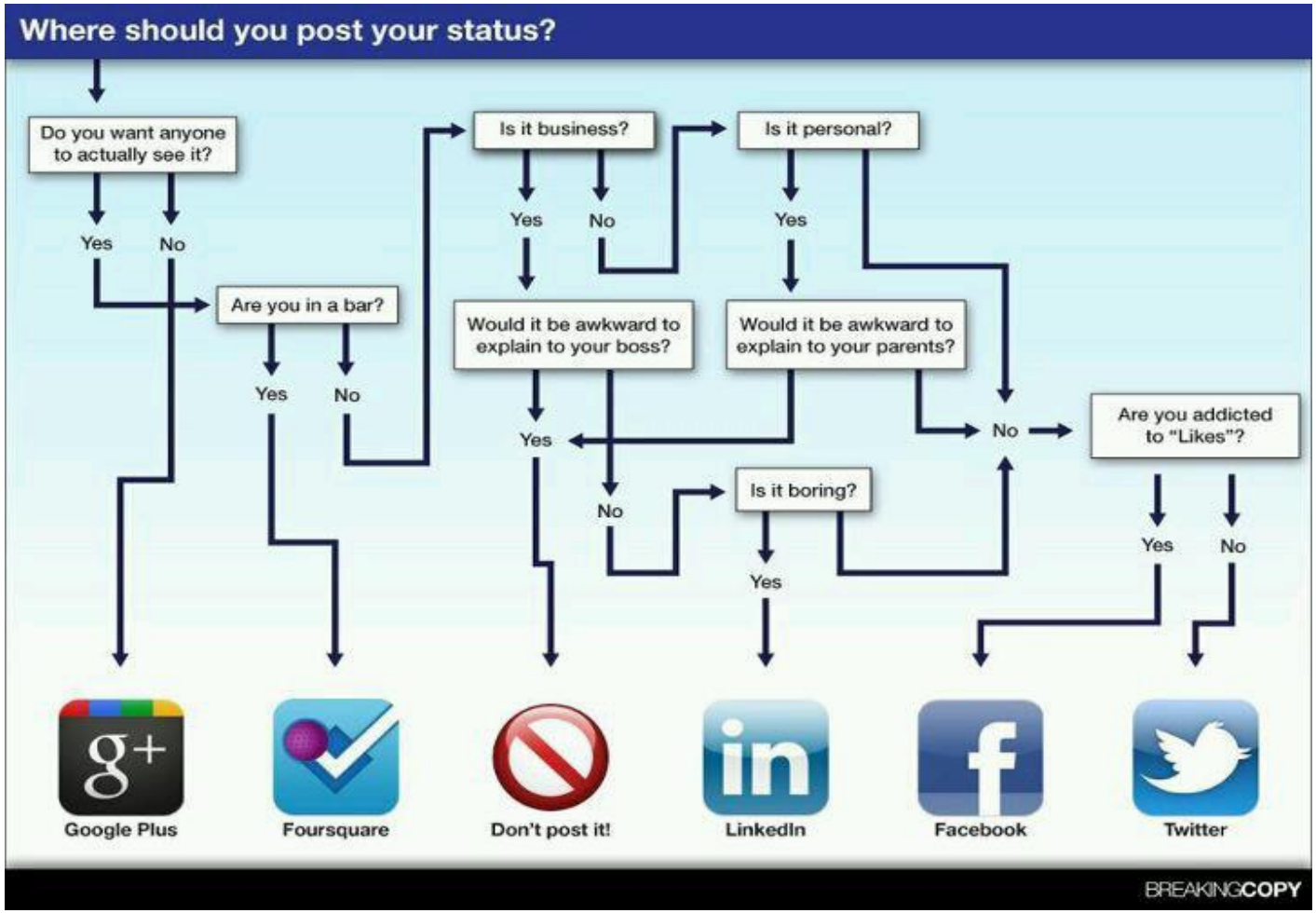
Consuming twice as much of our online time as any other activity

Top 10 Sectors by Share of U.S. Internet Time				
Rank	SubCategory	Share of Time June 2010	Share of Time June 2009	% Change in Share of Time
1	Social Networks	22.7%	15.8%	43%
2	Online Games	10.2%	9.3%	10%
3	E-mail	8.3%	11.5%	-28%
4	Portals	4.4%	5.5%	-19%
5	Instant Messaging	4.0%	4.7%	-15%
6	Videos/Movies	3.9%	3.5%	12%
7	Search	3.5%	3.4%	1%
8	Software Manufacturers	3.3%	3.3%	-0%
9	Multi-category Entertainment	2.8%	3.0%	-7%
10	Classifieds/Auctions	2.7%	2.7%	-2%
	Other	34.3%	37.3%	-8%
Source: The Nielsen Company				

Popular social networks (1)

- **Facebook**
  - 850+ million active users
    - the average user spends more than 55 minutes per day on Facebook
  - Over 1.5 million business pages
- **Twitter**
  - 200 million registered users (100+ million active)
  - 150 million tweets (March 2011) sent per day
    - 1750 tweets per second
- **LinkedIn**
  - 150 million professionals, including all Fortune 500 companies
- **Foursquare**
  - 15+ million registered users
    - 2010 annual growth rate of 3400%
- **Google+**
  - 100+ million registered users
    - 625 thousands new users every day
      - 400 million registered users by the end of 2012?

Popular social networks (2)



http://www.simplyzesty.com

Facebook (1)

Facebook social graph

Facebook (2)

Facebook vs MySpace (2007)

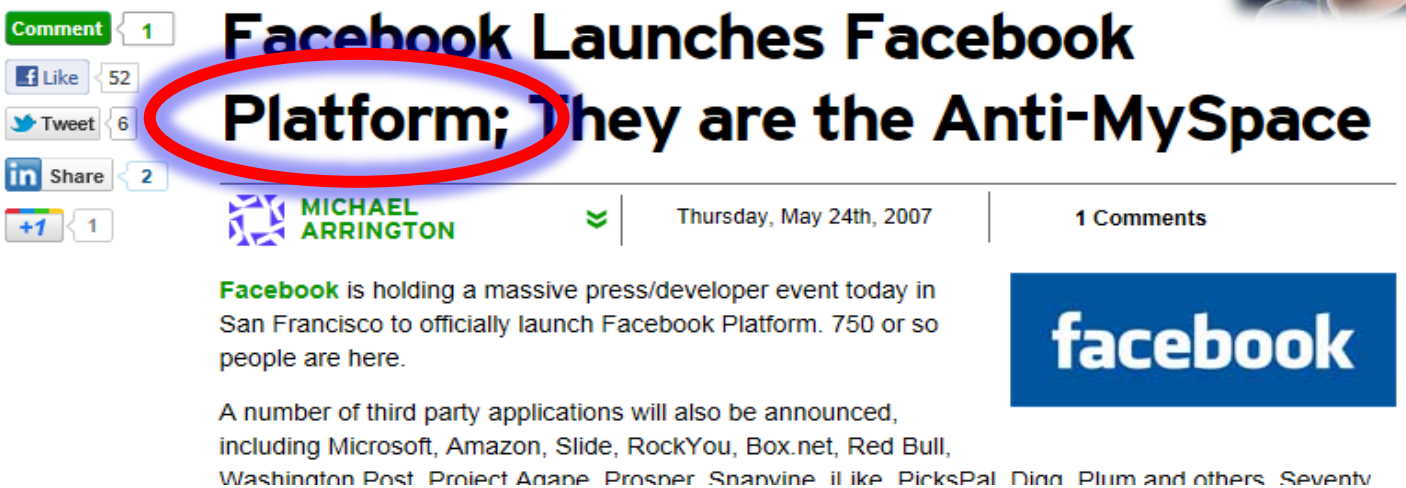
- MySpace does not have public API
  - 3rd parties cannot develop applications

(75)

vs.

(22)

- Facebook goes public with its API
  - 3rd parties can develop applications



Comment 1
Like 52
Tweet 6
Share 2
+1 1

Facebook Launches Facebook Platform; They are the Anti-MySpace

MICHAEL ARRINGTON | Thursday, May 24th, 2007 | 1 Comments

Facebook is holding a massive press/developer event today in San Francisco to officially launch Facebook Platform. 750 or so people are here.

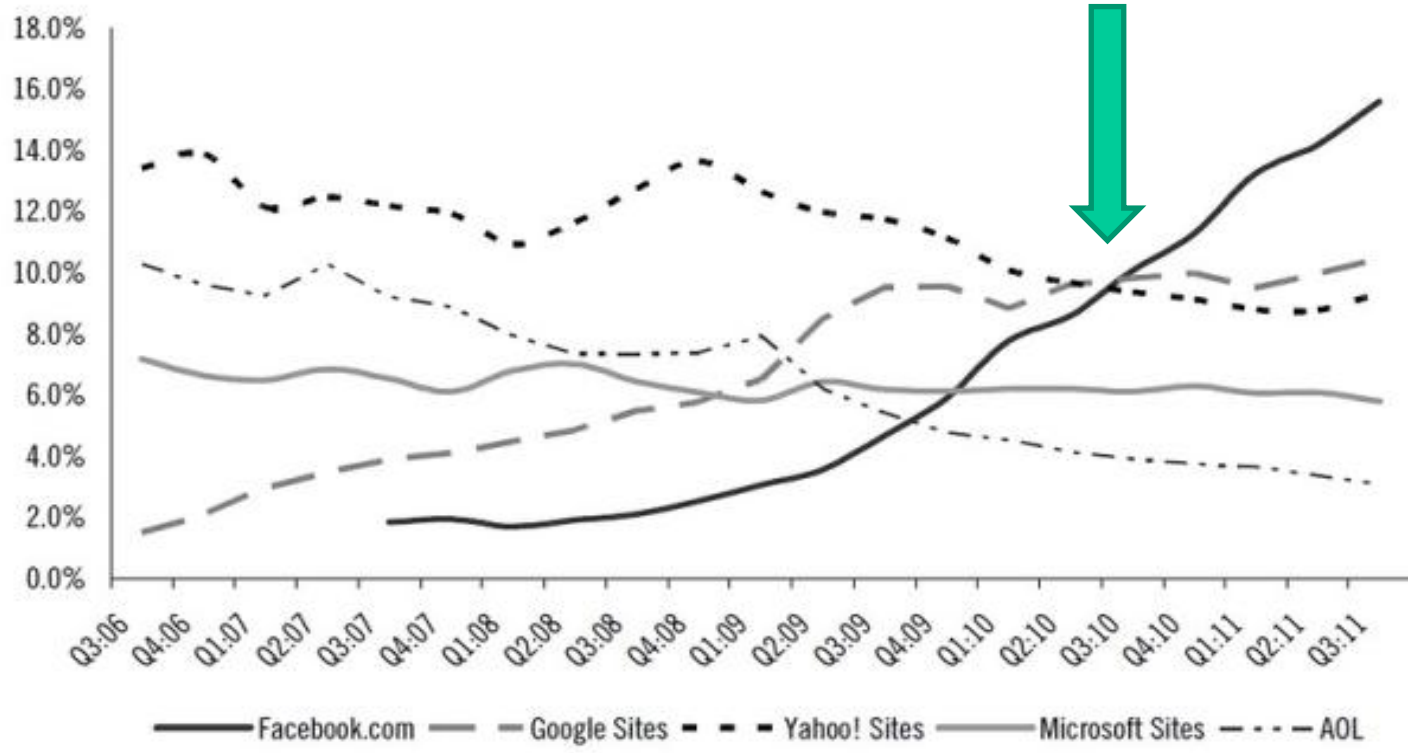
A number of third party applications will also be announced, including Microsoft, Amazon, Slide, RockYou, Box.net, Red Bull, Washington Post, Project Agape, Prosper, Snapvine, iLike, PicksPal, Digg, Plum and others. Seventy

http://techcrunch.com/2007/05/24/facebook-launches-facebook-platform-they-are-the-anti-myspace/

Facebook (3)

How do we spend or online time? (US statistics)

Figure 6. U.S. Share Of Time Spent Online



Source: Citi Investment Research and Analysis

http://www.zdnet.com/blog/facebook/facebook-is-destroying-google-in-time-spent-online-chart/4183

Social Networking as enabler of social (ir)responsibility

Japan earthquake and tsunami 2011, The Arab Spring

Japan earthquake and tsunami 2011 (1)

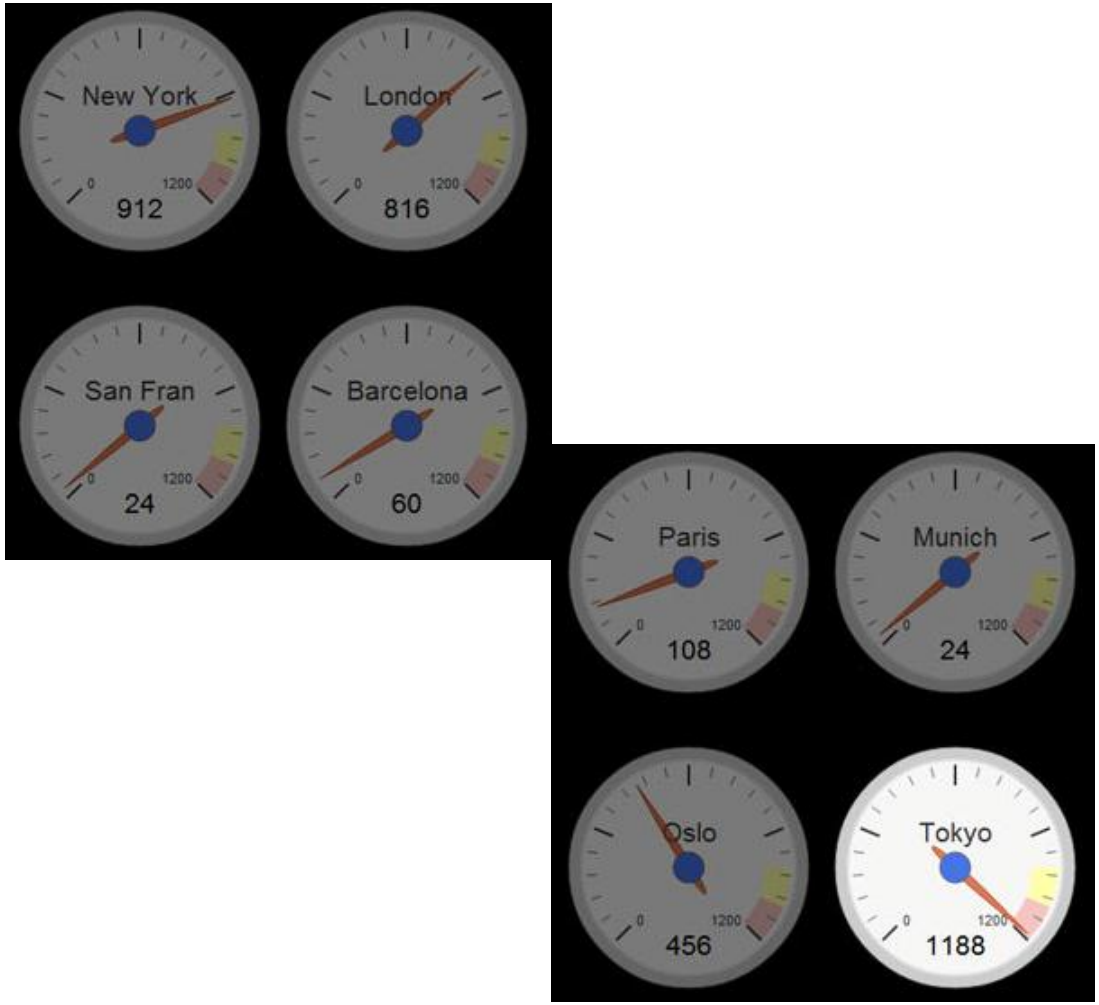
How news spread on Facebook via status messages?

- 4.5 million status updates from 3.8 million users across the world on March 11 that mentioned
  - "Japan"
  - "earthquake"
  - "tsunami"

- Most of these status updates shared news, reports and prayers
- For some, Facebook provided a way to quickly get in touch with loved ones in devastated areas

Japan earthquake and tsunami 2011 (2)

Citizens' reaction on Twitter



- Less than an hour after the quake
  - Country's phone system knocked out
  - The number of tweets coming from Tokyo were topping 1200 per minute

Japan earthquake and tsunami 2011 (3)

Japanese Power Company creates Twitter account for nuclear plant updates

- Tokyo Electric Power Company (TEPCO) has created a Twitter account for its nuclear power plants
  - Keeping Japanese residents, and the rest of the world, informed about the plants that were damaged by the March 11 earthquake and tsunami
    - notifying people of power blackouts and radiation leaks
  - Amassed almost 200 thousand followers in less than a day
  - TEPCO has sent seven tweets until March 18

- Japan's prime minister created a Twitter account after March 11 earthquake and tsunami, as well

The Arab Spring (1)

How Facebook and Twitter supported the Egyptian revolution?

- The revolution in Egypt was driven by the use of social networks

- Protests began on January 25
  - A flood of #Jan25 and #Egypt tweets was launched
  - Creation of Facebook groups that gained hundreds of thousands of members and promoted the protests in Cairo
- The government blocked Facebook and Twitter and eventually shut down Internet access completely
  - Facebook and Twitter users found ways to work around the blackout

The Arab Spring (2)

The power of social media

„Over the past few years, Wael, 30, began working outside the box to make his peers understand that only their unstoppable people power could effect real change. He quickly grasped that social media, notably Facebook, were emerging as the most powerful communication tools to mobilize and develop ideas”

the leader
@
the 2011 TIME 100
most influential people in the world

Wael Ghonim

Spokesman for a Revolution

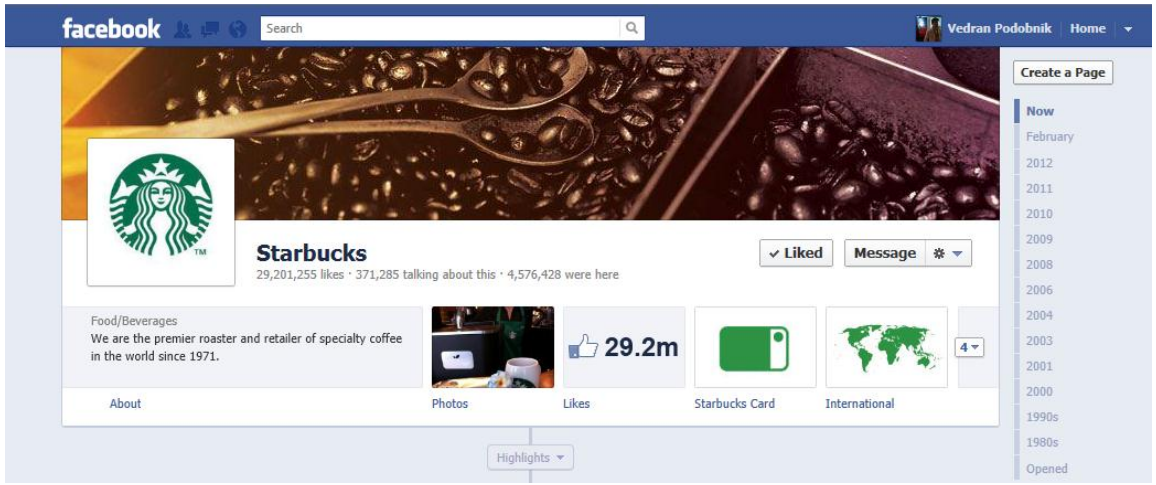
Social Media Marketing (SMM)

The examples of Facebook, Twitter and Foursquare, Socialnumbers

Social Media Marketing (SMM)

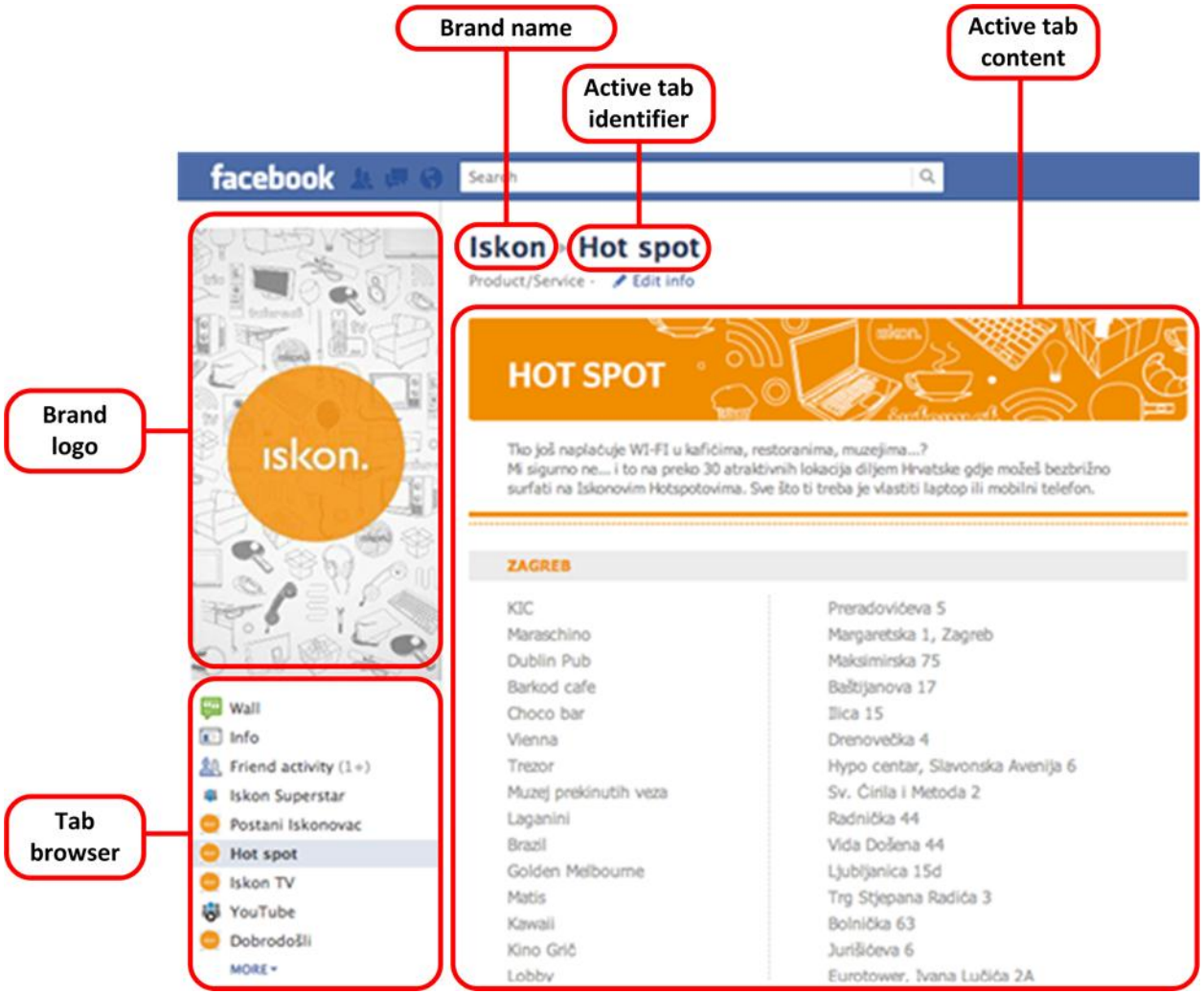
Users do not connect only with other people, but also with brands they interact in real life

- If one reads the New York Times, he/she connects with the profile of the New York Times on a certain social network to follow its updates
- If a user is buying in the Walmart, he/she should be connected with the Walmart Facebook page and Twitter profile
- If one drinks coffee in the Starbucks, he/she should be connected to Starbucks on Facebook and Twitter



SMM on Facebook (1)

Facebook page: an example of the Facebook page for a certain Croatian brand



SMM on Facebook (2)

Facebook page: an example of a status update on a Facebook page

- There are a lot of status updates every minute and usually a user does not have time to read them all
  - EdgeRank mechanism
    - An index which evaluates quality of every posted update on Facebook pages
      - Decision which content to push to users and which content not to push

SMM on Facebook (3)

Facebook page: good practices

- Visually attractive, easy-recognizable and original Facebook page
  - Important to align Facebook page according to brand's existing visual identity
- Good promotion of the Facebook page
  - Important to get as much likers (i.e., users connected to that brand) on Facebook page as possible
- Communication with likers
  - Important to achieve a lot of interaction and feedback from users because of EdgeRank mechanism

SMM on Facebook (4)

Facebook application: An example of a branded Facebook application

- Dynamic social applications on the Facebook platform
  - Sweepstakes and contests
    - Facebook users play games with their Facebook friends with goal of getting a prize

SMM on Facebook (5)

Facebook adds: located in the right-hand column of a Facebook page

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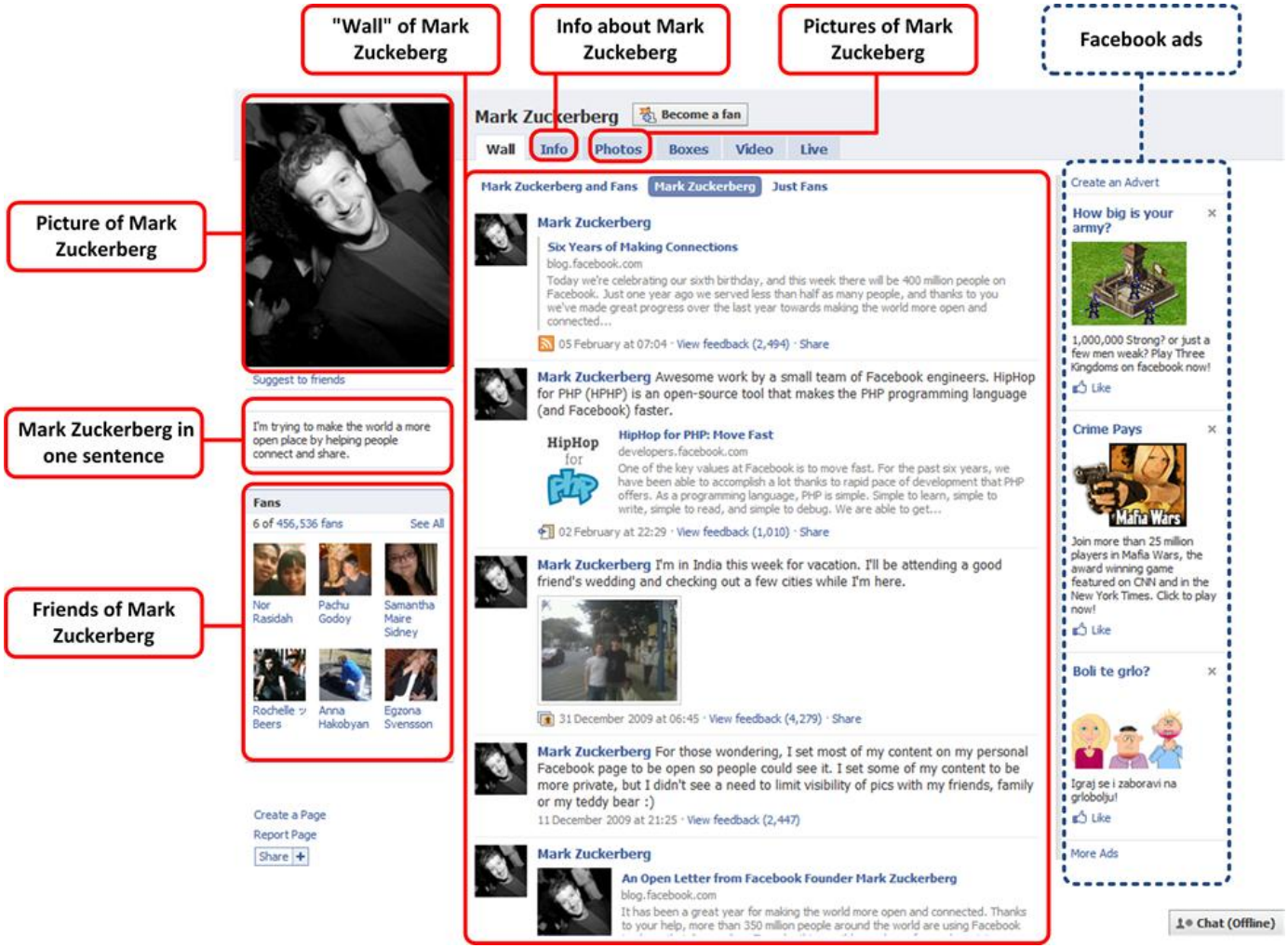
- Cost-per-Click
  - CPC
- Cost-per-Impression
  - CPM
- Average prices depend on country
  - Netherlands (18/213)
    - CPC: $0.50
    - CPM: $0.22
  - Croatia (137/213)
    - CPC: $0.14
    - CPM: $0.06



SMM on Facebook (6)

Facebook adds: target users based on user profile information

- Gender (e.g., fragrance ad targets only female users)
- Age (e.g., clothes ad targets only teenagers);
- Location (e.g., event ad targets only users currently located in Rotterdam)
- Interests (e.g., concert ad targets only users which liked Facebook page of a band which performs on that concert);
- Relationship status (e.g., divorce lawyer ad targets only married users)

- If a Croatian photographer wants to sell service of a wedding photography he/she can create Facebook ad which will target engaged users located in Croatia and having between 20 and 30 years

SMM on Twitter

Facebook adds: Twitter brand profile: similar to Facebook page cancept

SMM on Foursquare (1)

Foursquare: a location-based social networking service

- Difference from Facebook and Twitter is that users do not exchange status updates and tweets about what are they doing and thinking
  - They exchange information about their current location by checking into places

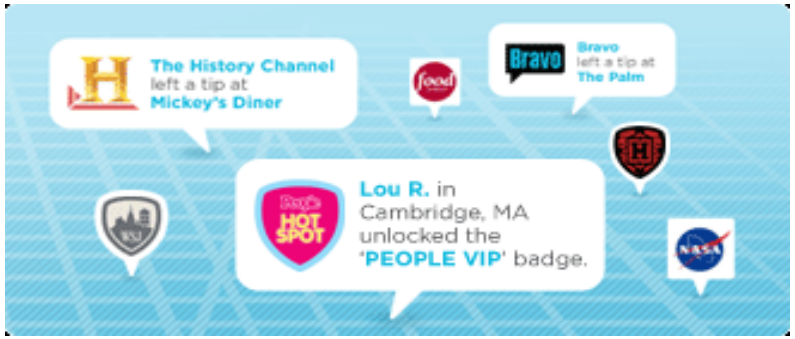
- Foursquare offers different ways for brand marketing when compared to Facebook and Twitter

SMM on Foursquare (2)

Foursquare Venue vs Foursquare Brands

Foursquare Venue

targets brands with physical location (e.g., restaurants, cafes, hotels, stores)



Foursquare Brands

primarily targets brands without physical location (e.g., Coca Cola), but it can be used by brands with physical location as well

https://foursquare.com/business

SMM on Foursquare (3)

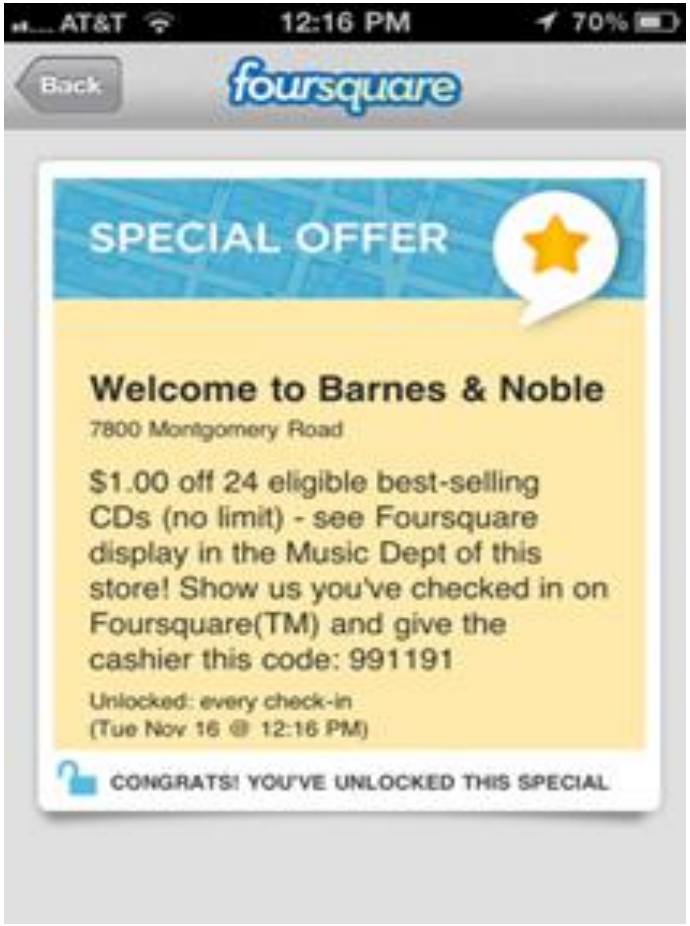
Foursquare Venue (1)

- The Foursquare Venue represents a place where users can check in and get some reward for that action
  - This reward is referred to as the Special
    - The most popular Specials are:
      - **A discount with purchase**
        - E.g., when you check in in a clothes store, you get $20 off for every $100 spent
      - **Something for free**
        - E.g., when you check in a supermarket, you get a bag of chips for free if you buy a pack of beer
      - **Special treatment**
        - E.g., when you check in a student canteen, you get access to the fast track service
      - **Reward your best customers**
        - E.g., when you check in in the restaurant on your fifth visit, you get free drink

SMM on Foursquare (4)

Foursquare Venue (2)

Foursquare Venue



Foursquare Special

SMM on Foursquare (5)

Foursquare Brand

- On Foursquare users can connect with their friends but also with brands
  - Brands can leave comments and suggestions (called tips) on various locations and users will get those comments when they check in at targeted locations
    - The Iceland Tourist Board left entertaining (but also educational) comments on all popular tourist locations
      - When a tourist checks in at one of Iceland's airports he/she gets the following comment:

"This is an airport where most of my visitors land when they visit me in flying machines. (Don't worry, it does not hurt when they land.) It is close to my Blue Lagoon, where many humans like to swim".

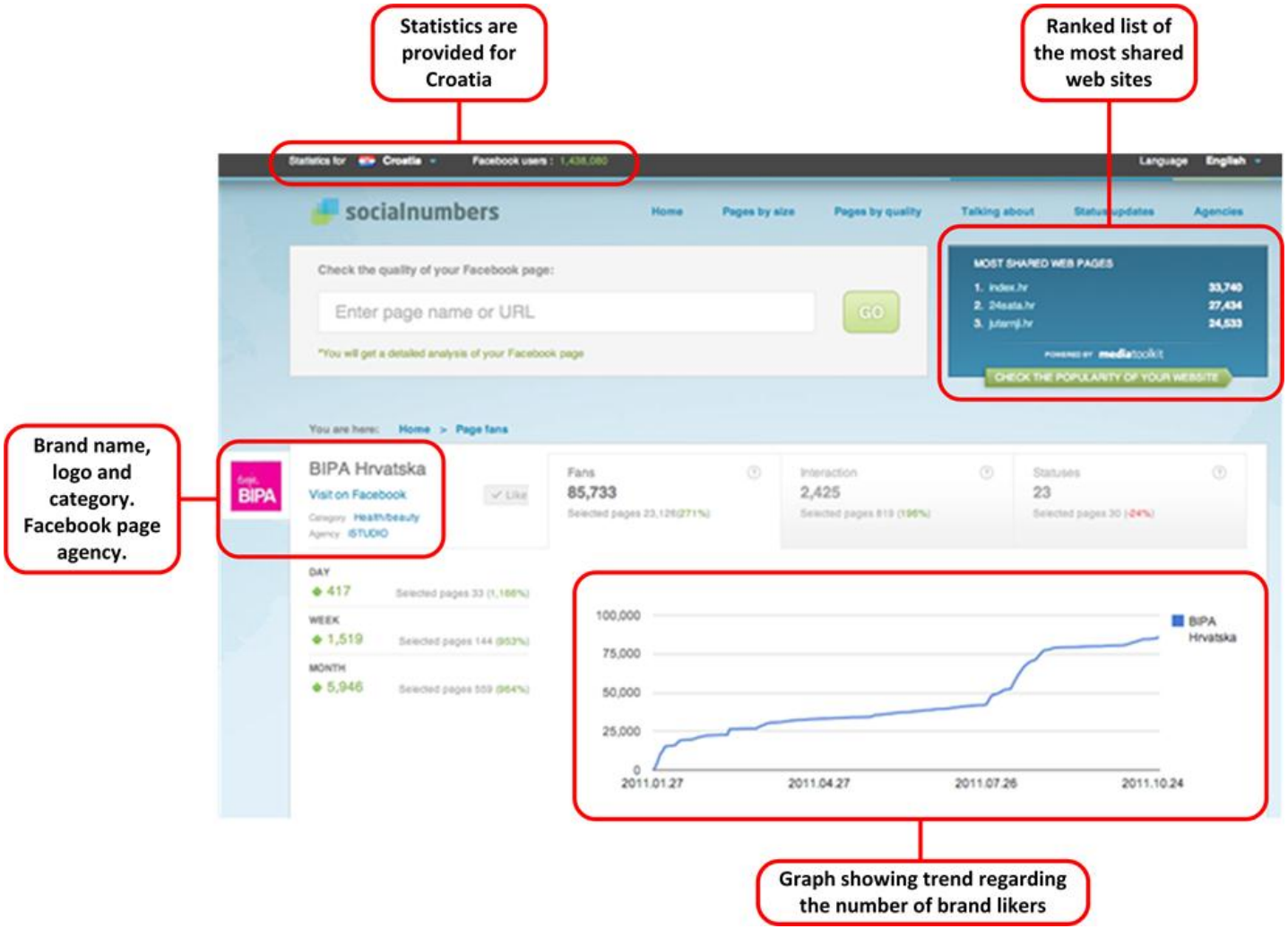
Socialnumbers (1)

A portal offering rich statistical information about Facebook pages in Europe

- Information of interest to brand and community managers, marketing agencies, journalists, bloggers, academics and all others interested in Facebook marketing
  - Ranked lists of Facebook pages by size and by quality
  - Specific graphs for every Facebook page showing trends regarding the number of likers, frequency of interactions and distribution of status updates
  - Ranked list of the top status updates from Facebook pages
  - Ranked list of the top social media agencies
  - Ranked list of the most shared web sites

Socialnumbers (2)

A screenshot of the Socialnumbers website



http://socialnumbers.com

Socialnumbers (3)

Netherlands: Facebook pages by size

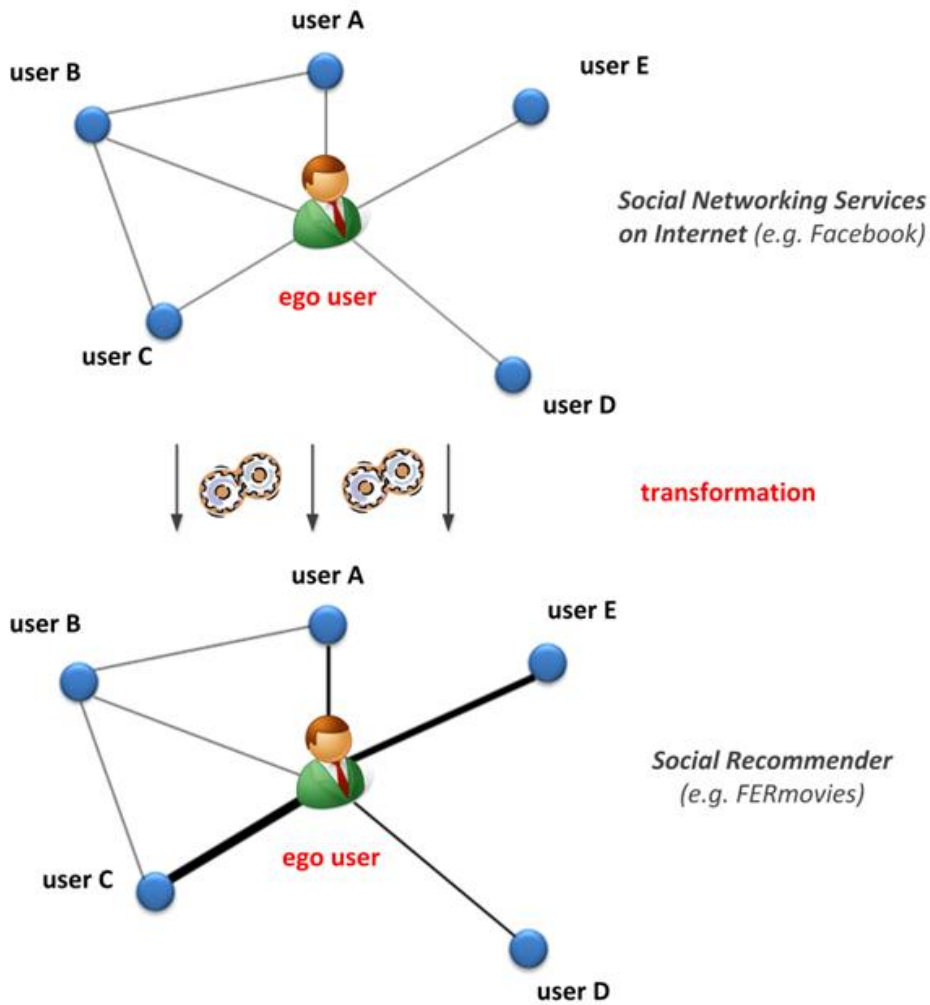
PAGES BY SIZE	DAY	WEEK	MONTH	FANS
Tiësto (Claim this page)	32,483	119,169	514,173	11,349,512
Heineken (Claim this page)	13,562	52,123	286,301	6,058,732
Armin van Buuren (Claim this page)	8,644	36,241	186,773	4,118,366
Within Temptation (Claim this page)	2,127	8,024	39,029	1,491,566
Edwin Van der Saar (Claim this page)	2,366	9,556	68,405	1,280,002

Social Recommender

Social trust, FERmovies: social movie recommender

Social recommender (1)

How to calculate trust between Facebook users?



Social recommender (2)

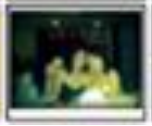
FERmovies social recommender implementation – Facebook activities

$$idx = \frac{3 * x1 + 2 * x2 + x3 + 3 * p1 + 2 * p2}{11}$$

Label	Description
idx	interaction index - coefficient of interaction of the ego user with his/her friends over the past three months
x1	total number of announcements on ego user's Facebook profile from his/her friend in last 3 months
x2	total number of comments on ego user's Facebook profile from his/her friend in the last 3 months
x3	total number of "likes" on ego user's Facebook profile from his/her friend in last 3 months
p1	total number of common occurrences of the ego user and his/her friend in last 6 months
p2	total number of ego user's friend property files that the ego user appears in during the last 6 months

Social recommender (3)

FERmovies social recommender user application – Facebook activities

Rank	Facebook photo	Name	Interaction index
[1.]		Goran Jelen	85
[2.]		Danijela Štriga	64
[3.]		Sanela Briški	38
[4.]		Tomislav Vus	26
[5.]		Natalija Jurkin	21

Social recommender (4)

FERmovies social recommender implementation – Facebook profiles

$$psimx = \frac{\frac{l_{common}}{l_{total}} + \frac{g_{common}}{g_{total}}}{2}$$

$$simx = \frac{3 * \frac{f_{common}}{f_{total}} + \frac{m_{common}}{m_{total}} + \frac{l_{common}}{l_{total}} + \frac{g_{common}}{g_{total}} + 5 * idx}{11}$$

Label	description
f_common	total number of common movies between the ego user and his/her friend
f_total	total number of ego user movies
l_common	total number of common content likes between the ego user and his/her friend
l_total	total number of ego user content likes
g_common	total number of common groups of the ego user and his/her friend
g_total	total number of ego user groups
m_common	total number of common music likes between the ego user and his/her friend
m_total	total number of ego user music likes
simx	similarity index
psimx	partial similarity index

Social recommender (5)

FERmovies social recommender user application – Facebook profiles

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Facebook Top Friends			
Rank	Facebook photo	Name	Similarity index
[1.]		Danijela Štriga	426.56
[2.]		Sanela Briški	246.87
[3.]		Tomislav Vus	182.63
[4.]		Vedran Podobnik	5.35
[5.]		Kristijan Katalenić	4.01

Facebook Top Friends			
Rank	Facebook photo	Name	Partial similarity index
[1.]		Danijela Štriga	145.53
[2.]		Sanela Briški	117.95
[3.]		Tomislav Vus	117.7
[4.]		Vedran Podobnik	21.01
[5.]		Kristijan Katalenić	15.76

Social recommender (6)

FERmovies social recommender – movie recommender

Friend's Recommendation			
Action	**Movie name**	**Movie info**	**Trailer**
[1.]	Ocean's Thirteen	Info IMDb	YouTube trailer
[2.]	Crossroads	Info IMDb	YouTube trailer
[3.]	Titanic	Info IMDb	YouTube trailer
Adventure	**Movie name**	**Movie info**	**Trailer**
[1.]	Crossroads	Info IMDb	YouTube trailer
Drama	**Movie name**	**Movie info**	**Trailer**
[1.]	Ocean's Thirteen	Info IMDb	YouTube trailer
[2.]	Wicker Park	Info IMDb	YouTube trailer
[3.]	Seven Pounds	Info IMDb	YouTube trailer
[4.]	Crossroads	Info IMDb	YouTube trailer
[5.]	Shutter Island	Info IMDb	YouTube trailer
[6.]	Dirty Dancing	Info IMDb	YouTube trailer
[7.]	Titanic	Info IMDb	YouTube trailer
[8.]	Youth in Revolt	Info IMDb	YouTube trailer

Paradigm switch from Customer Relationship Management (CRM) to Customer-Managed Relationship (CMR)

Implicit social networking

Podobnik, V.; Lovrek, I.: Telco Agent: Enabler of Paradigm Shift towards Customer-Managed Relationship. Lecture Notes in Computer Science. 6276 (2010); 251-260.

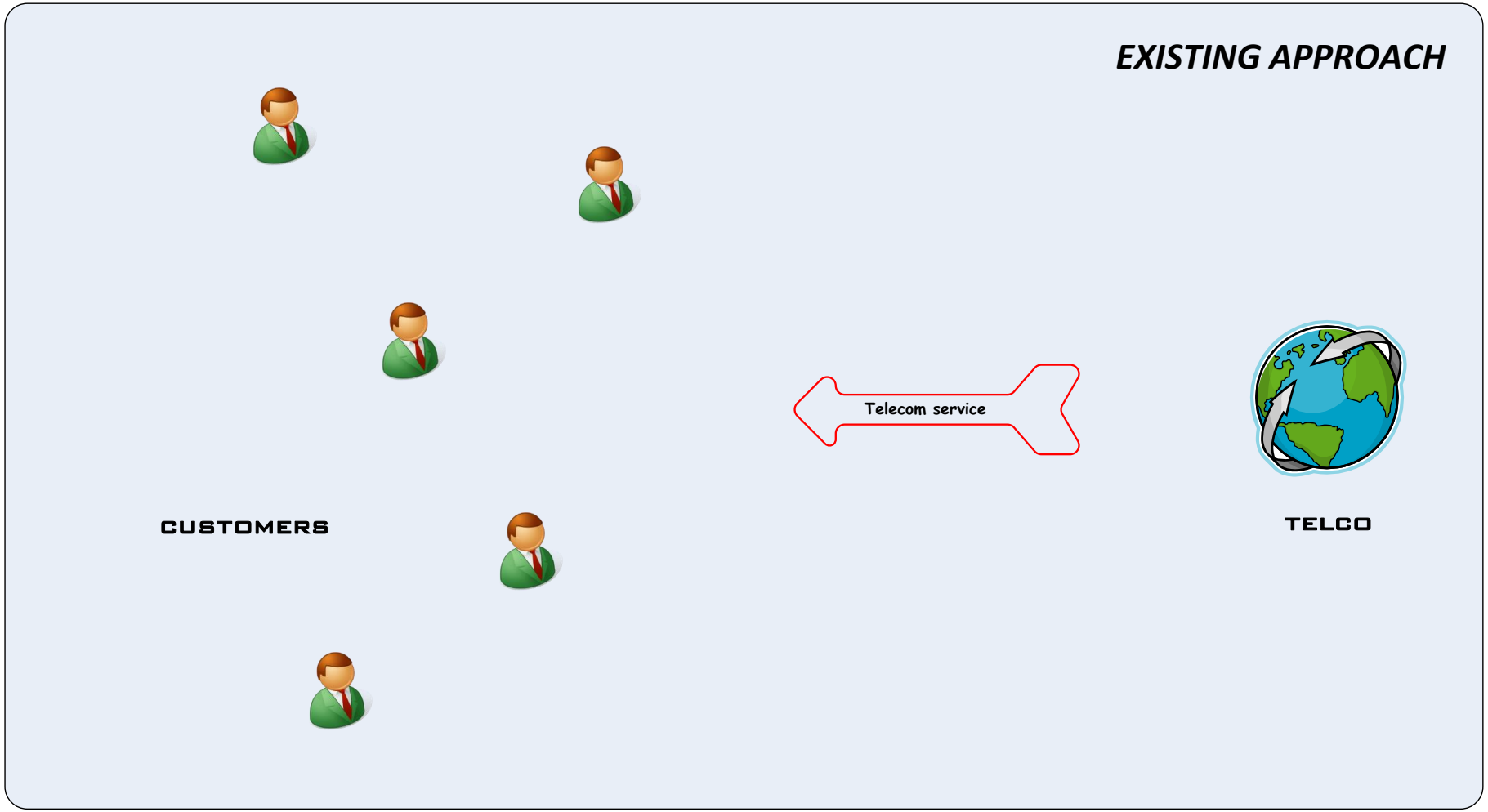
Research problem

Paradigm shift from the CRM towards the CMR

- Environment
  - Telco industry
- **C**ustomer **R**elationship **M**anagement (**CRM**)
  - **Companies** are in the control of company-customer relationship
- **C**ustomer-**M**anaged Relationship (**CMR**)
  - **Customers** are in the control of company-customer relationship
  - Dynamic interactions
  - Personalized and context-aware services

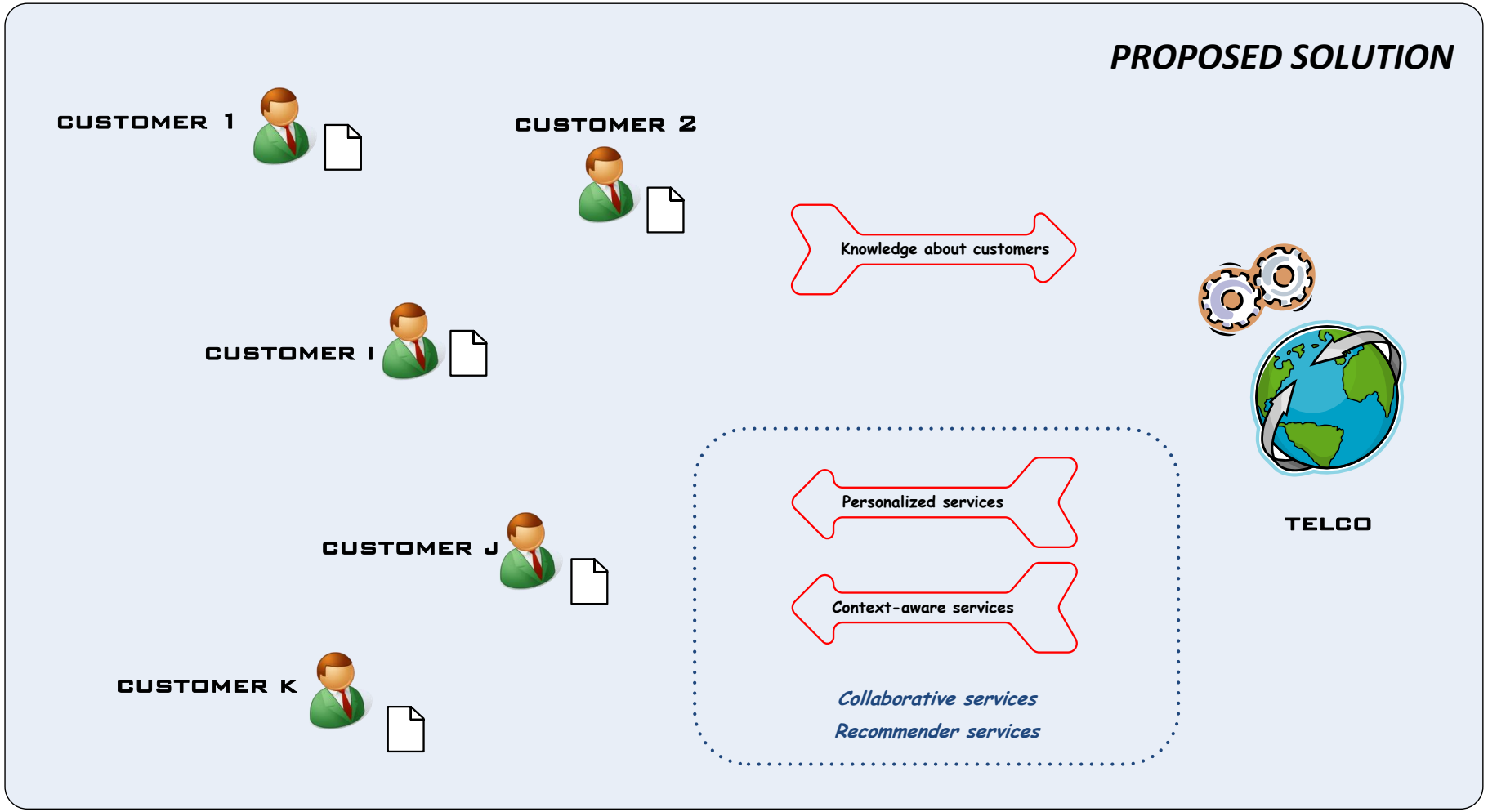
Proposed solution (1)

Existing approach in telecom service provisioning



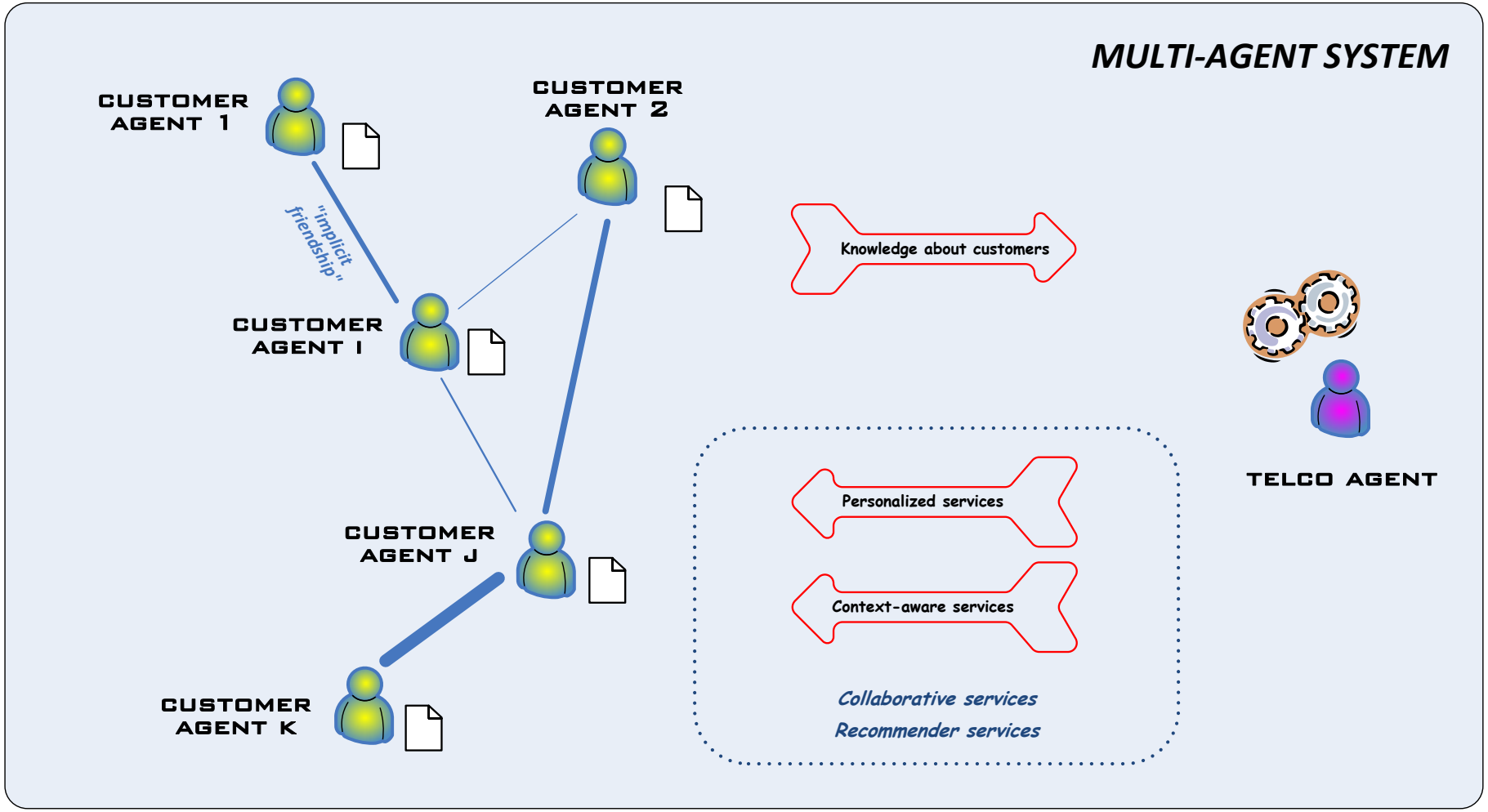
Proposed solution (2)

Telco gathers and uses knowledge about customers



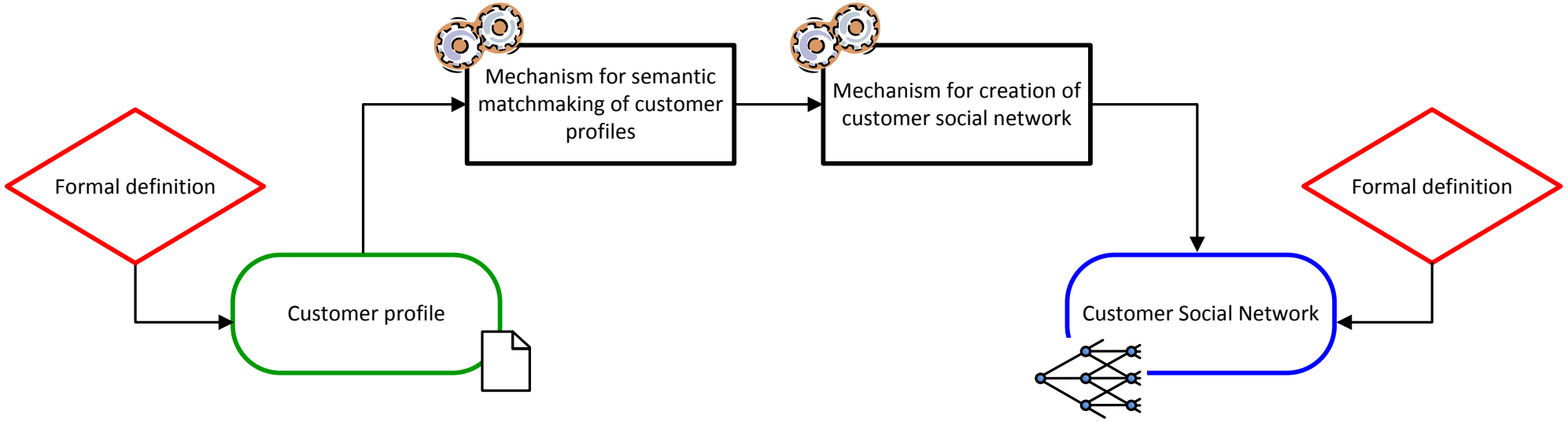
Proposed solution (3)

Software agents enable implicit social networking of customers with profiles



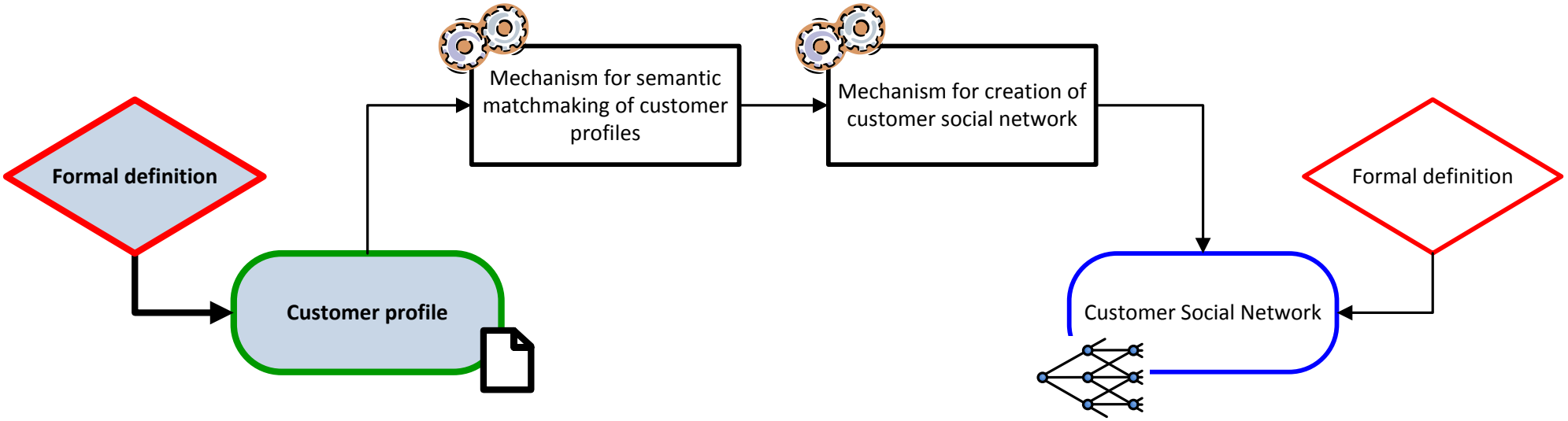
Customer social network (1)

A network creation process



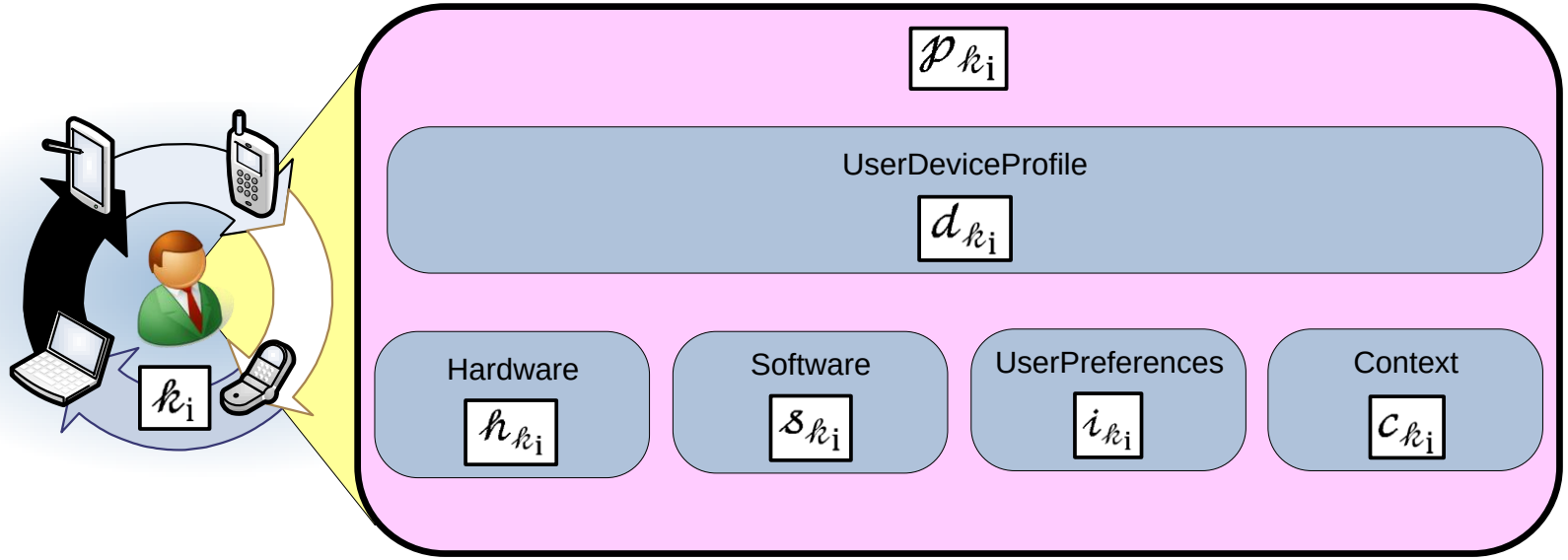
Customer social network (2)

Customer profiles



Customer profiles (1)

The profile structure

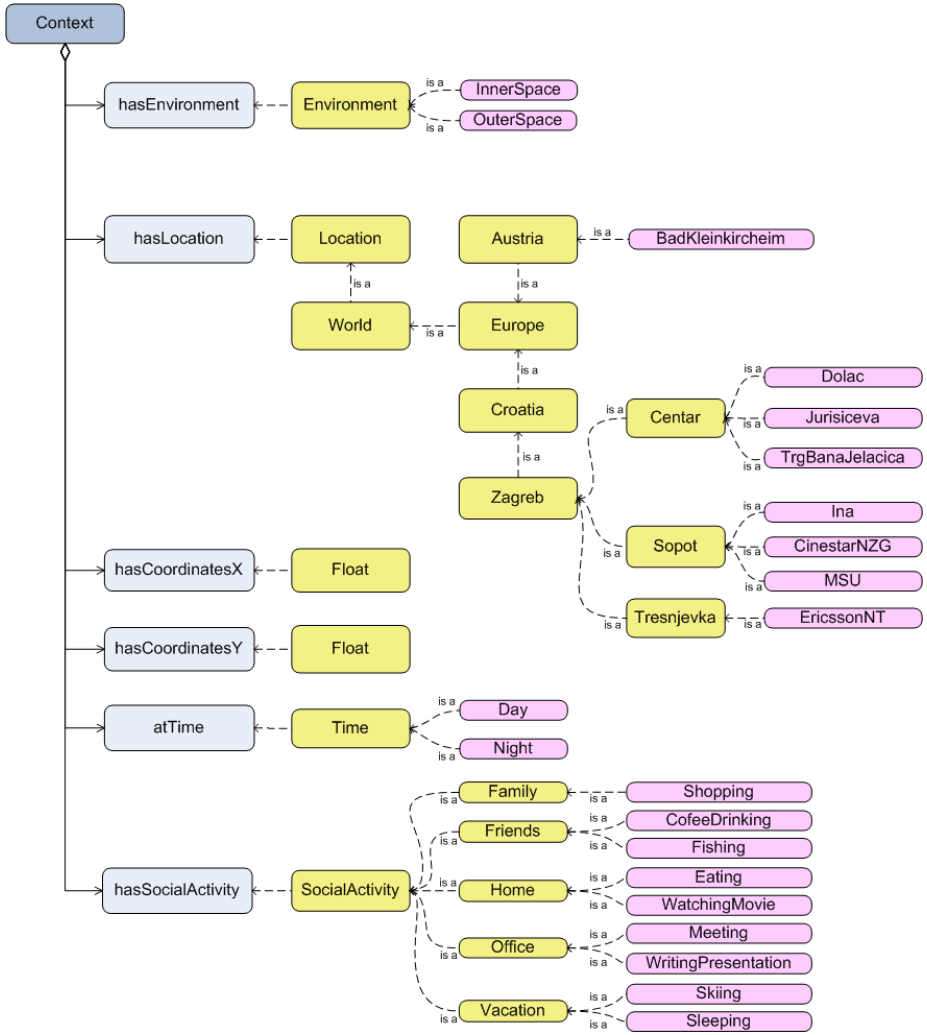


$$\mathcal{p}_{\mathcal{k}_i} = \left(d_{\mathcal{k}_i}, \mathcal{h}_{\mathcal{k}_i}, \mathcal{s}_{\mathcal{k}_i}, i_{\mathcal{k}_i}, c_{\mathcal{k}_i}\right)$$

- information about customer *device type* ($d_{\mathcal{k}_i}$)
- attributes defining the customer device *hardware* ($\mathcal{h}_{\mathcal{k}_i}$)
- attributes defining the customer device *software* ($\mathcal{s}_{\mathcal{k}_i}$)
- attributes defining the customer *interests and preferences* ($i_{\mathcal{k}_i}$)
- attributes defining the customer *context* ($c_{\mathcal{k}_i}$)

Customer profiles (2)

The customer context



Attribute	Codomain	Attribute description
hasEnvironment	Environment	The customer environment– inner or outer space.
hasLocation	Location	The customer location described with an address.
hasCoordinatesX	float	The customer location described with a GPS-coordinate (x-axis).
hasCoordinatesY	float	The customer location described with a GPS-coordinate (y-axis).
atTime	Time	The service provisioning timing – a day or a night.
hasSocialActivity	SocialActivity	The customer social activity.

Customer profiles (3)

The profile with all attributes

UserDeviceProfile

- MobilePhoneProfile: SonyEricssonK700

Hardware

- hasAvailableMemory: 18000
- hasHorizontalScreenResolution: 180
- hasVerticalScreenResolution: 230
- hasScreenBitsPerPixel: 16
- hasImei: 35461002-303538-0-34

Software

- hasOs: BasicOS
- hasBrowser: SonyEricssonBrowser
- hasJavaVersion: 15

UserPreferences

- hasPreferredInformationType: PlainText
- hasPreferredInformationservice: CroatiaPoliticsInstance
- hasPreferredLanguage: English
- hasPreferredGenre: RockMusic
- hasPreferredQoS: Silver
- hasPreferredDeliveryType: NonStreaming

Context

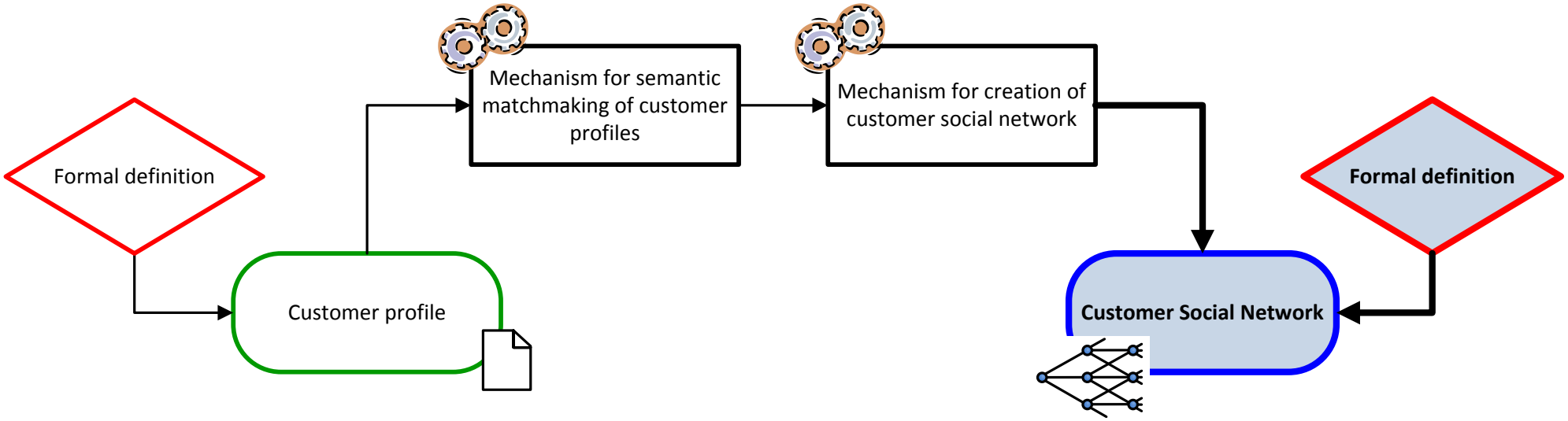
- hasEnvironment: InnerSpace
- hasLocation: Ina
- hasCoordinatesX: 50.21389
- hasCoordinatesY: 48.21389
- atTime: Night
- hasSocialActivity: WritingPresentation

Customer profiles (4)

The profile with all attributes (RDF document)


```
<?xml version="1.0"?>
<rdf:RDF
    xmlns="http://www.tel.fer.hr/astorm/InfoServiceV2.owl#"
    xmlns:is="http://www.tel.fer.hr/astorm/InfoServiceV2.owl#"
    xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
    xmlns:xsd="http://www.w3.org/2001/XMLSchema#"
    xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
    xmlns:owl="http://www.w3.org/2002/07/owl#"
    xml:base="http://www.tel.fer.hr/astorm/User1.owl">

<!-- profile for User1's mobile phone Sony Ericsson K700 -->
    <is:MobilePhoneProfile rdf:ID="SonyEricssonK700">

<!-- hardware -->
    <is:hasAvailableMemory rdf:datatype="http://www.w3.org/2001/XMLSchema#int">18000</is:hasAvailableMemory>
    <is:hasHorizontalScreenResolution rdf:datatype="http://www.w3.org/2001/XMLSchema#int">180</is:hasHorizontalScreenResolution>
    <is:hasVerticalScreenResolution rdf:datatype="http://www.w3.org/2001/XMLSchema#int">230</is:hasVerticalScreenResolution>
    <is:hasScreenBitsPerPixel rdf:datatype="http://www.w3.org/2001/XMLSchema#int">16</is:hasScreenBitsPerPixel>
    <is:hasImei rdf:datatype="http://www.w3.org/2001/XMLSchema#string">35461002-303538-0-34</is:hasImei>

<!-- software -->
    <is:hasOs rdf:resource="http://www.tel.fer.hr/astorm/InfoServiceV2.owl#BasicOs"/>
    <is:hasBrowser rdf:resource="http://www.tel.fer.hr/astorm/InfoServiceV2.owl#SonyEricssonBrowser"/>
    <is:hasJavaVersion rdf:datatype="http://www.w3.org/2001/XMLSchema#int">15</is:hasJavaVersion>

<!-- user preferences -->
    <is:hasPreferredInformationType rdf:resource="http://www.tel.fer.hr/astorm/InfoServiceV2.owl#PlainText"/>
    <is:hasPreferredInformationService rdf:resource="http://www.tel.fer.hr/astorm/InfoServiceV2.owl#CroatiaPoliticsInstance"/>
    <is:hasPreferredLanguage rdf:resource="http://www.tel.fer.hr/astorm/InfoServiceV2.owl#English"/>
    <is:hasPreferredGenre rdf:resource="http://www.tel.fer.hr/astorm/InfoServiceV2.owl#RockMusic"/>
    <is:hasPreferredQoS rdf:resource="http://www.tel.fer.hr/astorm/InfoServiceV2.owl#Silver"/>
    <is:hasPreferredDeliveryType rdf:resource="http://www.tel.fer.hr/astorm/InfoServiceV2.owl#NonStreaming"/>

<!-- context -->
    <is:hasEnvironment rdf:resource="http://www.tel.fer.hr/astorm/InfoServiceV2.owl#InnerSpace"/>
    <is:hasLocation rdf:resource="http://www.tel.fer.hr/astorm/InfoServiceV2.owl#Ina"/>
    <is:hasCoordinatesX rdf:datatype="http://www.w3.org/2001/XMLSchema#float">50.21389</is:hasCoordinatesX>
    <is:hasCoordinatesY rdf:datatype="http://www.w3.org/2001/XMLSchema#float">48.21389</is:hasCoordinatesY>
    <is:atTime rdf:resource="http://www.tel.fer.hr/astorm/InfoServiceV2.owl#Night"/>
    <is:hasSocialActivity rdf:resource="http://www.tel.fer.hr/astorm/InfoServiceV2.owl#WritingPresentation"/>

    </is:MobilePhoneProfile>
</rdf:RDF>
```

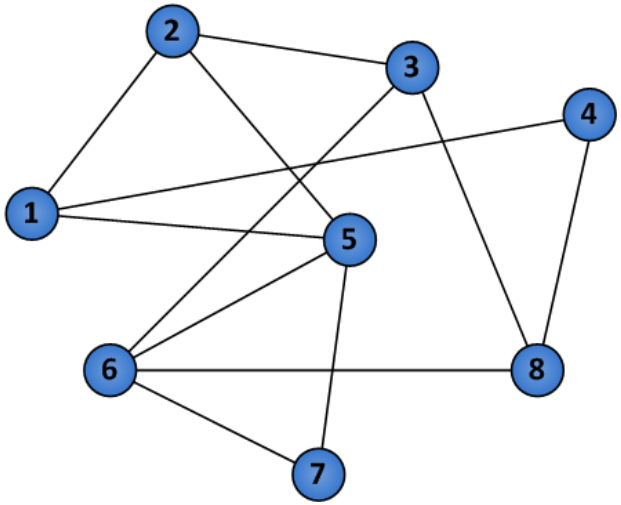
Customer social network (3)



Customer social network (4)

A formal definition with graph and matrix

undirected graph

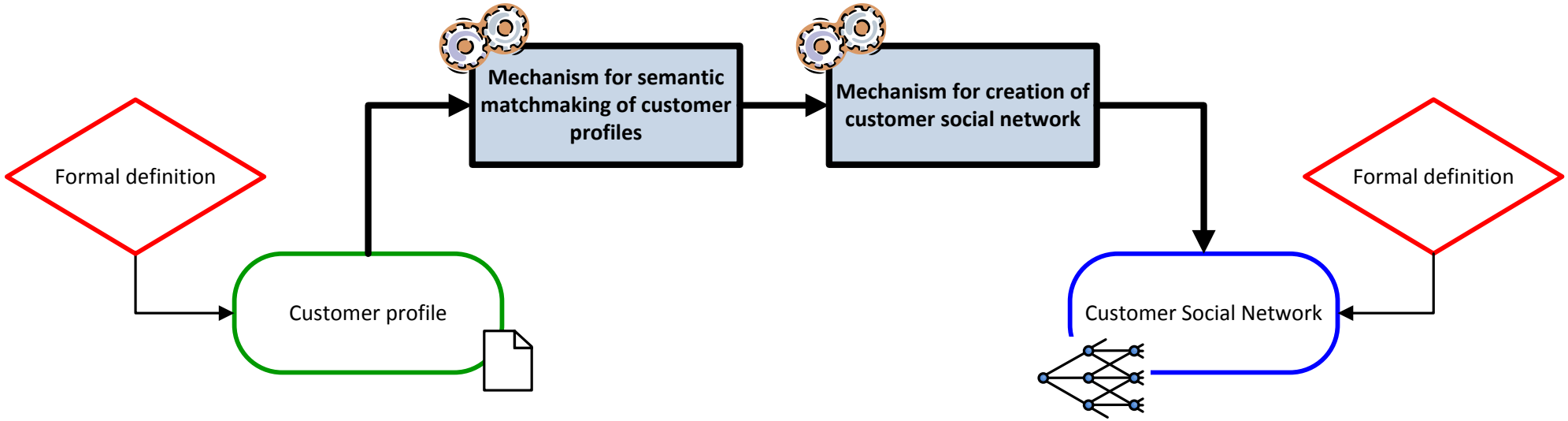


adjacency matrix

$$[\mathcal{G}] = \begin{bmatrix} \mathbf{0} & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 1 & \mathbf{0} & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & \mathbf{0} & 0 & 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & \mathbf{0} & 0 & 0 & 0 & 1 \\ 1 & 1 & 0 & 0 & \mathbf{0} & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & \mathbf{0} & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & \mathbf{0} & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 & \mathbf{0} \end{bmatrix}$$

Customer social network (5)

A creation of social network



Creation of social network (1)

Mechanism for semantic matchmaking of customer profiles

$$usp\left(p_{k_i}, p_{k_j}\right): \mathcal{P} \times \mathcal{P} \rightarrow [0, 1]$$

- Arguments
  - Two customer profiles
- Result
  - Real number with value between 0 and 1
    - The result 0 stands for completely different profiles
    - The result 1 stands for identical profiles
- The higher result value stands for higher similarity between profiles
- Symmetry:

$$usp\left(p_{k_i}, p_{k_j}\right) = usp\left(p_{k_j}, p_{k_i}\right)$$

Mechanism for semantic matchmaking of customer profiles

A matchmaking example (all attribute weights set to the same value, attribute comparison worth 70%)

Department of Telecommunications

		Attribute	Type	P_{E_i}	P_{E_j}	Score
1	Device	ProfileClass	*class*	MobilePhoneProfile	LaptopProfile	0.250
2	Hardware	hasAvailableMemory	*integer*	18000	1000000	0.018
3		hasHorizontalResolution	*integer*	180	1600	0.113
4		hasVerticalResolution	*integer*	230	1050	0.219
5		hasBitsPerPixel	*integer*	16	32	0.500
6		hasImei	*string*	35461002-303538-0-34		0.000
7	Software	hasOs	*instance*	BasicOs	WindowsVista	0.500
8		hasBrowser	*instance*	SonyEricssonBrowser	MozillaFirefox	0.500
9		hasJavaVersion	*integer*	15	16	0.938
10	Preferences	hasPreferredInformationType	*instance*	PlainText	Avi	0.333
11		hasPreferredInformationService	*instance*	CroatiaPoliticsInstance	MoviesInstance	0.333
12		hasPreferredLanguage	*instance*	English	Hrvatski	0.500
13		hasPreferredGenre	*instance*	RockMusic	ThrillerMovie	0.333
14		hasPreferredQoS	*instance*	Silver	Gold	0.500
15		hasPreferredDeliveryType	*instance*	NonStreaming	Streaming	0.500
16	Context	hasEnvironment	*instance*	InnerSpace	InnerSpace	1.000
17		hasLocation	*instance*	Ina	TrgBanaJelacica	0.286
18		hasCoordinatesX	*float*	50.21459	30.21389	0.602
19		hasCoordinatesY	*float*	48.21344	41.21389	0.855
20		atTime	*instance*	Night	Night	1.000
21		hasSocialActivity	*instance*	WritingPresentation	CoffeDrinking	0.333
					Profile similarity	***0.427***

Creation of social network (2)

Mechanism for creation of customer social network

$$idm\left([mat]_{usp_{p_{k_{|\mathcal{K}_t|}}}}\right): \begin{bmatrix} usp(p_{k_1}, p_{k_1}) & \cdots & usp\left(p_{k_1}, p_{k_{|\mathcal{K}_t|}}\right) \\ \vdots & \ddots & \vdots \\ usp\left(p_{k_{|\mathcal{K}_t|}}, p_{k_1}\right) & \cdots & usp\left(p_{k_{|\mathcal{K}_t|}}, p_{k_{|\mathcal{K}_t|}}\right) \end{bmatrix} \rightarrow \mathcal{G}_{dm_t}$$

- Argument
  - Matrix of mutual similarities of all customer profiles
- Result
  - Customer social network
    - One vertex for every customer
    - Edge weight denotes the connection strenght (“implicit friendship”) between customers this edge is linking

$$\mathcal{G}_{dm_t} = (\mathcal{K}_t, \mathcal{E})$$

Mechanism for creation of customer social network (1)

A creation of adjacency matrix

	k_1	k_2	k_3	k_4	k_5	k_6	k_7	k_8	k_9	k_{10}
k_1	1.000	0.743	0.427	0.448	0.756	0.748	0.448	0.455	0.459	0.463
k_2	0.743	1.000	0.414	0.431	0.863	0.803	0.457	0.465	0.510	0.509
k_3	0.427	0.414	1.000	0.661	0.476	0.482	0.841	0.624	0.614	0.813
k_4	0.448	0.431	0.661	1.000	0.448	0.511	0.680	0.817	0.797	0.632
k_5	0.756	0.863	0.476	0.448	1.000	0.856	0.474	0.479	0.515	0.483
k_6	0.748	0.803	0.482	0.511	0.856	1.000	0.497	0.473	0.471	0.505
k_7	0.448	0.457	0.841	0.680	0.474	0.497	1.000	0.647	0.623	0.817
k_8	0.455	0.465	0.624	0.817	0.479	0.473	0.647	1.000	0.830	0.553
k_9	0.459	0.510	0.614	0.797	0.515	0.471	0.623	0.830	1.000	0.568
k_{10}	0.463	0.509	0.813	0.632	0.483	0.505	0.817	0.553	0.568	1.000

$$\left[\mathcal{G}_{dm_{p_{k_{10}}}}\right] = \begin{bmatrix} 0.000 & 0.743 & 0.427 & 0.448 & 0.756 & 0.748 & 0.448 & 0.455 & 0.459 & 0.463 \\ 0.743 & 0.000 & 0.414 & 0.431 & 0.863 & 0.803 & 0.457 & 0.465 & 0.510 & 0.509 \\ 0.427 & 0.414 & 0.000 & 0.661 & 0.476 & 0.482 & 0.841 & 0.624 & 0.614 & 0.813 \\ 0.448 & 0.431 & 0.661 & 0.000 & 0.448 & 0.511 & 0.680 & 0.817 & 0.797 & 0.632 \\ 0.756 & 0.863 & 0.476 & 0.448 & 0.000 & 0.856 & 0.474 & 0.479 & 0.515 & 0.483 \\ 0.748 & 0.803 & 0.482 & 0.511 & 0.856 & 0.000 & 0.497 & 0.473 & 0.471 & 0.505 \\ 0.448 & 0.457 & 0.841 & 0.680 & 0.474 & 0.497 & 0.000 & 0.647 & 0.623 & 0.817 \\ 0.455 & 0.465 & 0.624 & 0.817 & 0.479 & 0.473 & 0.647 & 0.000 & 0.830 & 0.553 \\ 0.459 & 0.510 & 0.614 & 0.797 & 0.515 & 0.471 & 0.623 & 0.830 & 0.000 & 0.568 \\ 0.463 & 0.509 & 0.813 & 0.632 & 0.483 & 0.505 & 0.817 & 0.553 & 0.568 & 0.000 \end{bmatrix}$$

$$\left[\mathcal{G}_{dm_{p_{k_{10}}}}\right]_{i,j} = \begin{cases} \left[[mat]_{usp_{p_{k_{10}}}}\right]_{i,j} & , \; if \; i \neq j \\ 0 & , \; if \; i = j \end{cases} , \forall \, (i,j) \in [1,10]$$

Mechanism for creation of customer social network (2)

A created customer social network visualized with undirected weighted graph

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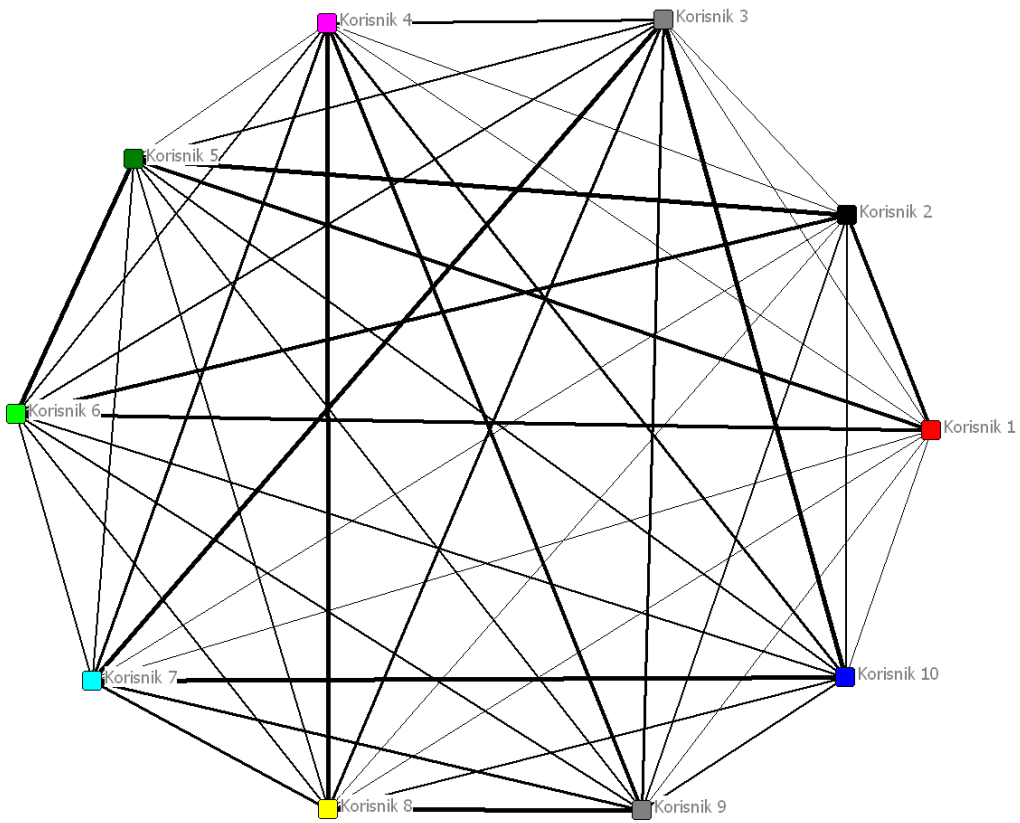
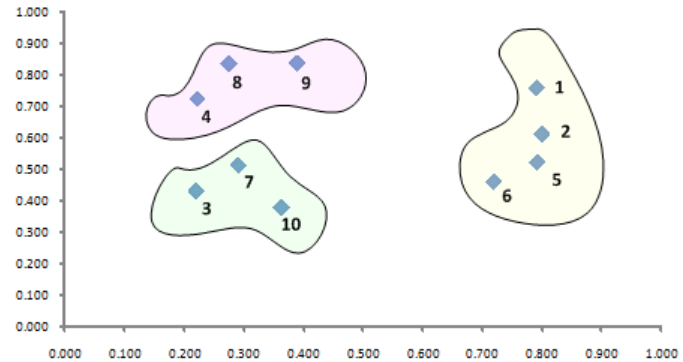
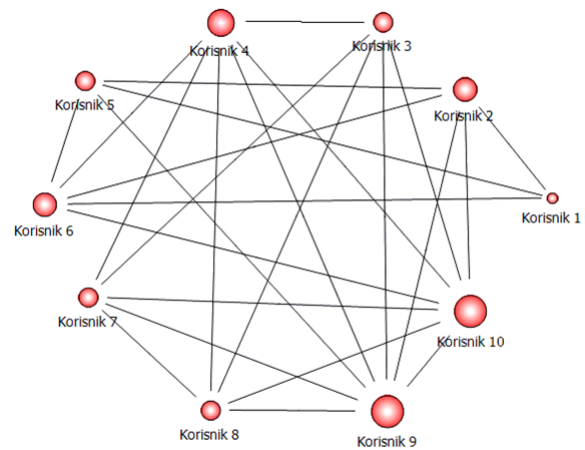






Customer social network analysis

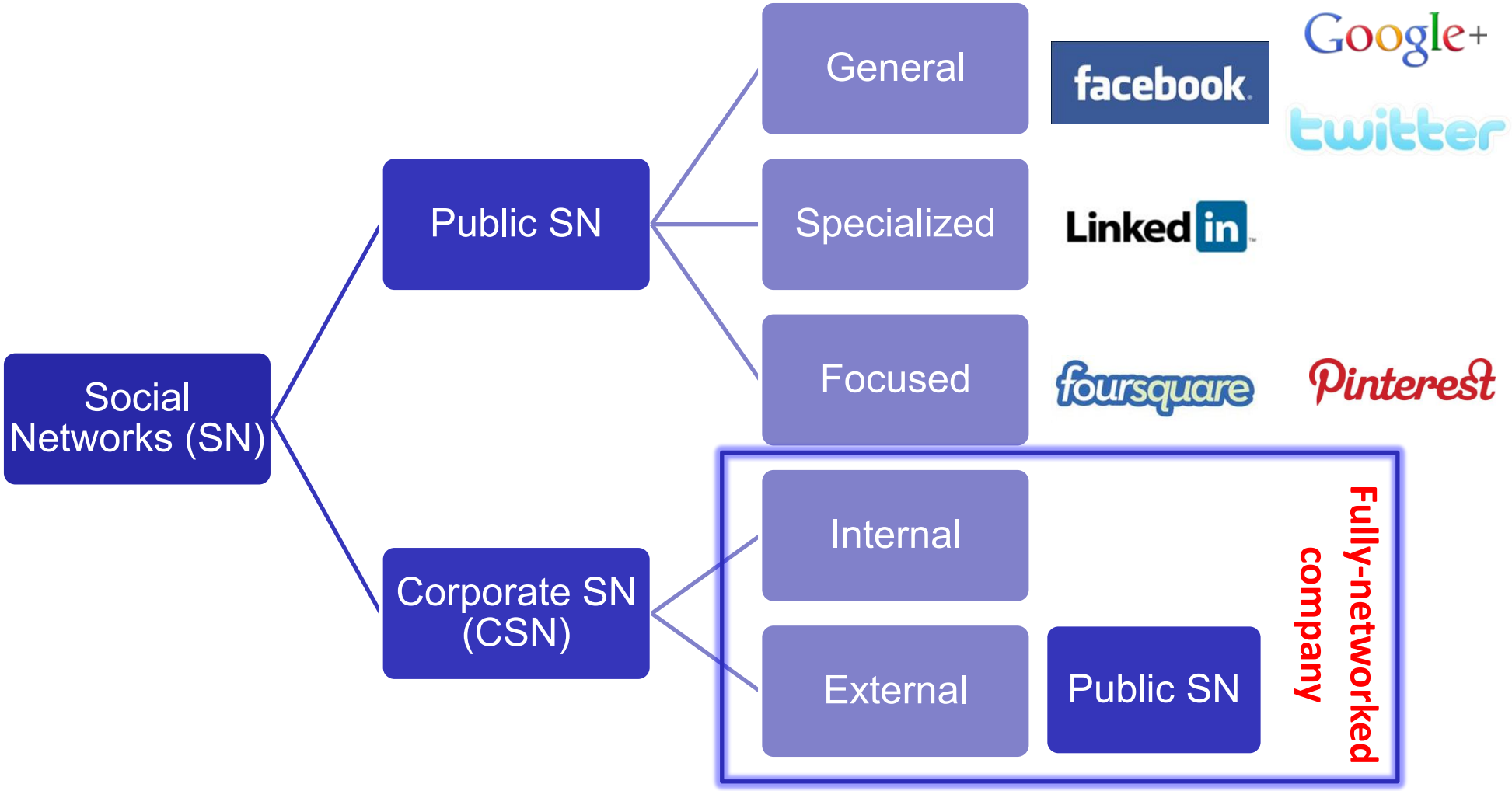
A comparison with Social Networking Sites

	Social Networking Sites (Web)	Customer Social Network (Telco)
Customers	profile	profile
Network	explicit	implicit
Roles	public	hidden
Relationships	public	hidden
Communities	public	hidden

Corporate Social Networking (CSN)

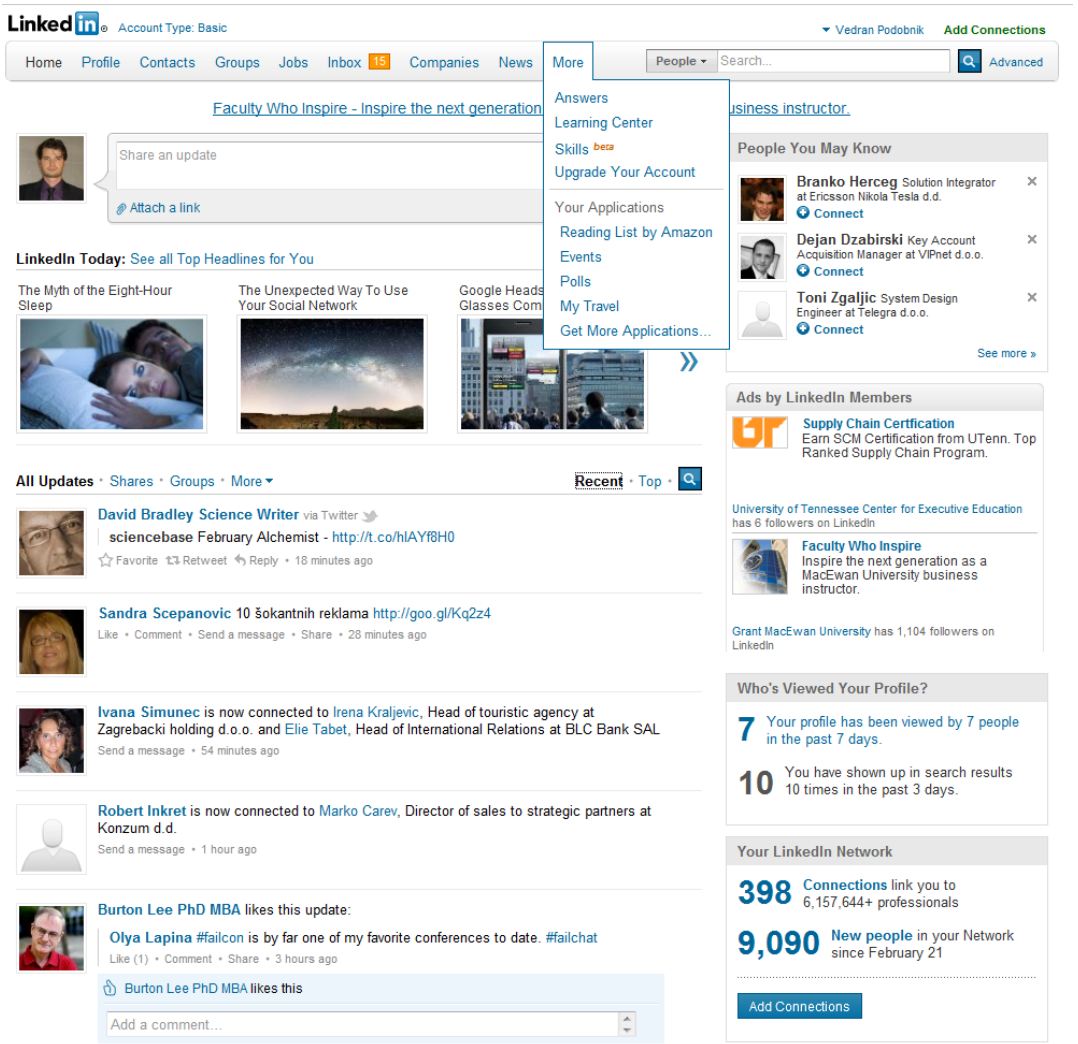
External & Internal CSN

Social networks taxonomy



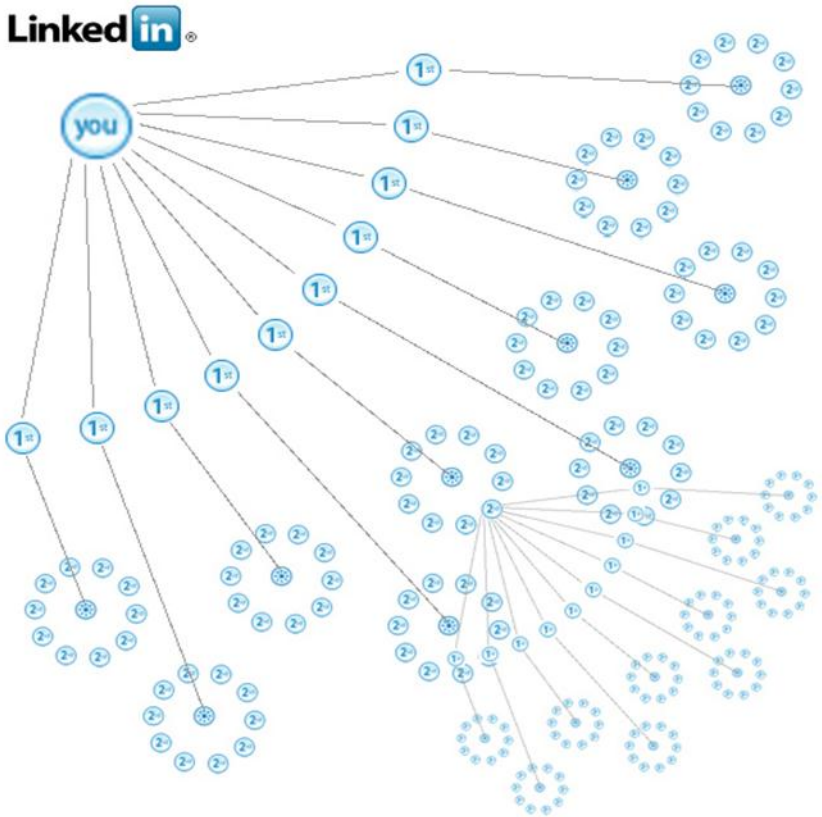
LinkedIn (1)

The most popular external CSN established in 2004



LinkedIn (2)

Accessibility: 3 levels



Your Network of Trusted Professionals

You are at the center of your network. Your connections can introduce you to 6,157,600+ professionals — here's how your network breaks down:

Your Connections Your trusted friends and colleagues	398
Two degrees away Friends of friends; each connected to one of your connections	97,400+
Three degrees away Reach these users through a friend and one of their friends	6,059,700+
Total users you can contact through an Introduction	6,157,600+

9,090 new people in your network since February 21

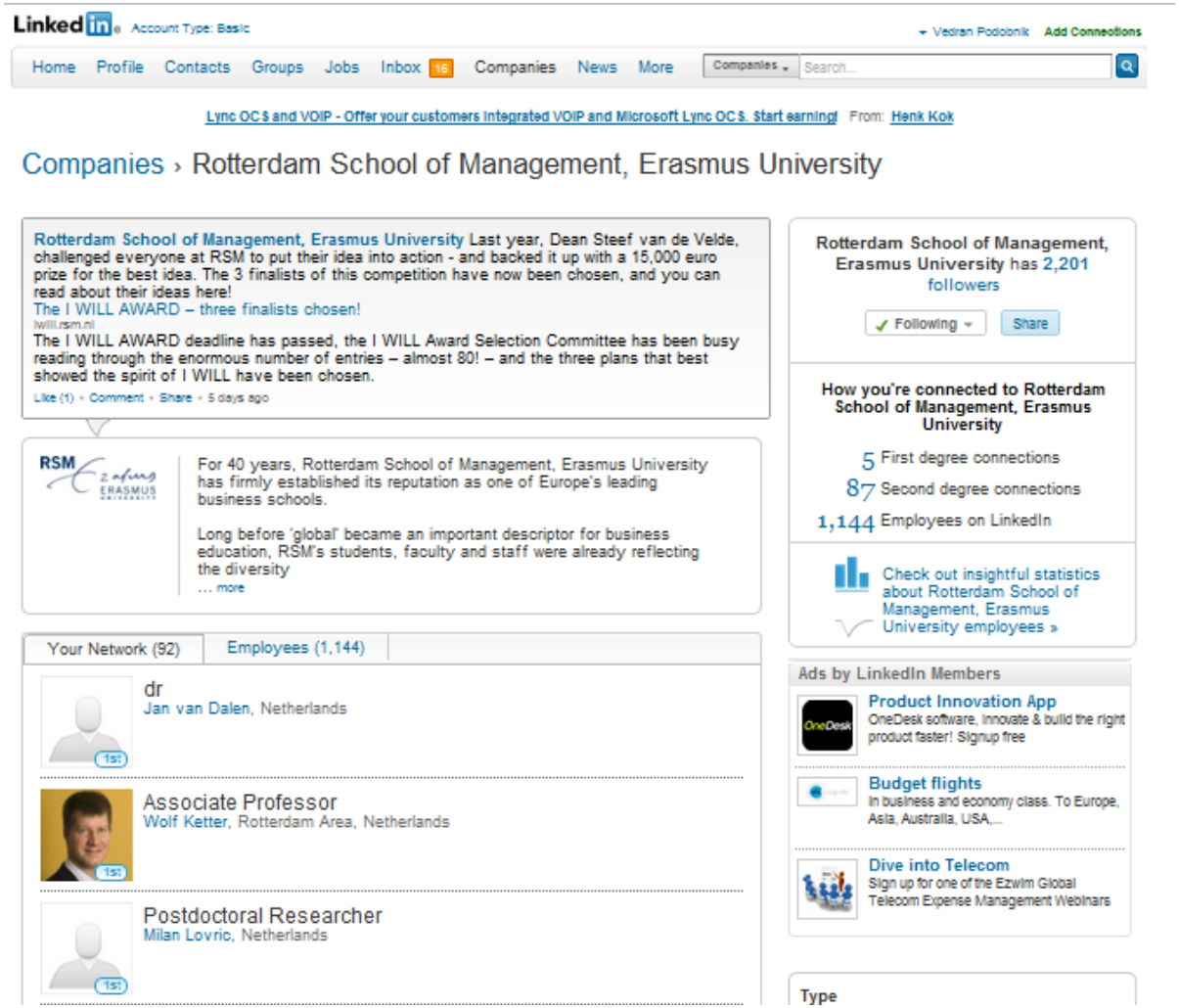
The LinkedIn Network

The total of all LinkedIn users, who can be contacted directly through InMail.

Total users you can contact directly — **try a search now!**	150,000,000+

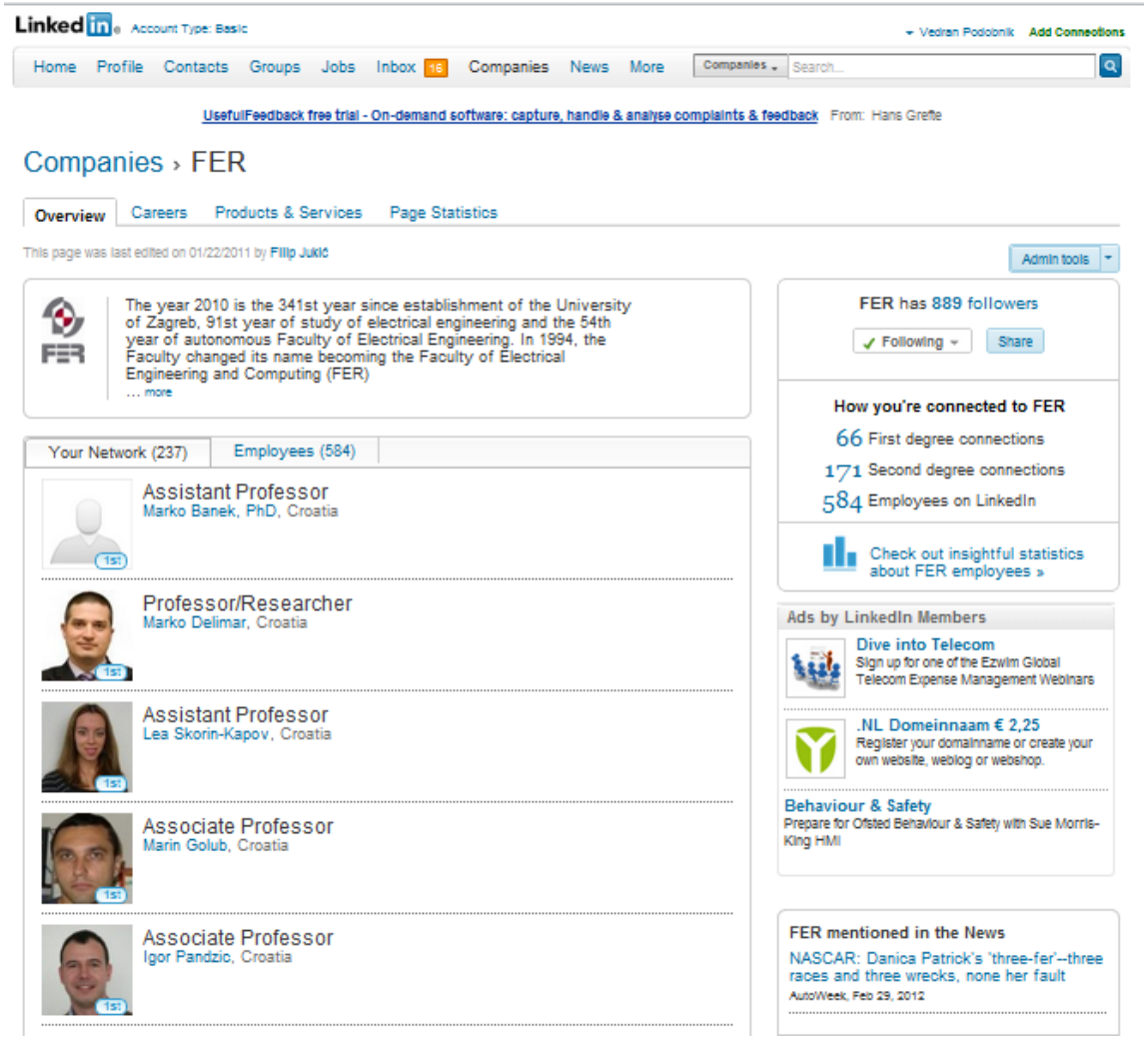
LinkedIn (3)

Company page: Rotterdam School of Management, Erasmus University



LinkedIn (4)

Company page: Faculty of Electrical Engineering and Computing, University of Zagreb

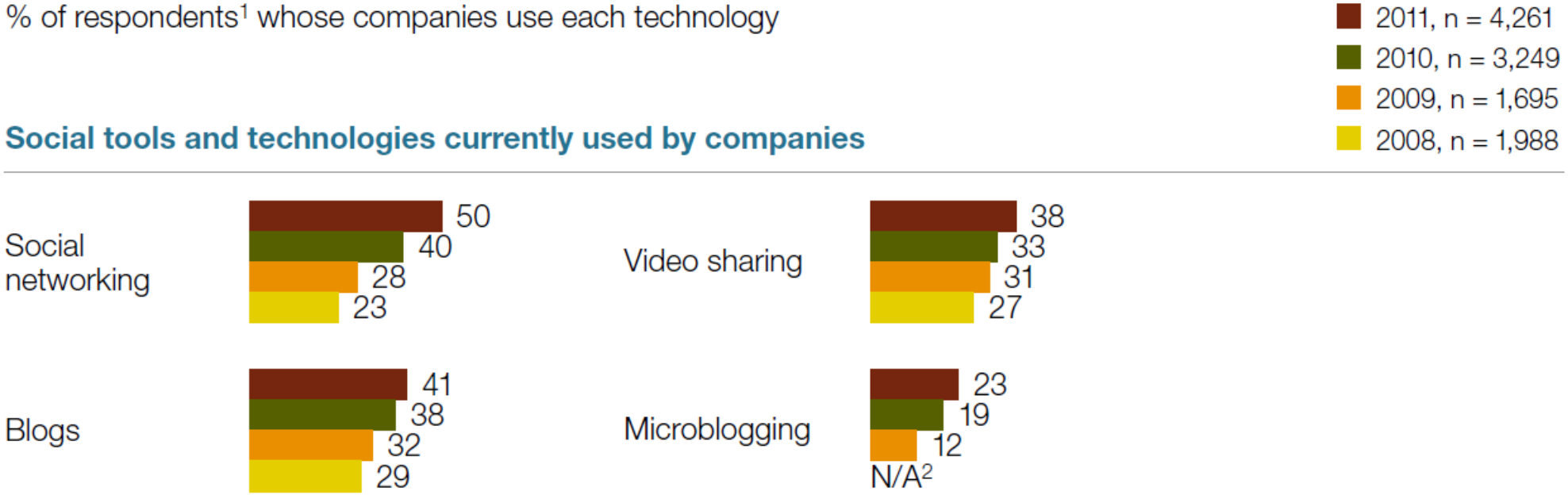


Social-aware technologies in industry

Adoption rate (2008-2011)

Rising adoption rates

% of respondents[1] whose companies use each technology

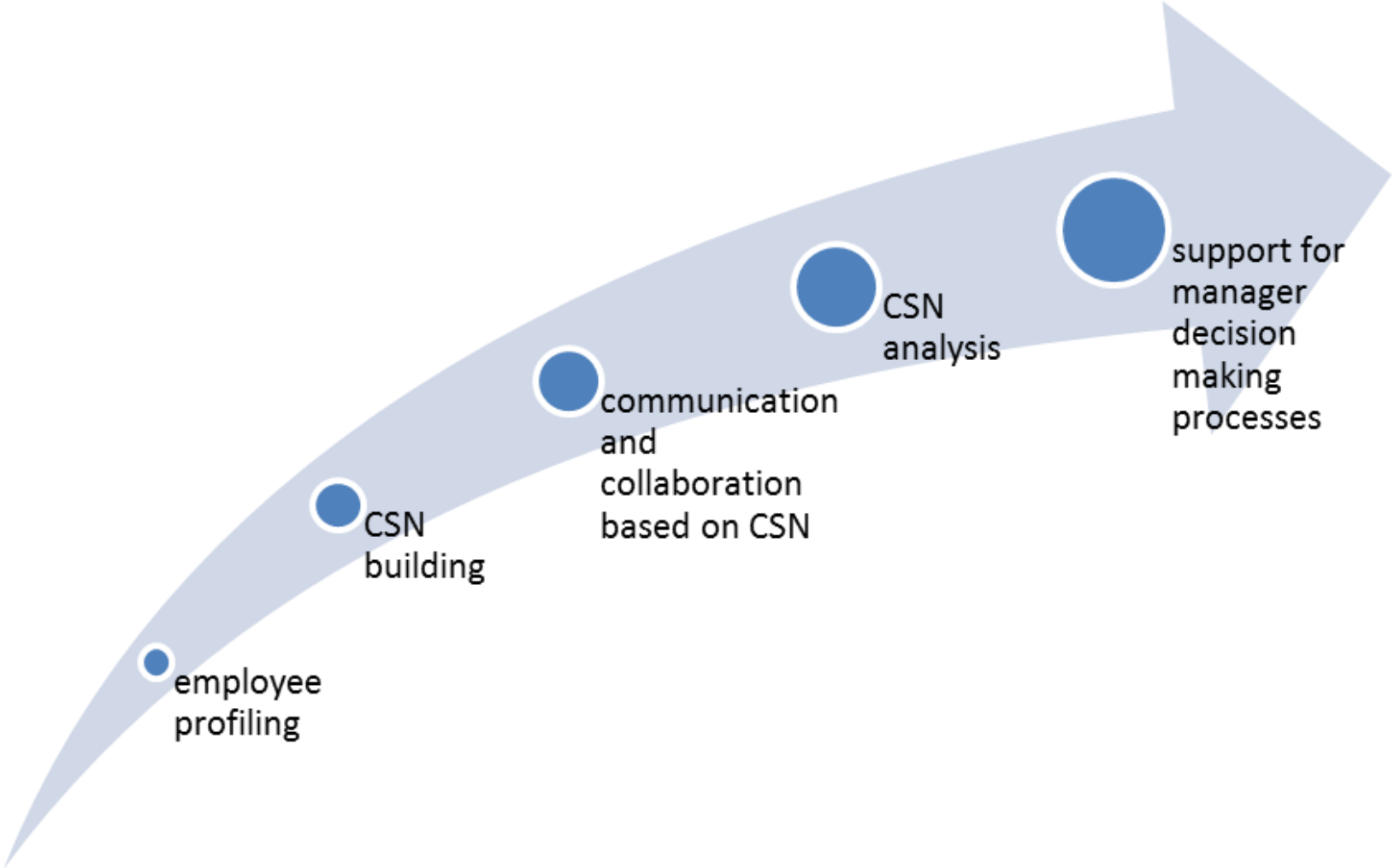


[1]Respondents who answered "don't know" are not shown.
[2]Microblogging was not offered as a technology in the 2008 survey.

McKinsey&Company: How social technologies are extending the organization, 2011

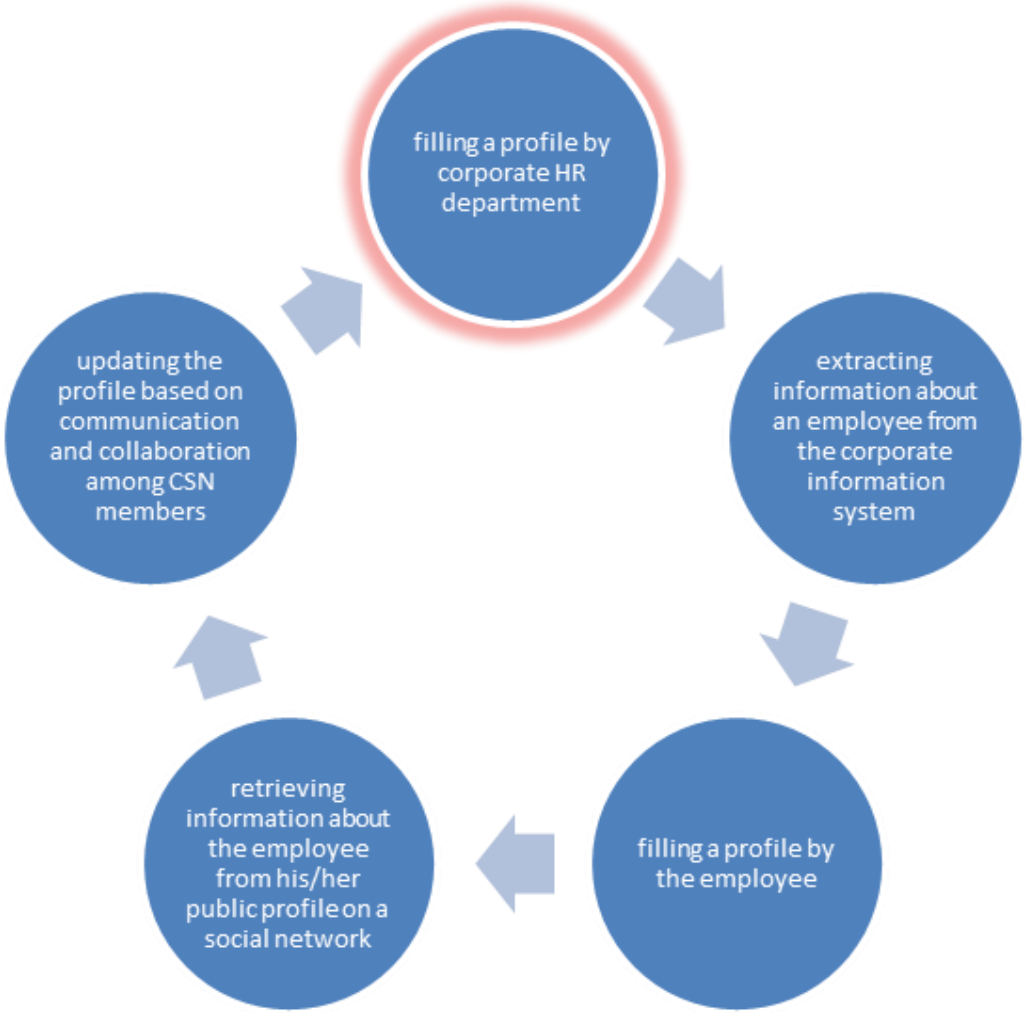
Internal corporate social networking (1)

CSN life-cycle



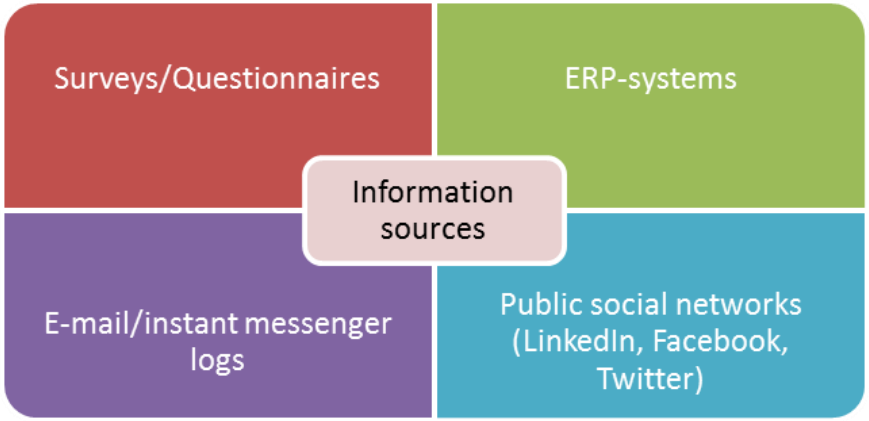
Internal corporate social networking (2)

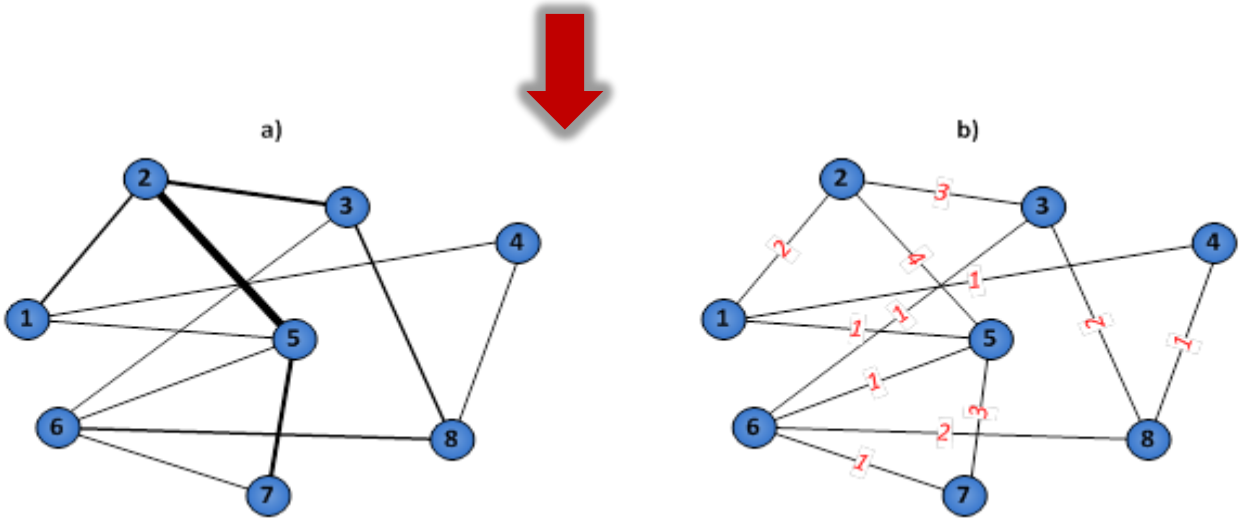
Phase 1: Employee profiling



Internal corporate social networking (3)

Phase 2: CSN building





$$\mathcal{G}^{w} = (\mathcal{V}, \mathcal{E}, \mathcal{W})$$

Internal corporate social networking (4)

Phase 3: communication and collaboration based on CSN

- Enhancing existing processes in the company
  - Improving communication, transparency, trust and empowerment of employees by flattening company hierarchy
  - Improving collaboration among employees

- Introducing innovative processes in the company
  - Maintaining the corporate knowledge pool
  - Sharing company and employee news and press releases
  - Stimulating ideation (idea generation)

Internal corporate social networking (5)

Phase 4: CSN analysis

- Procedures based on graph theory
- CSN analysis can be performed on several levels
  - Individual employee
    - E.g. closeness centrality

$$C_C(v_a) = \frac{|\mathcal{V}| - 1}{\sum_{v_b \in (\mathcal{V} \setminus v_a)} gd(v_a, v_b)}$$

  - Employee pairs (*dyads*) and triples (*triad*)
  - Sub-groups and groups
- Tools for CSN analysis

Internal corporate social networking (6)

Phase 5: support for manager decision making processes

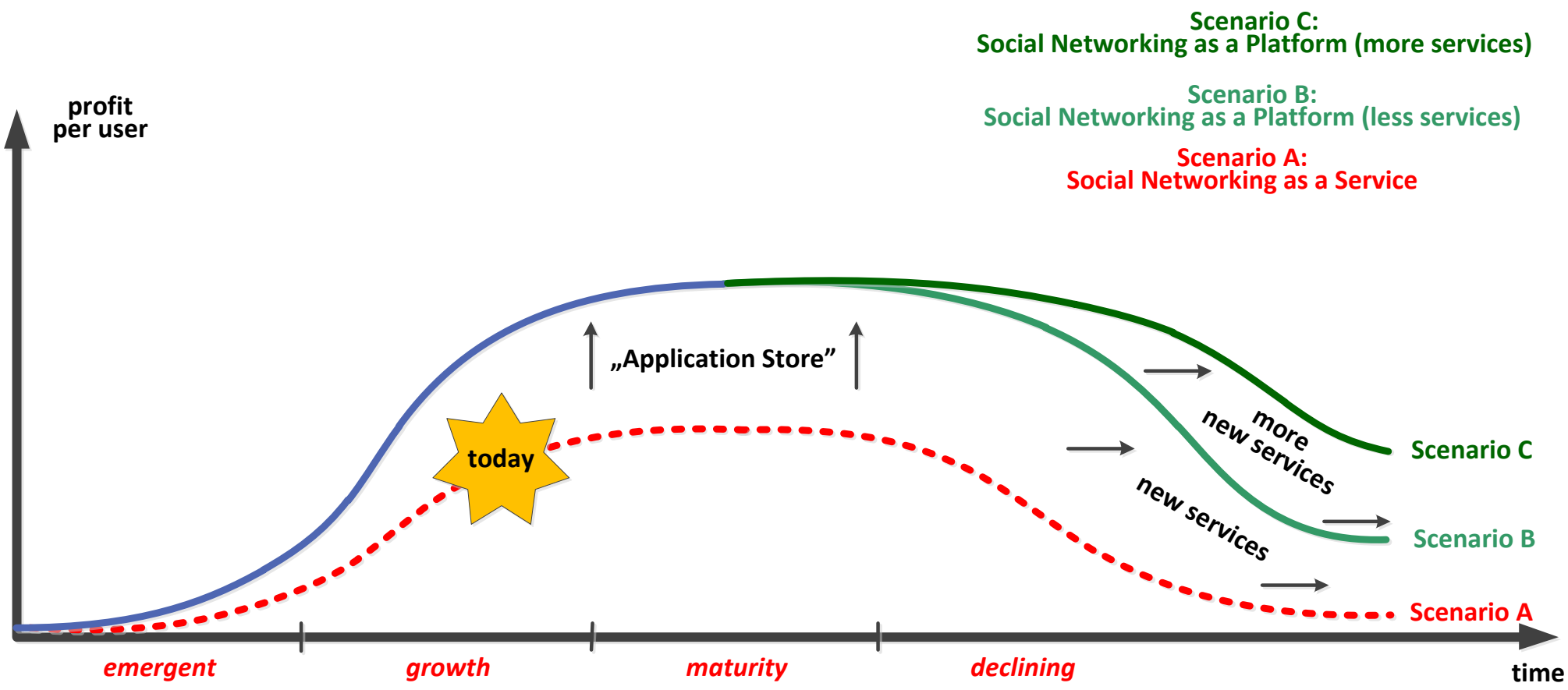
- CSN analysis enables:
  - Enhancing existing processes in the company
    - identifying and encouraging “star” employees
- Introducing innovative processes in the company
    - construction of temporary/permanent expert groups among employees (*crowdsourcing*)

Concluding remarks

The future od social networking

A social networking platform

Social networking on an S-curve



Podobnik, V.; Lovrek, I.: Transforming Social Networking from a Service to a Platform: a Case Study of Ad-hoc Social Networking. Proceedings of the 13th International Conference on Electronic Commerce (ICEC'11). Liverpool, UK: ACM, 2011.

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