



# *Knowledge Management and Protection Systems (KMaPS)*

## **Corso di Laurea in Ingegneria**

***Parte 6 - Social Media Technologies and Solutions***

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# Part 6: *Social Media Technologies and Solutions*

## ❑ Collaborative systems

- ⌘ Definition and Terminology

## ❑ Social Network

- ♣ Forrester Trend for Social Networking
- ♣ Motivations for Social Networking
- ♣ Application, classification of Social Networking
- ♣ Examples of Social Networks
- ♣ factors of Social Networks

## ❑ User/Content Social Network

- ♣ User classification and behavior
- ♣ User Generated Content, UGC
- ♣ Content descriptors
- ♣ User and group descriptors

## ⌘ *Measures of Social Networks*

- ♣ User profile problems
- ♣ Measures of Social Networks
- ♣ Metrics and examples: Centrality, Clustering, ....
- ♣ Direct measures of user actions

## ⌘ *Business of Social Networks*

- ♣ Penetration of social networks
- ♣ Numbers of Social Networks

## ⌘ *interoperability and standards*

- ♣ Social icons
- ♣ Embedding
- ♣ Authentication



# Collaborative Systems

## ❑ Collaborative systems are:

- ♣ CSCW solutions in which one or more objectives are reached on the basis of collaborations among users.

## ❑ Different paradigms according to the emphasis on one or more of the 4 axes:

- ♣ Objectives of the collaboration
- ♣ Interaction among users
- ♣ Observation of the common environment
- ♣ Assessment of results against objectives



# Collaborative and Social

- ❑ A specific kind of collaborative/competitive systems are the Social Networks, that have:
  - ♣ **Objective:** general of the network
    - ➔ goals defined by the organizers, clear on user and content profiles
    - ➔ while: evolution is left to the users' objectives
  - ♣ **Interaction:** among users
    - ➔ mainly asynchronous (non real time) user collab./interac./comp.
  - ♣ **Observation:** as user to user observation
    - ➔ reciprocal observation: profiles of friends, groups, forums, ....
  - ♣ **Assessment:** to persecute the objectives
    - ➔ Controlling/assessing user behavior, via metrics
    - ➔ Gratify the users according to their objectives, egos, etc.
    - ➔ Analysis of: groups, forums, meetings, pages, messages, etc..
    - ➔ Assessment of the achievements with respect to the Objectives





# Terminology

## ❑ Social TV

- ♣ A TV based on Social Networking principles, with the support of UGC, etc

## ❑ Social Learning Management System, SLMS

- ♣ Learning management system with SN features

## ❑ Enterprise Social Network, ESN

- ♣ Project management and control with SN features

## ❑ Best Practice Network

- ♣ Specific kind of social network devoted to the definition of best practices.

## ❑ Social Media

- ♣ A set of technologies and solutions that exploit the social network related data and solutions.
- ♣ A Social Network based on media, multimedia

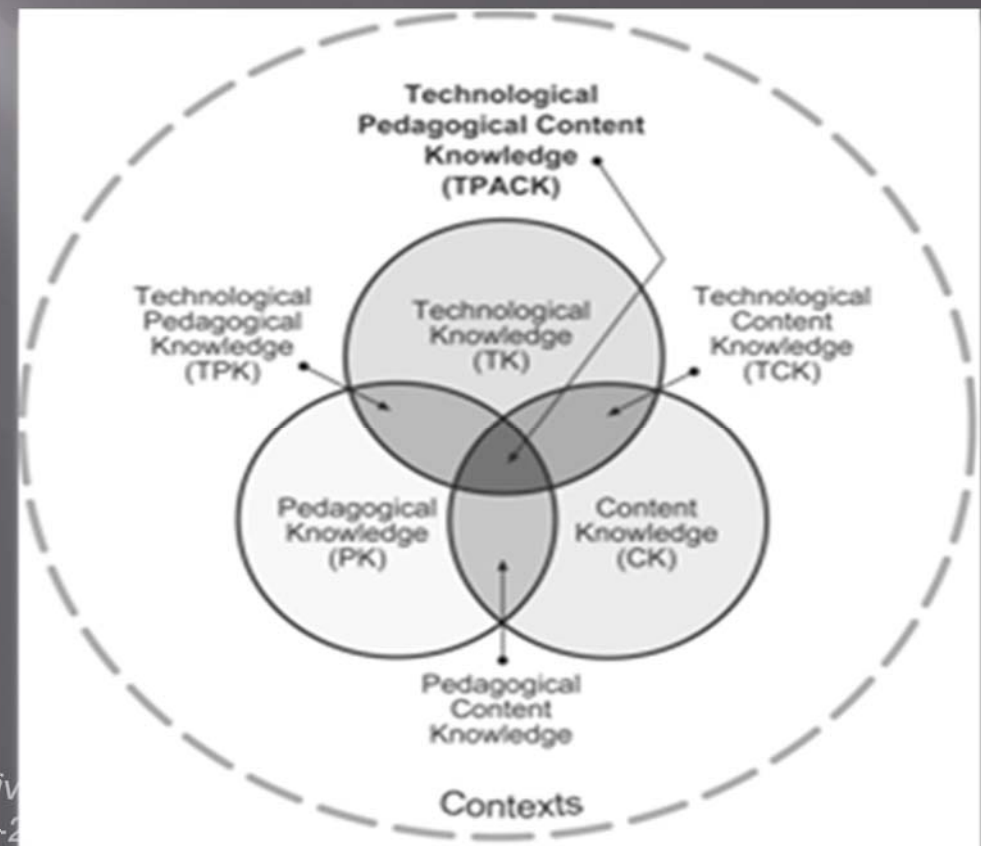
## ❑ Social Network Analysis

- ♣ The discipline to analyze the social network in terms of user clustering and relationships, metrics for SN assessment, etc..
- ♣ It can be used to better understand motivation and rationales of success and/or problems.

# Accrescimento della Conoscenza

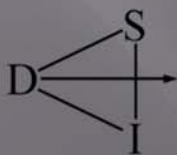


- **Knowledge Management SECI Model** (Nonaka & Takeuchi, 1995)
- **Technological Pedagogical And Content Knowledge (TPACK)** (Koehler & Mishra, 2009)



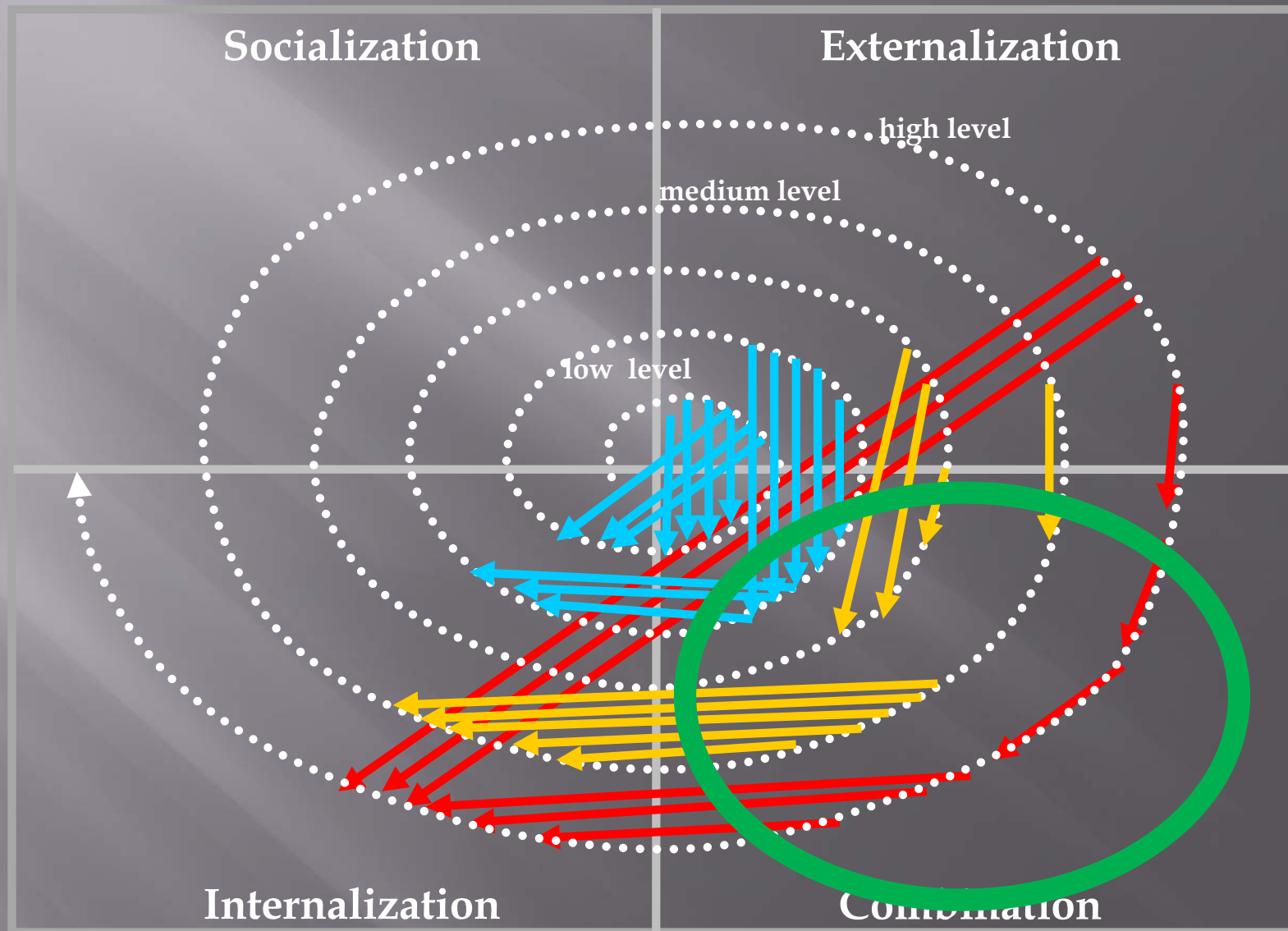


# Creazione e accrescimento della conoscenza





# Stimoli Sociali







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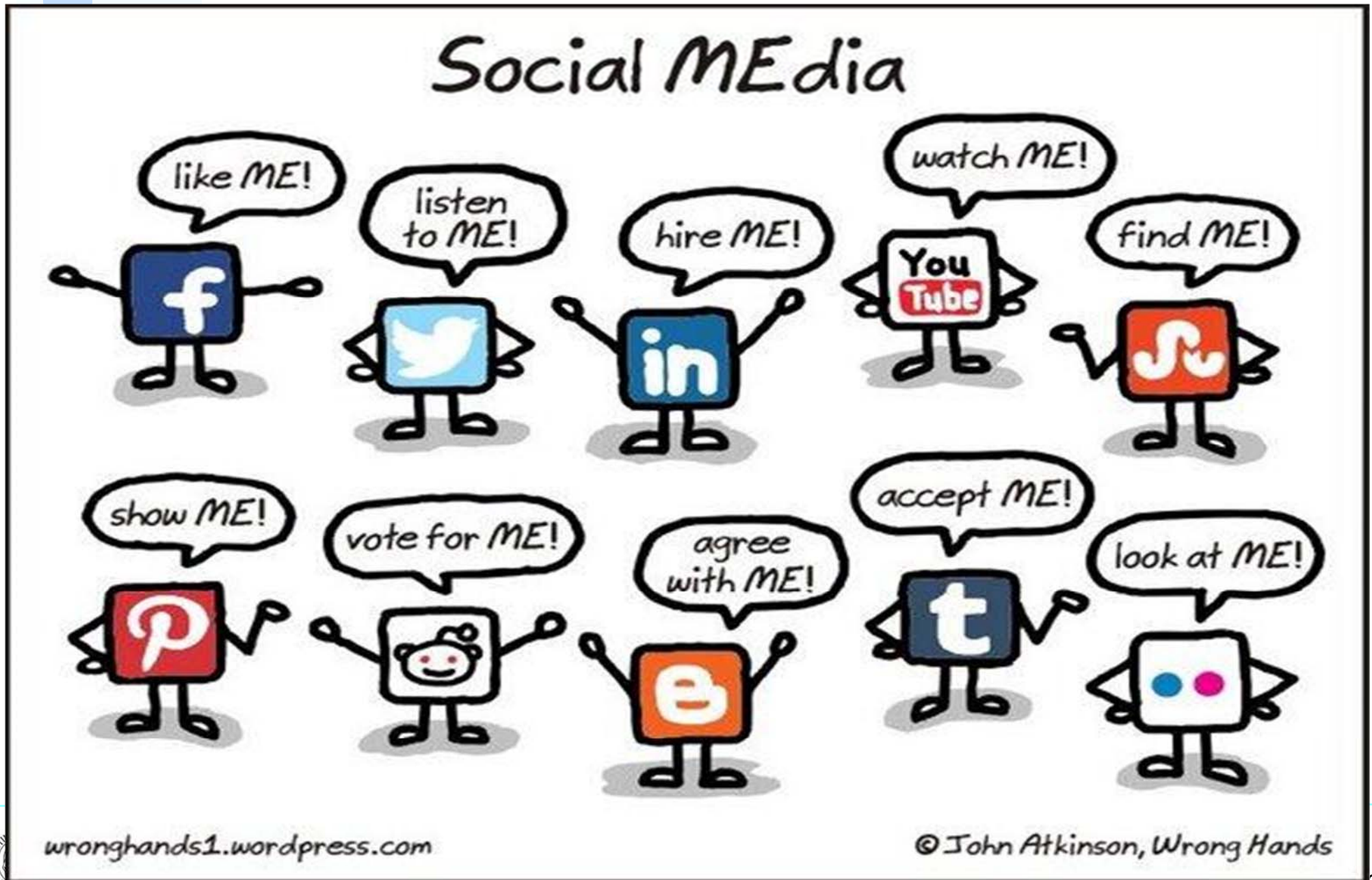
# Social Network Objectives

## □ Social network objectives

- ♣ goals defined by the organizers,
  - ➔ Business goals
    - Monitoring Business goals
  - ➔ Satisfaction of the target users
    - With the aim of user growth
- ♣ clear impact on
  - ➔ user profile
  - ➔ content profiles/descriptors: if any
- ♣ Assessment and Validation of the business goals achievements !!!



# Social Network Aims

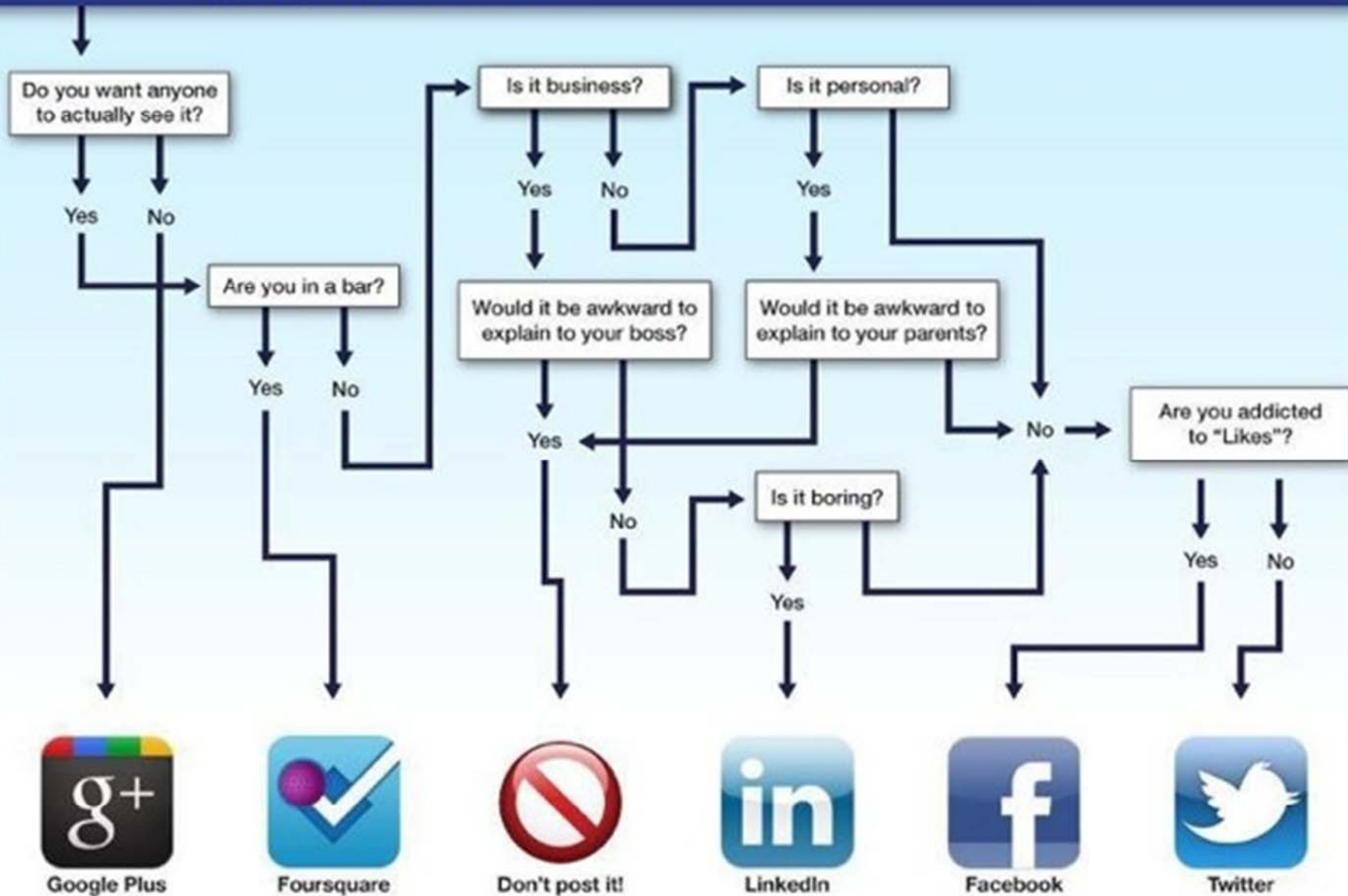






# Scegliere !? ###

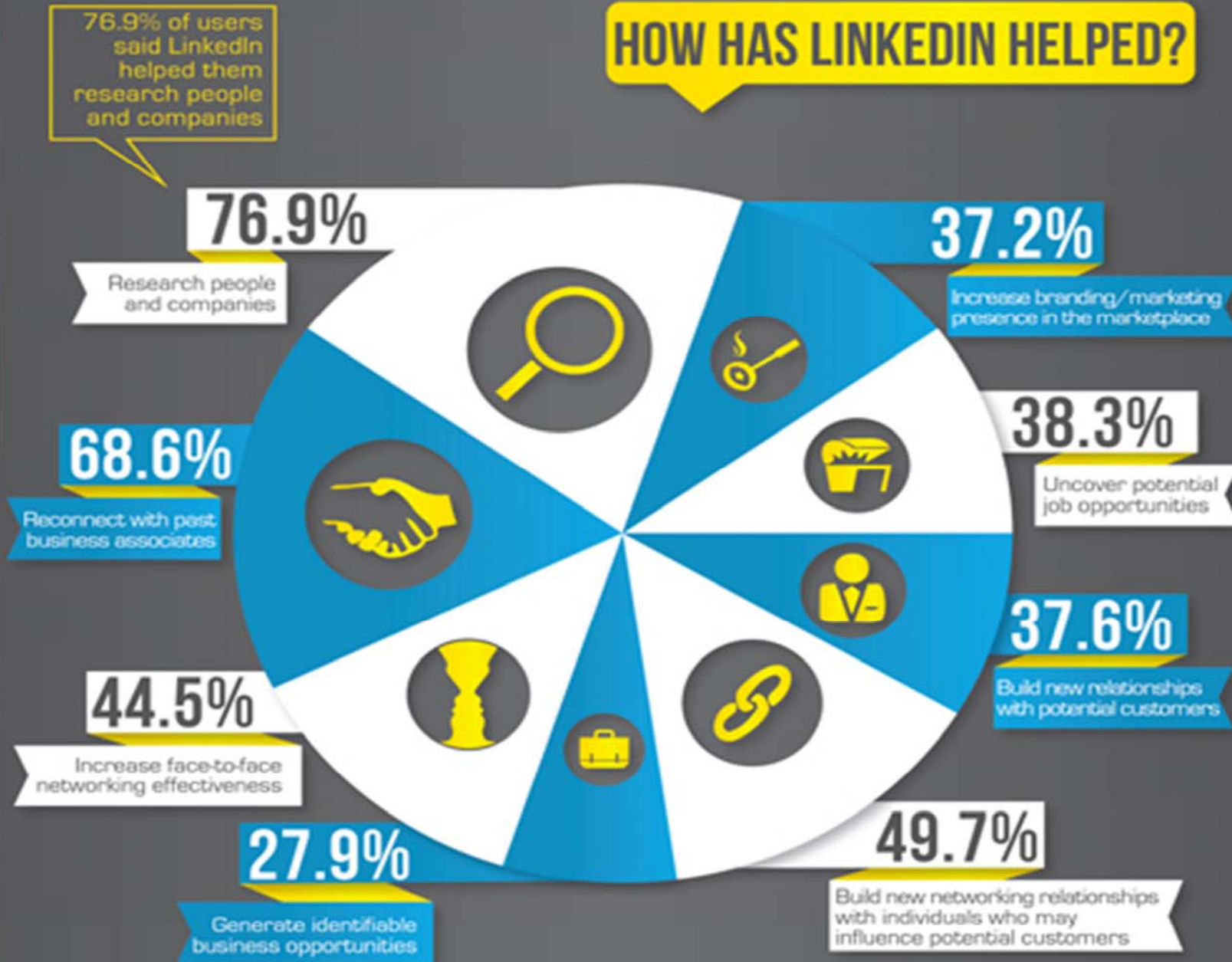
## Where should you post your status?







## HOW HAS LINKEDIN HELPED?



76.9% of users said LinkedIn helped them research people and companies





# Social Networks User Objectives

## □ User Objectives

- ♣ each user persecutes its own objectives
- ♣ Identification of needs of the target users
  - ➔ Requirements of the target users
- ♣ For each target user kind they have to be
  - ➔ Guessed !
  - ➔ identified to create a service that is used
- ♣ Monitoring the user behavior
- ♣ Identification of the collective behavior
- ♣ Validation of the target user satisfactory !!!



# Social Network: User's Motivations

- ❑ **Creating Social relationships and contacts**
  - ♣ Finding new friends and/or colleagues
  - ♣ Becoming a reference among friends, get higher reputation
    - ➔ Sharing content with friends
    - ➔ Writing comments and sharing experience
    - ➔ Organizing events, providing information
  - ♣ Get knowledge about what other people do in their life
    - ➔ Keeping friends/colleagues in contact
  
- ❑ **Increasing Knowledge on**
  - ♣ specific topics, the subject of the UGC and of the SN
  - ♣ how content can be created and shared
  - ♣ life of your connected friends



# Social Network: User's Motivations

## ❑ Personal advantages for the users

- ♣ Conquering/getting a leadership
  - ➔ Increasing visibility in the community
  - ➔ be observed/recognised by a community
- ♣ Improving position in the job/life community
  - ➔ commercial purpose

## ❑ Save money for the users

- ♣ Storing user content permanently and making it accessible for its own usage (making it public as side effect)
- ♣ making content public for friends
  - ➔ Saving streaming/hosting costs
- ♣ Making business among users (e.g., ebay)
  - ➔ Selling personal stuff
  - ➔ Finding difficult to find products and stuff





# Examples of Social Networks

- ❑ **Creating a community to provide a service**
  - ♣ Motivating target users
    - ➔ Objective: share experience, collect/provide knowledge
    - ➔ knowledge production (content, comments, annotations, etc.)
    - ➔ Collaborative work with users
    - ➔ Sharing Improving community knowledge
  
- ❑ **Creating a community to make business on advertising**
  - ♣ Get Content for placing advertising
  - ♣ Objective: increment number of users, minimizing the costs
  - ♣ Stimulating viral propagation
  - ♣ Sharing friendship
  - ♣ Attracting new users, replacing those that abandon the SN

# Social Media Landscape



FredCavazza.net





# Part 6: *Social Media Technologies and Solutions*

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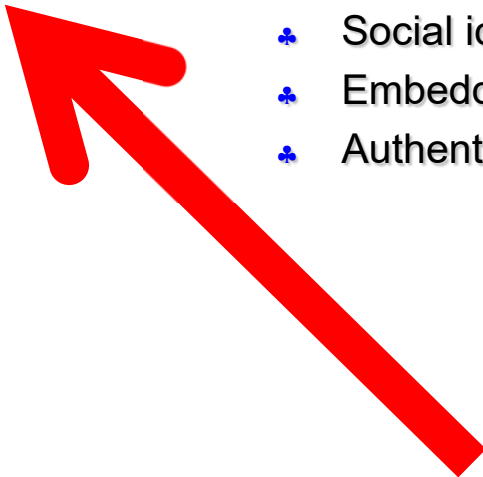
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# User/Content of Social Network

## □ What they are:

### ♣ Content related Items

- Media files, web pages
- Comments, tags, votes
- Aggregations and links

### ♣ User related information

- User profiles and relationships
- Groups profiles (professionals ...)
- Email, messages, etc.





# Social Network User Classification

- ❑ **Lurkers: passive users,**
  - ♣ take and do not contribute: no content, no other users, ....
  - ♣ can be even frequent users to read only
  - ♣ they are typically invited and does not invite
- ❑ **Occasional users:**
  - ♣ sometimes they also contribute with content
  - ♣ marginal active in terms of invitations
- ❑ **Active users:**
  - ♣ frequently contribute
  - ♣ The first source of invitations of users and content
- ❑ **Pushers:**
  - ♣ Typically active users paid to stimulate activities with content, discussions, users, mailing, etc.



# The role of the Pushers

- Many SNs are promoting/pushing the most played/accessed content in the last months/days and weeks (they are most clicked content items since are most frequently presented)
  - ♣ The entrance of a content/object into those lists is a strong opportunity for marketing and promotion
  - ♣ The entrance in those lists depends on number of plays/votes, comments, etc.
    - ➔ They can be artificially created by a new human figure, that has to be a SN Users, the PUSHER
- **The Pusher:**
  - ♣ Has to be a widely linked person
  - ♣ Can put the content in his preferred, may be removing the others that he has appreciated to make the last more evident, .....
  - ♣ Can promote/propone the content to other friends
  - ♣ Can make a lot of initial play and votes to place it in a better place
  - ♣ For some aspects can be robot, a bot



# User Activities on Social Networks

## ❑ Wikipedia (2006)

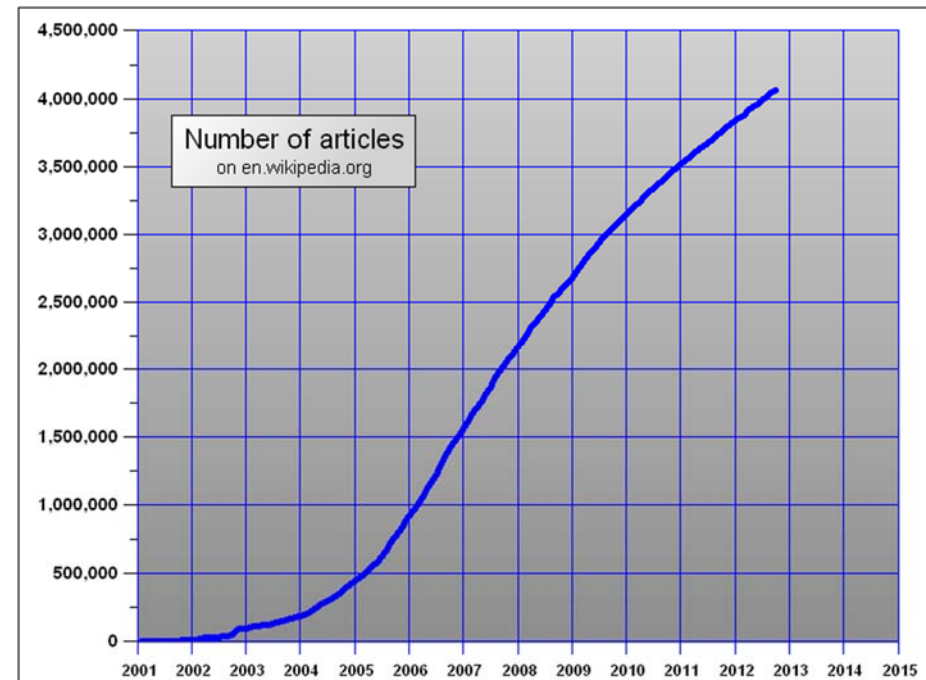
- ♣ 68000: active users
- ♣ 32 millions of lurkers
- ♣ While the 1000 more active users produced the 66% of changes.

## ❑ Similar numbers in other portals:

- ♣ 90% lurkers
- ♣ 9% occasional users
- ♣ 1% active users
  
- ♣ 90% is produced by the 1% of active users
- ♣ 10% is generated by the 9% of users including the occasional

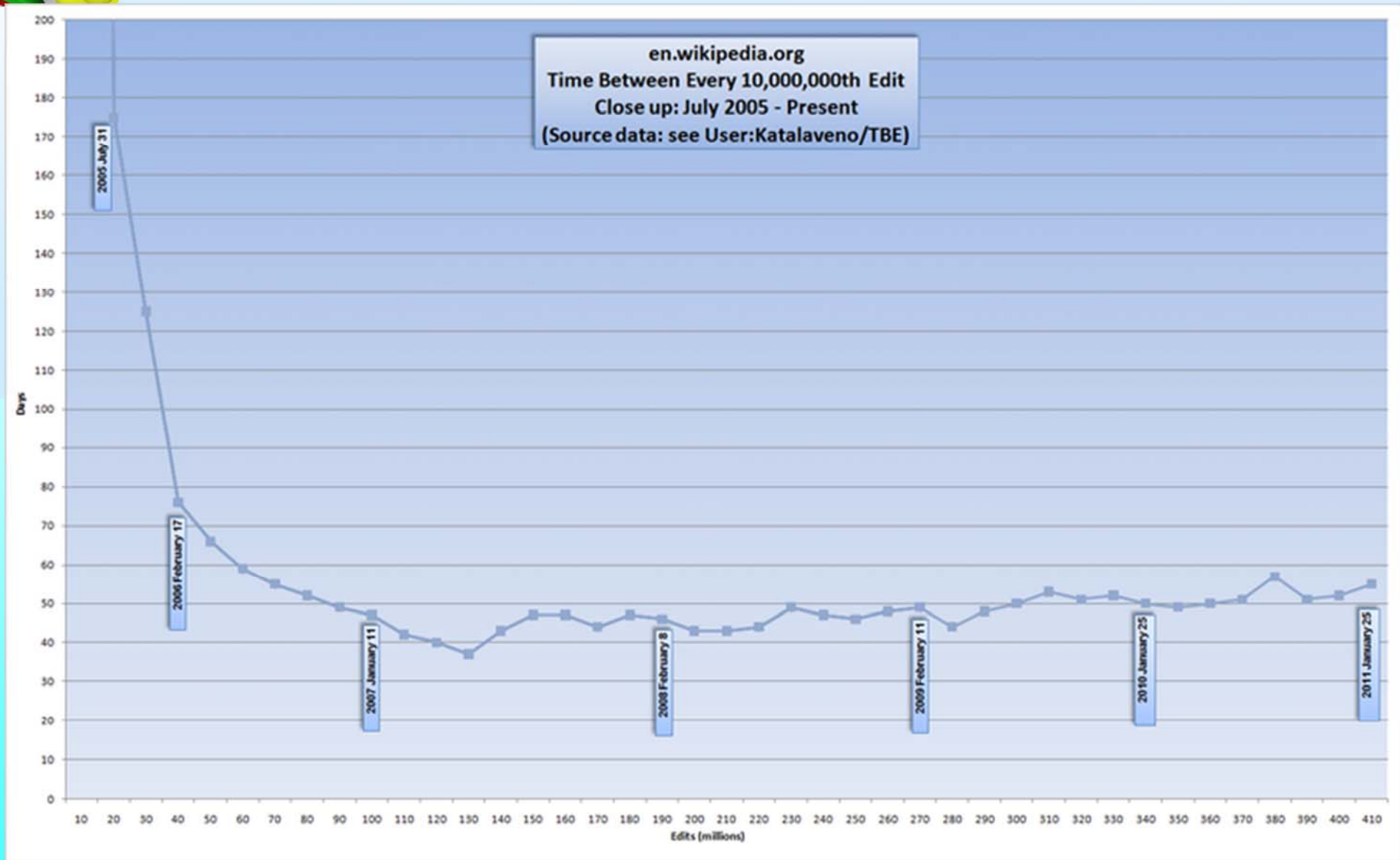
## ❏ Wikipedia (2012)

- ♣ 77000: active users
- ♣ 450 millions of unique user per month
- ♣ 22 millions of pages
- ♣ While the 1000 more active users produced the 66% of changes.





# Wikipedia, persistenza delle pagine







# Social Network Activities meaning

- ❑ **Since the 90% is managed by a small percentage of active users:**
  - ♣ **Votes** are also produced with the same small part of the community
  - ♣ **Comments, tags, annotations** are also produced with the same small part of the community
  - ♣ **Pushers** are frequently needed to create activities and waves into the Social Networks, they create fashions and interests among the lurkers, etc.. ..
  
- ❑ **Number of plays/accesses** are produced by the whole community



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# Different User Generated Content Items

## ❑ Media Content

- ♣ Classical: audio, video, images, document, animations
- ♣ Cross Media Content: interactive content, widgets, applications, procedures, courses, ....

## ❑ Collections, aggregations

- ♣ Essay, courses, playlists, etc..

## ❑ Web pages, panels, Wiki

## ❑ Annotations and comments on

- ♣ media content, web pages, wiki
- ♣ Contextual on audiovisual

## ❑ Links among media and issue

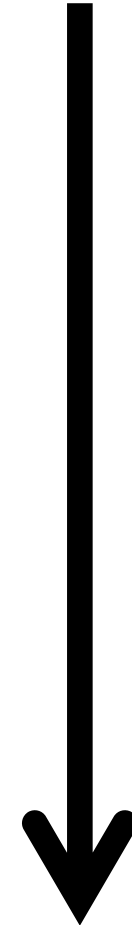
## ❑ Forum,

- ♣ Forum topics

## ❑ Blogs

## ❑ Messages, tags

*static*



*dynamic*



# UGC Pros

- ❑ **No costs** for hosting and distributing UGC
- ❑ **WEB sites that host** your content and provide some tools to make them accessible on web for your friends for free, if you accept to make them public or close to public
- ❑ **Natural selection/emergence** of better UGC items, increment of visibility for some of UGC users...
- ❑ **Annotation** and reuse of UGC of others users and friends
  - ♣ Gratification about the promotion of UGC
- ❑ **Simple search** on your UGC





# UGC Cons 1/2

- ❑ **Restricted social penetration since**
  - ♣ only User with are ICT skilled and have a certain economical capability may access to internet and spend time to enjoy SN
- ❑ **Lack of privacy control, lack of DRM**
  - ♣ too much information is requested
  - ♣ some people do not expose their true personal info
  - ♣ usage data are used to profile the users' preferences in any way so that the user profile is reconstructed even with GPS locations.
  - ♣ *See Terms of Use*
- ❑ **IPR problems:**
  - ♣ Violation of IPR of third party content, free usage of UGC
  - ♣ Lack of control about your own Content and UGC
  - ♣ Reuse and annotation of professional content
  - ♣ *See Terms of Use*



# Content Descriptors

- ❑ **Static aspects:** content description not changing over time. They are:
  - ♣ metadata, keywords extracted from description, comments, etc.;
  - ♣ **technical description** (as the Format in the following): audio, video, document, cross media, image,...;
  - ♣ **content semantic descriptors such as:** rhythm, color, etc.; genre, called Type in the following;
  - ♣ **groups** to which the content has been associated with;
  - ♣ **taxonomies** classification to which the content has been associated, taking into account also the general taxonomy;
- ❑ **dynamic aspects** may be related to:
  - ♣ user's votes, user's comments;
  - ♣ number of votes, comments, downloads, direct recommendations, etc.
  - ♣ List of content played, related taxonomy ;



# Content Descriptors, 1/3

- ❑ **Classification** based on Metadata (static)
  - ♣ For example: Dublin Core, Mets, ... multi-instance and multilingual fields, taxonomy, dates, locations, etc.
  - ♣ Mainly provided by users at the upload
- ❑ **Identification** codes: (static)
  - ♣ as ISAN, ISMN, ISBN, ISRC, barcodes, URI, ...
  - ♣ More diffuse on professional content
  - ♣ Provided by users at the upload and/or by the SN manager
- ❑ **Technical information:** (static)
  - ♣ As: Size, format, source, mime type, color, tonality, url, duration, ....
  - ♣ Estimated at the upload or when processed for distribution, so that when several formats are produced
  - ♣ Formalized in MPEG-7, including fingerprint, .....



# Content Descriptors, 2/3

- ❑ **Geotagging:** (static)
  - ♣ Grab GPS position, placement on Google map
    - ➔ Collected via: IP resolution via services, GPS signal, ..
    - ➔ *Provided by users at the upload or by common users*
  - ♣ Referred/associated Position (dynamic), by human
  
- ❑ **Standard Tags** among those proposed by the SN (static)
  - ♣ Classification as a function of the content format
    - ➔ *Taxonomic* classification, multilingual
    - ➔ Support of dictionary/vocabulary and/or of an ontology
  - ♣ Provided by users at the upload
  
- ❑ **Free Tags**, such as *Folksonomy* (dynamic)
  - ♣ Support of dictionary and/or ontology
  - ♣ Provided by common users





# Content Descriptors, 3/3

## ☺ **Marking: (dynamic)**

- ☺ preferred, uploaded, suggested, viewed

## ☐ **Annotations: (dynamic)**

- ♣ Links to other URL
- ♣ Citations to articles in form of links
- ♣ Relationships among resources: aggregations: playlist, collections, courses
- ♣ Textual annotation as comments
- ♣ Votes, ranks, ...
- ♣ *Mainly produced by humans*

## ☐ **Contextual Annotations (dynamic)**

- ♣ Description of the scene, E.g., on an image/video:
  - ➔ mark area in which a CAR is present, addition of a text
  - ➔ Mark area and time windows in which Carl and Jack talk, ...
- ♣ *Mainly produced by humans, may be deduced for similarity*



# Votes/ranks, Comments, Preferred

- ❑ **Users** may leave on Content and Users:
  - ♣ **Ranks and Votes** (positive or negative)
  - ♣ **Comments** on content items, web pages, other comments, forum lists, groups, (positive or negative) (sentiment analysis)
  - ♣ **Comments** may be left as
    - ➔ Text: simple messages in a context, tags
    - ➔ Content: video, audio, images, etc.
    - ➔ Emoticons 😊 ☹️ .....
  
- ❑ User may mark the preferred content and users (friends)
  - ♣ Preferred content are accessible with a direct list to shortening the time for their play



# Linguistic Complexity

## ❑ Multilingual:

- ♣ Speech: video, audio
- ♣ Text on: document, web pages, comments, subtitles, annotations, etc.
- ♣ Metadata (text): title, description, author, location, date, etc..

## ❑ Multilingual Complexity:

- ♣ Indexing and querying
  - ➔ Translation of metadata or of queries
  - ➔ Full text of documents, frequently only one language
- ♣ Linguistic processing of text to get semantics (see part of the course on NLP)
  - ➔ extract Contextual Annotations
  - ➔ understand comments: positive/negative



# Content Aggregations

## □ A content aggregation:

### ♣ Creating aggregated content

- Collections, Essay
- Courses
- Playlists

### ♣ Creating links and relationships among content

- Annotations: contextual, visual, etc.,
  - see you tube and Flickr annotations on video and images
- Audiovisual annotations
  - E.g., Creating links from a video to another

## □ IPR problems of content aggregation

- ♣ Aggregate means taking derivative works, you need to have the rights to do it.





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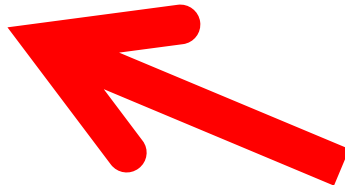
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# User Profile

## ❑ Static user profile aspects

- ♣ generically provided during registration
  - ➔ frequently not so much detailed in generic Social Networks,
  - ➔ users prefer to avoid filling in 'useless' forms and/or to provide false data.
- ♣ In small thematic and business oriented Social Networks the information is much more reliable.
- ♣ Dependent on the Social Network objectives

## ❑ Dynamic user profile aspects

- ♣ generate on the basis of the user's activities performed on the SN elements, such as the actions performed on
  - ➔ content, other users, on groups, on chat, etc.
- ♣ estimated/inferred by assessment/analysis



# Static Aspects of User profile

## ❑ Static information collected during registration++

- ♣ Name, surname,
- ♣ Nationality and languages (multiple)
- ♣ Genre, age, etc..other personal info,.
- ♣ Instruction/School, work, family structure, etc.
- ♣ Personal photo
- ♣ Jobs: several different jobs with periods, etc..
- ♣ Competences: several skills
- ♣ Economical data: range, etc.
- ♣ Explicit Preferred content:
  - ➔ topics, genre, period, area, etc.
- ♣ Subscribed (slow dynamic):
  - ➔ lists, groups, ..



# Dynamic Aspects of User profile

- ❑ **dynamic information collected on the basis of the activities:**
  - ♣ votes and comments/annotations on:
    - ➔ contents, forums, web pages, etc.;
  - ♣ downloads and play/view/executions of content, web pages, etc.;
  - ♣ uploads and publishing of user provided content;
  - ♣ marked content as preferred/favorite;
  - ♣ recommend content/groups or users to other users;
  - ♣ chat with other users, publishing forum topic on groups;
  - ♣ queries performed on the portal, etc.;
  - ♣ create a topic in a forum or contribute to a discussion;
  - ♣ relationships/connections with other users or groups;
  - ♣ Etc.





# Dynamic aspects of user actions

- ❑ Statements written on blogs and micro blogs
  - ♣ Short Comments in a context
  - ♣ Recurrent user and statement
  - ♣ The same statement on more than one blog (pushed by pushers)
  - ♣ Dates and time, successive blog posts
  
- ❑ Statements on comments
- ❑ Assessment of:
  - ♣ Market trends, market vigilance
  - ♣ Pharmavigilance



# Esempio di Profilo utenti

## ➤ Informazioni statiche:

### • Informazioni generali:

- nome, cognome, sesso,
- foto, data di nascita,
- descrizione personale,
- località di provenienza (ISO 3166),
  - Nazione
  - Suddivisione
  - Provincia

### • lingue parlate (ISO 369)

### • Informazioni di contatto:

- lista di contatti di instant messaging

### • Scuola e Lavoro:

- scelta del livello scolastico,
- nome della scuola,
- tipo di lavoro,
- nome del posto di lavoro

### • Interessi:

- Vettore contenente la lista di valori del campo  
Type degli oggetti scelti dall'utente

## ➤ Informazioni dinamiche:

- Lista di oggetti preferiti

- Lista di amici

- Lista gruppi

- Voti positivi ad oggetti

- Commenti ad oggetti

- Blog post

- ...

- ...

- Informazioni sulle preferenze  
sulla base delle  
visualizzazioni degli oggetti

- Format

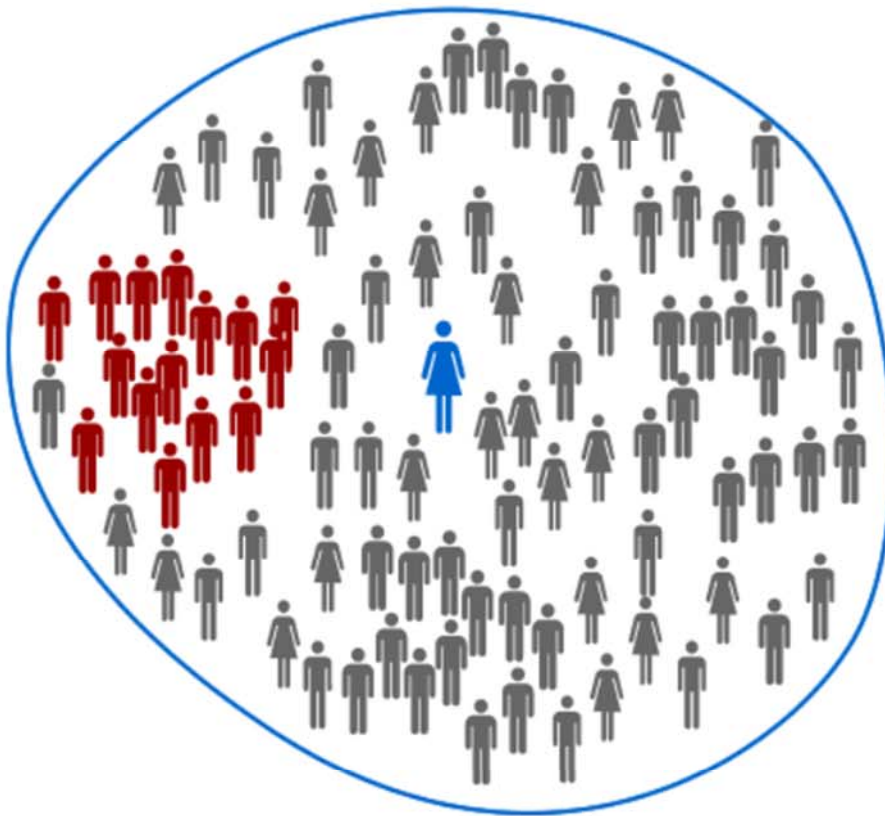
- Type

- Taxonomy

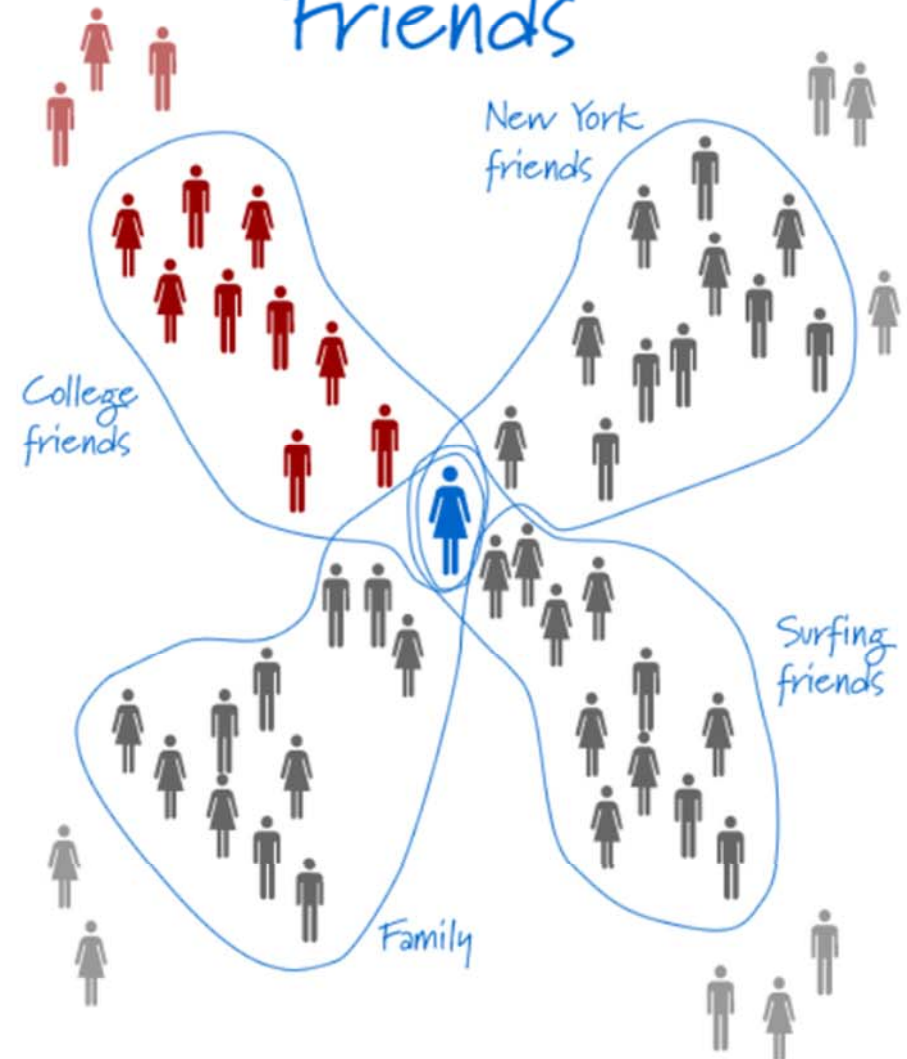


# Friends and Friends

Facebook Friends



Real Life Friends





# Descriptors of: user group

- ❑ **Groups** of users they may have specific descriptors and those inherited by the users:
  - ❑ **static** aspects of the groups such as:
    - ♣ objectives, topics, web pages, keywords, taxonomy, etc.;
  - ❑ **dynamic** aspects related to:
    - ♣ users belonging to the group; users may: join and leave the group, be more or less active over time;
    - ♣ content associated with the group: files, comments, etc., with their taxonomical classification, metadata and descriptors.





# Groups vs Channels

## □ Groups:

- ♣ The Group has an objective to persecute: thematic, goals, etc.
- ♣ Users belong to a group
- ♣ The users of a group may have advantages in terms of accesses at the users profiles and at services
- ♣ A group may have a distribution channel, a discussion forum, a mailing list, etc.

## □ Channels:

- ♣ The channel is a distribution group for content.
- ♣ The channel is typically only a way to access at content,

## □ Collective Intelligence

- ♣ Modeling of almost uniform group of users with a collective profiles that represent a collectivity



# Group vs Circle

- ❑ A Circle is only a collection of users without a circle coordinator/moderator.
- ❑ The concept of Circle in the context of SN has been introduced by Google+
- ❑ Main Circles kinds are:
  - ♣ Friends, family, known, following
  - ♣ Personalized circles can be created as well



# Part 6: *Social Media Technologies and Solutions*

## ❑ Collaborative systems

- 🕒 Definition and Terminology

## ❑ Social Network

- ♣ Forrester Trend for Social Networking
- ♣ Motivations for Social Networking
- ♣ Application, classification of Social Networking
- ♣ Examples of Social Networks
- ♣ factors of Social Networks

## ❑ User/Content Social Network

- ♣ User classification and behavior
- ♣ User Generated Content, UGC
- ♣ Content descriptors
- ♣ User and group descriptors



## *Measures of Social Networks*

- ♣ User profile problems
- ♣ Measures of Social Networks
- ♣ Metrics and examples: Centrality, Clustering, ....
- ♣ Direct measures of user actions

## 🕒 *Business of Social Networks*

- ♣ Penetration of social networks
- ♣ Numbers of Social Networks

## 🕒 *interoperability and standards*

- ♣ Social icons
- ♣ Embedding
- ♣ Authentication



# Social Network Analysis Metrics

- ❑ The SNA is mainly focused on ***evaluating the status of the network***
- ❑ **Relationships and metrics** that give an idea of the evolution of the SN and of the healthy aspects user and content:
  - ♣ Which are the most important persons
  - ♣ Which are the most active people
  - ♣ Which are the critical conditions
  - ♣ Which are the major drivers of growing
  - ♣ Which are the most interested aspects/content/feature in a given period
  - ♣ Which are the most relevant topics of interest
  - ♣ Which is the most used service/functionality in the SN
  - ♣ Etc.





# User Profile Problems

- ❑ **Different data types:**
  - ♣ Numbers: age, votes, #kids, ..
  - ♣ Enumerates/symbolic: language, nationality, etc.
- ❑ **Multiple Values / Selections:**
  - ♣ languages, nationalities, preferences, etc...
- ❑ **Non-Symmetrical Distances**, for instance:
  - ♣ Preferences:  $Dim (\{Pref(A)\}) \neq Dim (\{Pref(B)\})$
- ❑ **Dynamic information**
  - ♣ related computational complexity
- ❑ **Different Languages** of comments, descriptions,
  - ♣ Language processing and understanding
  - ♣ Dictionaries, Semantics, Taxonomy, etc.



# Relevance of Users

## ❑ Number of Connections with other users

Direct connections,

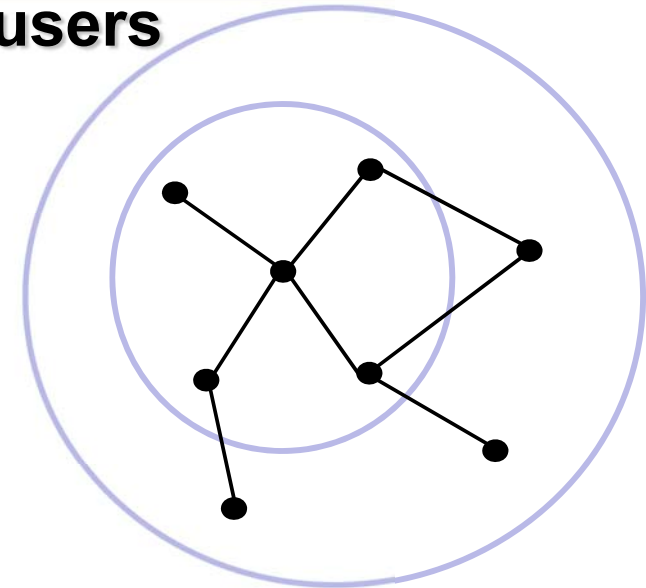
- ♣ Second and third level connections,
- ♣ Etc.

## ❑ Number of accesses to their

- ♣ profile page (if any)
- ♣ posted and/or preferred content
- ♣ Comments
- ♣ groups

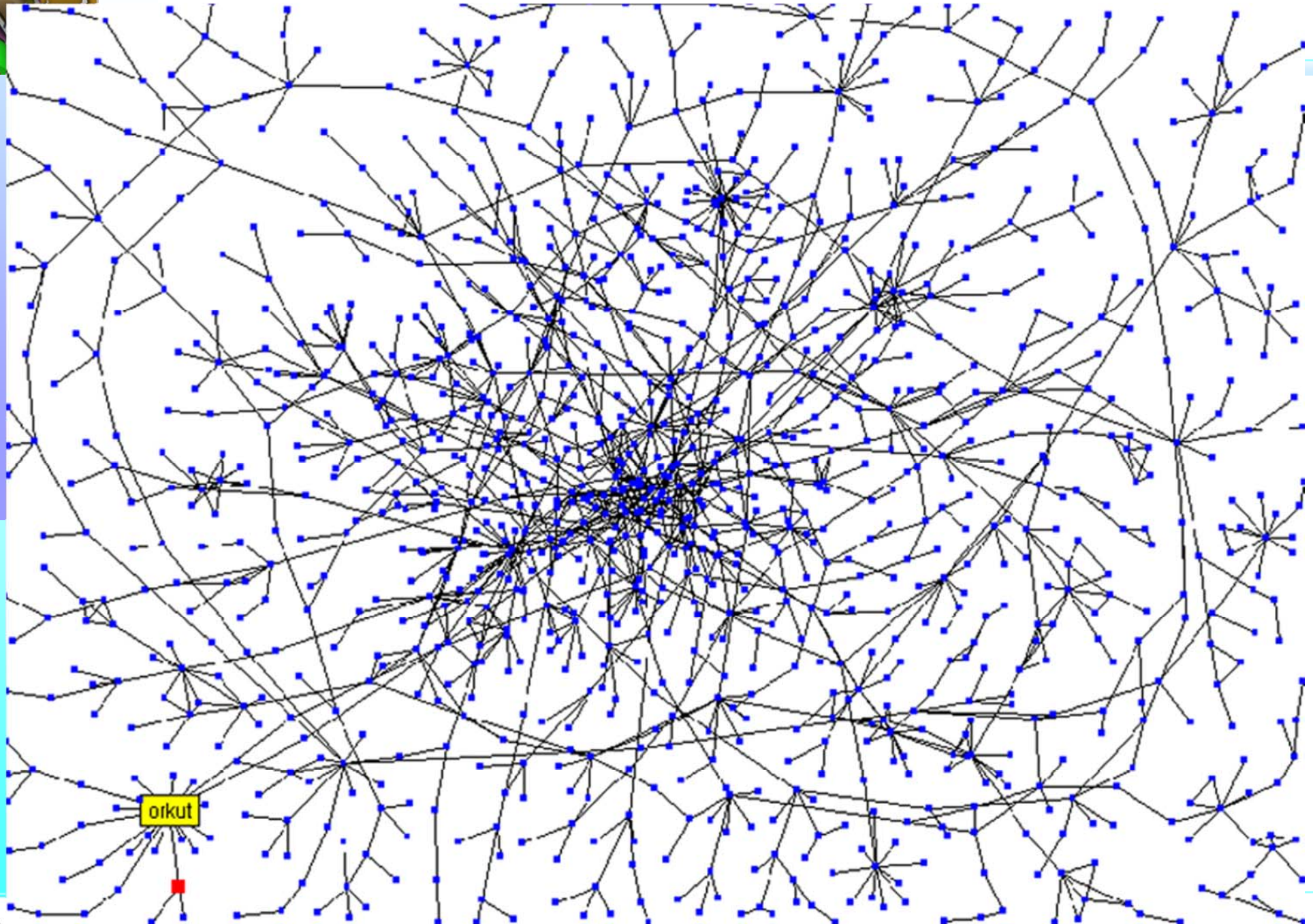
## ❑ Users' Activities

- ♣ Number of posted content in time
- ♣ Number of posted comments, on content, on area...
- ♣ Number of votes per content, per area, etc.
- ♣ Number of accesses to the network





# Stanford Social Web



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# Issues on Community Graphs

- ❑ **Absence of not connected users that may be the majority**
- ❑ **Presence of a main Center of gravity**
  - ♣ Presence of dense groups with leader or reference users
- ❑ **Number of Connections**
  - ♣ Distribution of connections
  - ♣ Density of connections
- ❑ **Presences of remotely located small Groups**
  - ♣ Self connections among these people
  - ♣ Some of these smaller remote groups are linked with the rest via 1 or few more chains of single people
    - ➔ Depending on their activities, the risk of losing those communities is evident





# friendship propagation




- ❑ User links and friendship propagation....
- ❑ **Mechanisms for invitation**
  - ♣ User A invites N Users
  - ♣ Among these N Users, M Accept the invitation
- ❑ **Viral Indicator**
  - ♣ If  $M > N$  a mechanism of viral grow is started
  - ♣ It can exponentially grow up or to simply produce a small pike
- ❑ **Users have:**
  - ♣ Direct Friends----- for example: 90
  - ♣ Indirect Friend of different levels -----: level 1: 900
  - ♣ Friends via groups (see LinkedIn) -----: 14000



# LinkedIn

## Your Network of Trusted Professionals

You are at the center of your network. Your connections can introduce you to 4,397,200+ professionals — here's how your network breaks down:

<b>1</b>  <b>Your Connections</b> Your trusted friends and colleagues	<b>285</b>
<b>2</b>  <b>Two degrees away</b> Friends of friends; each connected to one of your connections	<b>61,000+</b>
<b>3</b>  <b>Three degrees away</b> Reach these users through a friend and one of their friends	<b>4,335,900+</b>
<b>Total users you can contact through an Introduction</b>	<b>4,397,200+</b>

**26,016 new people** in your network since November 17

## The LinkedIn Network

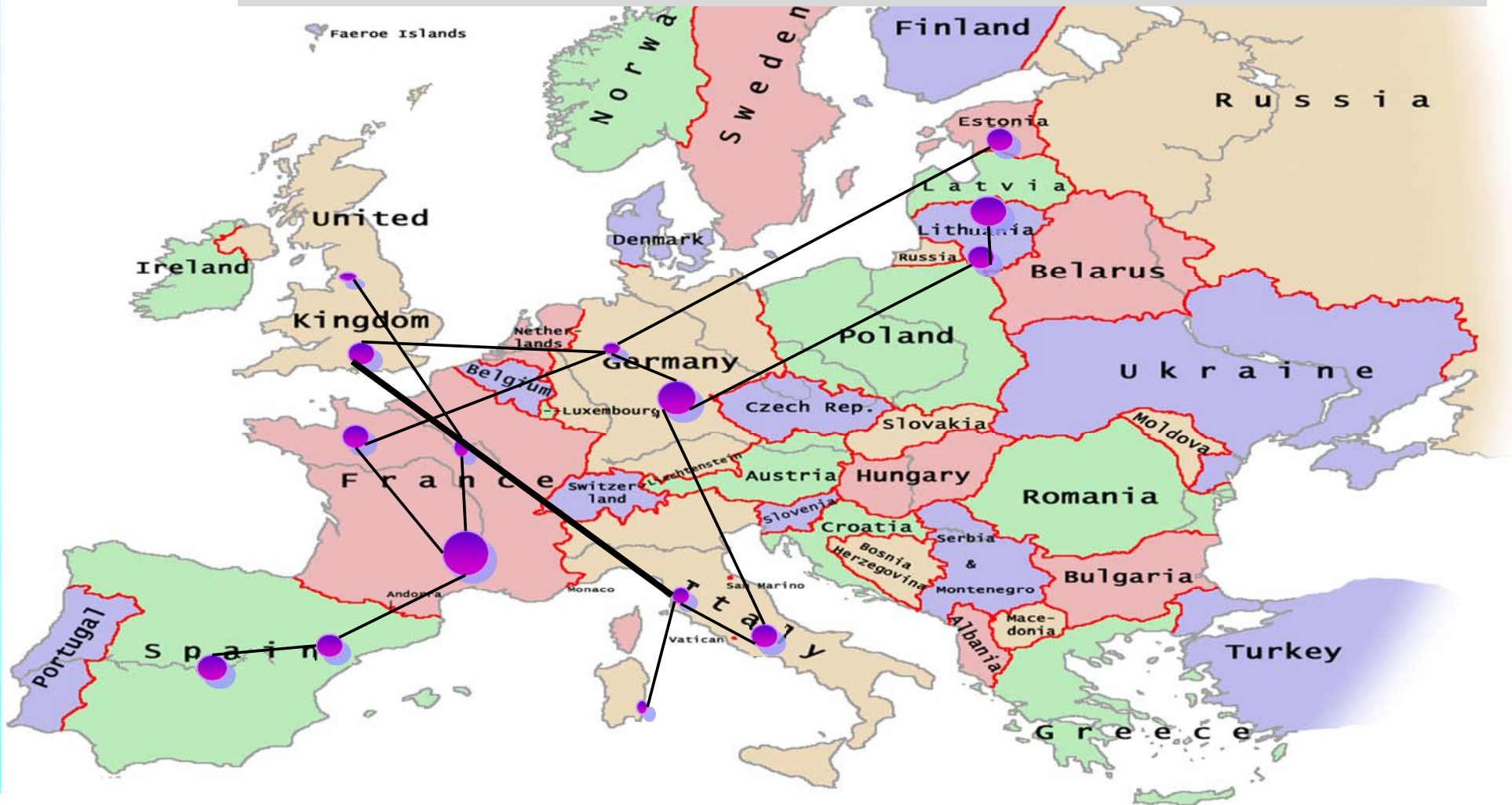
The total of all LinkedIn users, who can be contacted directly through [InMail](#).

Total users you can <a href="#">contact directly</a> — <a href="#">try a search now!</a>	<b>85,000,000+</b>
--	--------------------

# Main Geographical User/Group Distribution

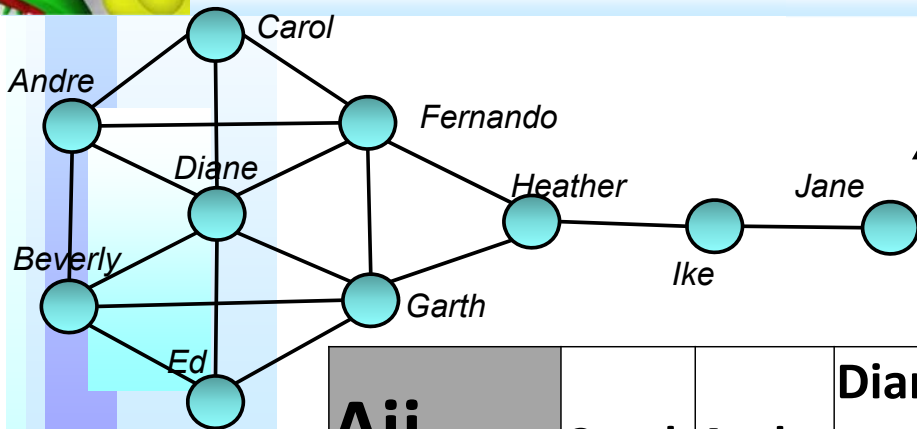


-Larger groups are represented with bigger dots  
-Multiple connections are represented with stronger lines





# Matrix of connections



$A[i][j]$ : matrix of connections

<b>Aij</b>	Carol	Andre	Diane	Fernando	Beverly	Ed	Garth	Heather	Ike	Jane	NC
<b>Carol</b>	0	1	1	1	0	0	0	0	0	0	3
<b>Andre</b>	1	0	1	1	1	0	0	0	0	0	4
<b>Diane</b>	1	1	0	1	1	1	1	0	0	0	6
<b>Fernando</b>	1	1	1	0	0	0	1	1	0	0	5
<b>Beverly</b>	0	1	1	0	0	1	1	0	0	0	4
<b>Ed</b>	0	0	1	0	1	0	1	0	0	0	3
<b>Garth</b>	0	0	1	1	1	1	0	1	0	0	5
<b>Heather</b>	0	0	0	1	0	0	1	0	1	0	3
<b>Ike</b>	0	0	0	0	0	0	0	1	0	1	2
<b>Jane</b>	0	0	0	0	0	0	0	0	1	0	1
<b>nc</b>	<b>3</b>	<b>4</b>	<b>6</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>5</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>36</b>

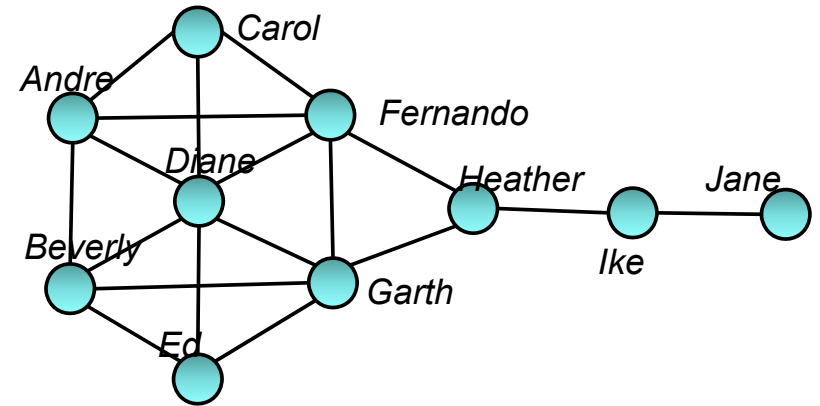




# Social Network Analysis Metrics

## □ Degree of Centrality of a node

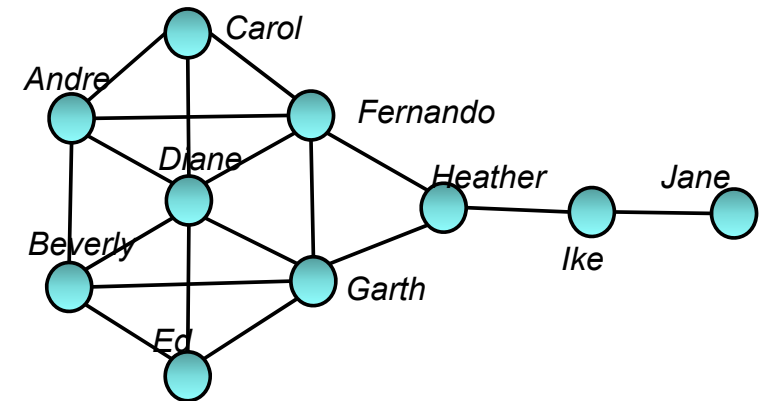
- ♣ Number of connections to a certain node
- ♣ can be non symmetric if the relationships are not symmetric, thus the graph is oriented
- ♣ Diane
  - ➔ has 6 connections
  - ➔ is connected to others which are in turn connected each other.
- ♣ It is not true that to count connections is the best model to identify the most relevant node. In the above case:
  - ➔ Diana is connected to people that are in any case connected each other.
  - ➔ While Heather is central to keep Ike and Jane connected to the rest of the network !!





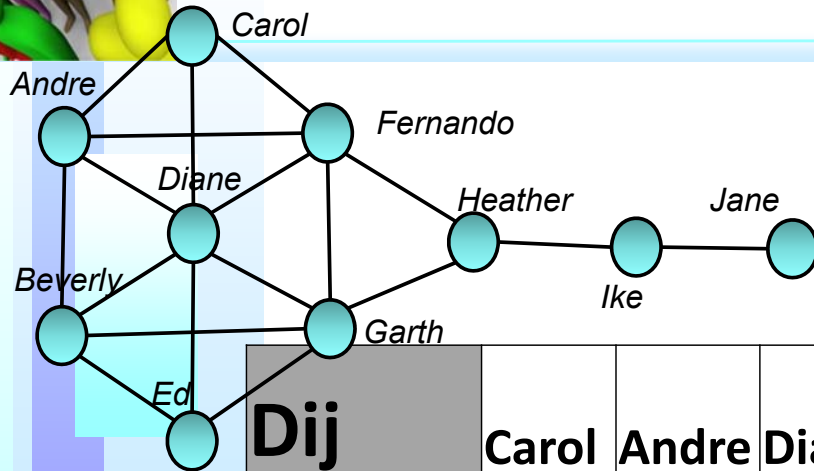
# Averaged Number of connections

- ❑ Total number of connections divided by the number of Nodes
- ❑ According to the examples above:
  - ♣ **NC**, Number of connections: 36
    - ➔ they are considered non bidirectional otherwise they should be 18
  - ♣ **NN**, Number of nodes: 10
- ❑ Averaged number of connections:
  - ♣ **ANC**:  $36/10$ , 3.6 connections per node
  - ♣ **ANC**:  $18/10$ , 1.8 connections per node
- ❑ It is more similar to the user perception to say 3.6 connections rather than 1.8





# Matrix of distances



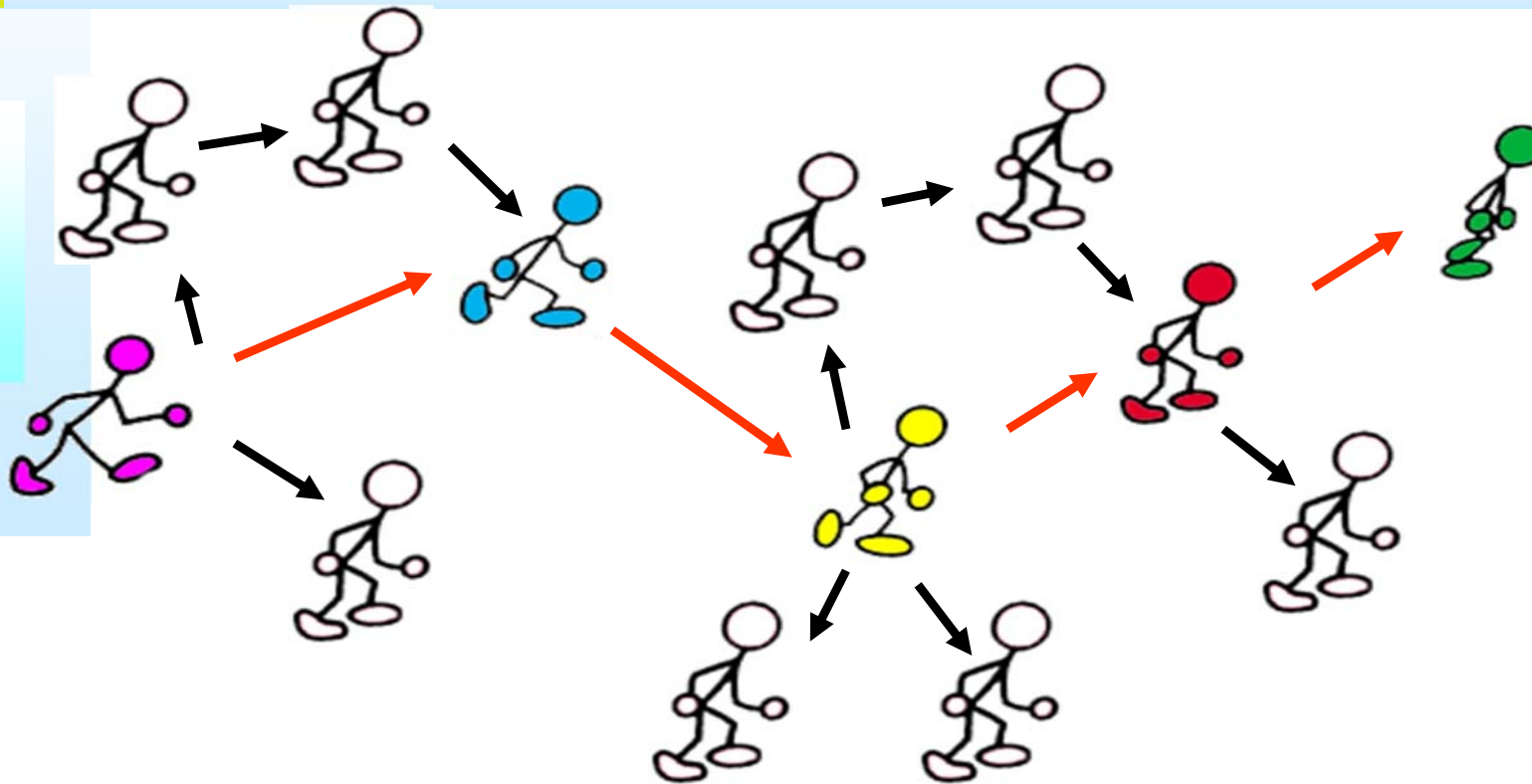
$D[i][j]$ : matrix of distances  
 $N*(N-1)/2$  elements

Dij	Carol	Andre	Diane	Ferna ndo	Beverl y	Ed	Garth	Heath er	Ike	Jane	
Carol	0	1	1	1	2	2	2	2	3	4	18
Andre		0	1	1	1	2	2	2	3	4	16
Diane			0	1	1	1	1	2	3	4	13
Fernando				0	2	2	1	1	2	3	11
Beverly					0	1	1	2	3	4	11
Ed						0	1	2	3	4	10
Garth							0	1	2	3	6
Heather								0	1	2	3
Ike									0	1	1
Jane										0	0

89



# Averaged shortest path from one person to another



MIT: 6.4 hops

Stanford: 9.2 hops

Our example: 1.97 hops

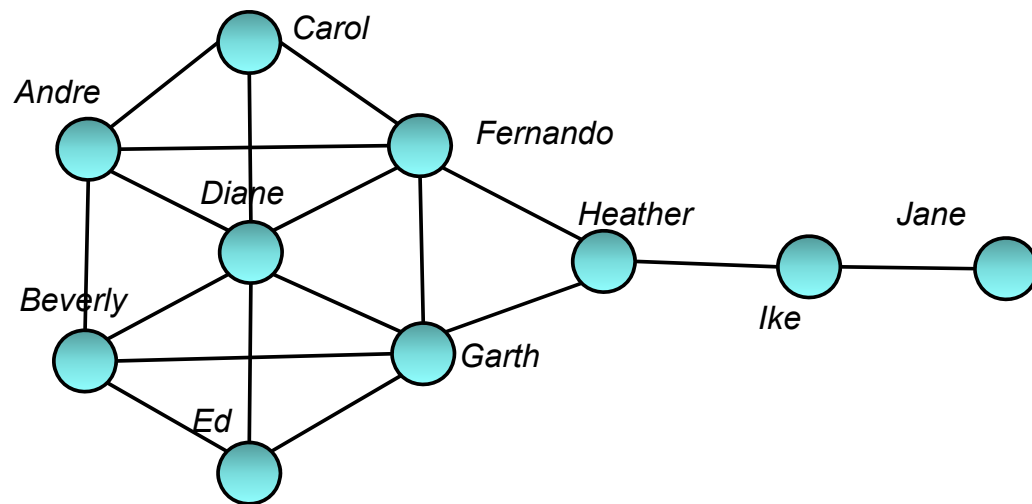
Sum of shortest paths: 89  
10 Nodes  
45 possible connections



# Eccentricity of a node

## □ Eccentricity:

- ♣ the max distance of a certain node with respect to all other nodes of the network
  - $Ecc(Jane) = 4$
  - $Ecc(Fernando) = 3$
- ♣ See Jane column on right side of table of Distance Matrix





# Centrality of a node

## □ Eccentricity:

♣  $Ecc(Jane) = 4$

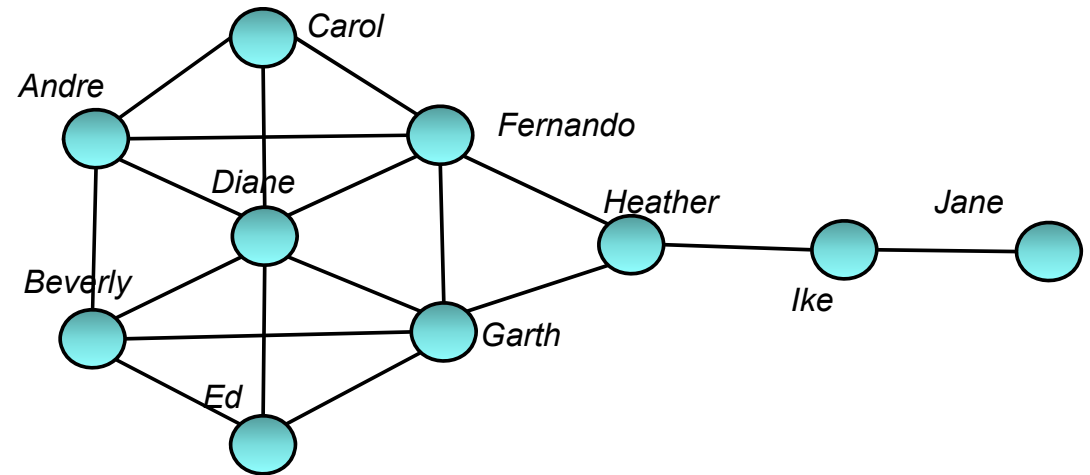
♣  $Ecc(Fernando) = 3$

## □ Centrality $C_e()$ :

♣  $C_e(Jane) = 1/4$

♣  $C_e(Fernando) = 1/3$

♣  $C_e(Heather) = 1/2$



$$C_E(v) = \frac{1}{ecc(v)} = \frac{1}{\max_{v \in V, u \neq v} d(v, u)}$$

- *Heather* is the node with  $\max C_e()$  since it can reach all the nodes with max 2 hops.

# Closeness Centrality of a node

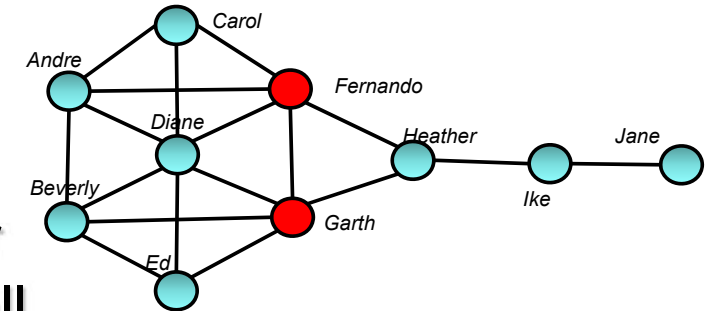
❑ **Closeness Centrality:** the reciprocal of the sum of all the distances of that node with respect to the other nodes

♣ See column on right of the distance matrix

❑ *Fernando* and *Gary* have a lower number of connections with respect to *Diane*, on the other hand they have the best position to access to all the other nodes.

♣ They have the best view on what happen in the network.

♣  $Cc(\text{Fernando}) = Cc(\text{Garth}) = 0,071$



$$C_C(v) = \frac{1}{\sum_{u \in V, u \neq v} d(v, u)}$$

Dij	Carol	Andre	Diane	Fernando	Beverly	Ed	Garth	Heather	Ike	Jane		
Carol	0	1	1	1	2	2	2	2	2	3	4	18 0,056
Andre	1	0	1	1	1	2	2	2	2	3	4	17 0,059
Diane	1	1	0	1	1	1	1	1	2	3	4	15 0,067
Fernando	1	1	1	0	2	2	1	1	1	2	3	14 <b>0,071</b>
Beverly	2	1	1	2	0	1	1	2	2	3	4	17 0,059
Ed	2	2	1	2	1	0	1	2	2	3	4	18 0,056
Garth	2	2	1	1	1	1	0	1	1	2	3	14 <b>0,071</b>
Heather	2	2	2	1	2	2	1	0	1	1	2	15 0,067
Ike	3	3	3	2	3	3	2	1	0	1	1	21 0,048
Jane	4	4	4	3	4	4	3	2	1	0	1	29 0,034
												89



# Betweenness Centrality of a node

❑ **Betweenness Centrality:** control degree of a node about the information flowing among other nodes

♣ the ratio between the number of shortest paths between vertex  $s, t$  in which the node ( $v$ ) is involved

$$C_B(v) = \sum_{s \neq t \neq v \in V} \frac{S_{st}(v)}{Total(S_{st})}$$

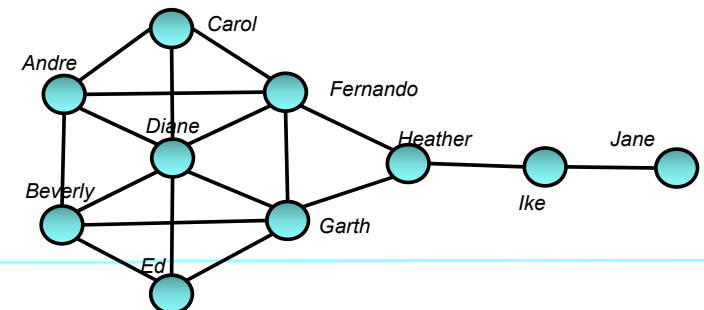
♣ No shortest path passes via Carol, Ed and Jane to connect a couple of other nodes:

➔  $S_{ij}()$  for them is Zero

❑ Heather is important since without it:

♣ Ike and Jane would be cut out.

	$S_{ij}$	$C_b(v)$
Carol	0	0,000
Andre	2	0,034
Diane	7	0,121
Fernando	11	0,190
Beverly	2	0,034
Ed	0	0,000
Garth	11	0,190
Heather	16	<b>0,276</b>
Ike	9	0,155
Jane	0	0,000
total	58	







# Clustering Coefficient

❑ In SN or in any large group of related data it very important to identify clusters.

♣ They can be independent or overlapped.

❑ **Clustering Coefficient:** the ration between the number of connections with its neighborhoods (neigh) and the max number of possible connections among them.

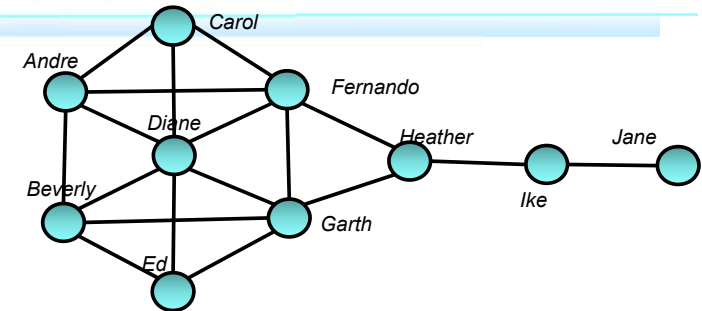
❑ In the above presented example the results are reported in this slide

❑ It can be estimated for all the network as

♣  $(\text{Num links}) / (\text{max num links})$

♣ Our case:  $18 * 2 / (10(10-1)) = 0,04$

♣ Average: 0,49



	Neigh	Clust Size	Ci()
Carol	3	4	4,50
Andre	4	5	6,40
Diane	6	7	10,29
Fernando	5	6	8,33
Beverly	4	5	6,40
Ed	3	4	4,50
Garth	5	6	8,33
Heather	3	4	4,50
Ike	2	3	2,67
Jane	1	2	1,00



# Clustering Coefficient, $C_i()$

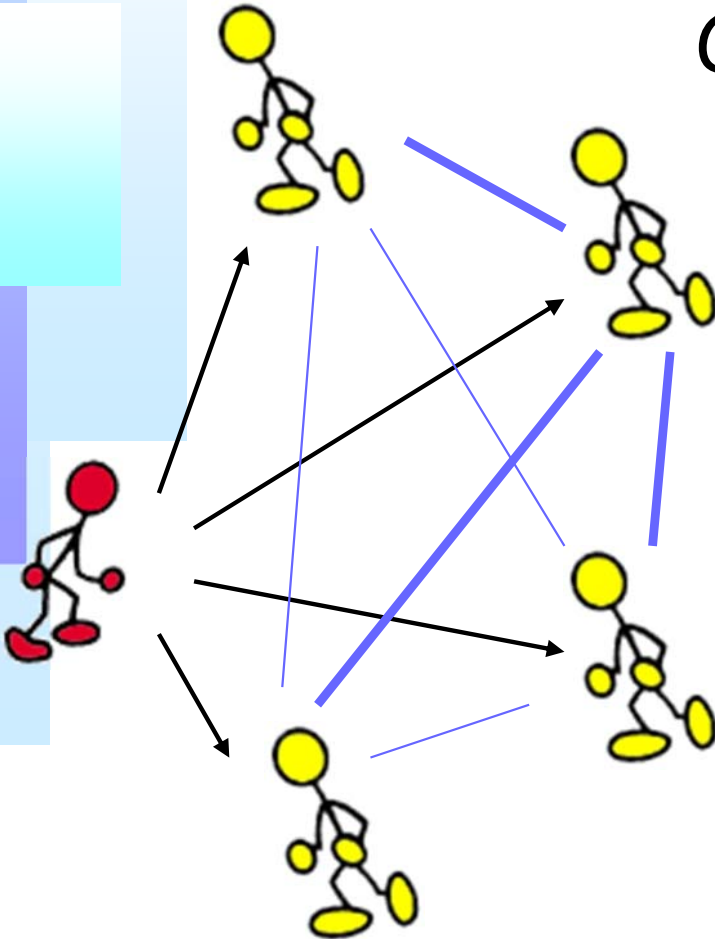
$$C = \frac{\text{\# of links to neighbors}}{\text{max \# links among neighbors}}$$

$$C_{\text{max}}() = (N-1) / (N(N-1)/2) = 2/N$$

$$C_i() = 2/5 = 0,40$$

Maximum for full connected.

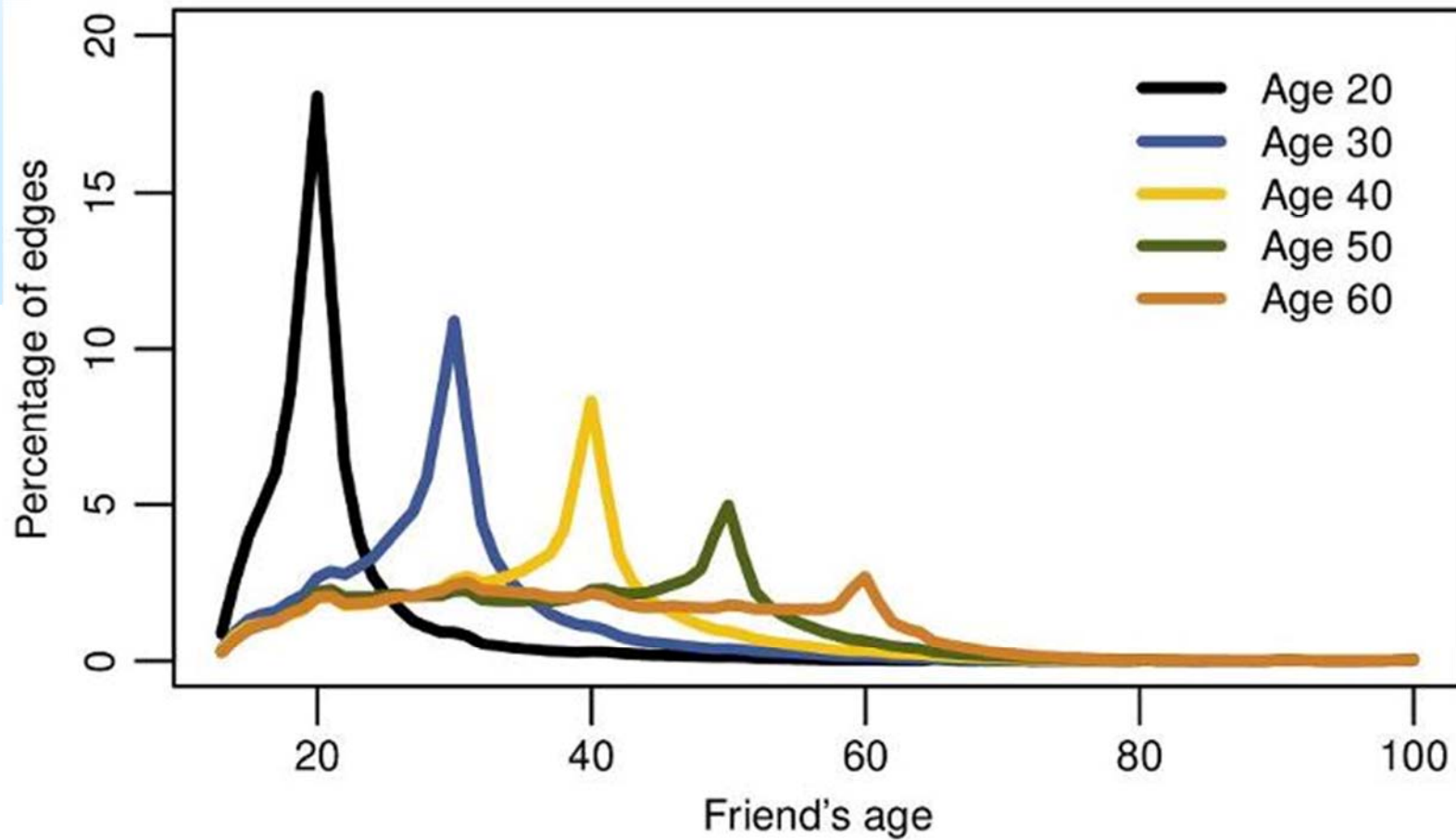
A lower value means to have less connections to neighbors and thus the needs of clustering



MIT:	0.22
Stanford:	0.21



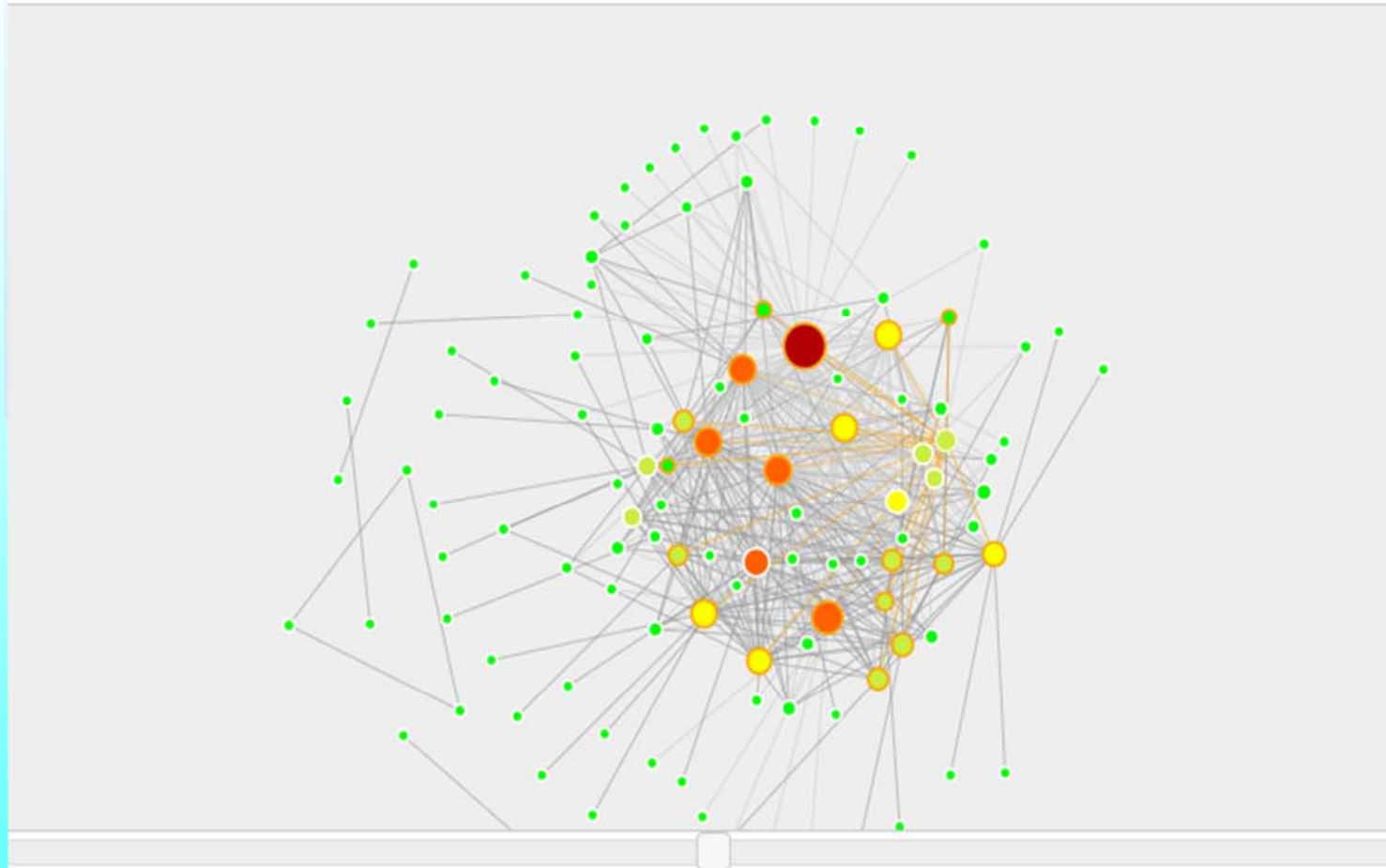
# Distribuzione dei colleghi (facebook)





# <http://www.eclap.eu/drupal/?q=graphviewer>

## User Metrics



## Connection

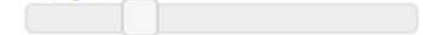
Nodes: 1117  
Links: 418  
Isolated nodes: 1002

In this graph nodes represent the users of the entire social network and edges indicate friendship. The radius of nodes depends on the value of the metric. Click on the node which you want to know.

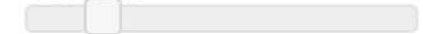
Links length: 120



Charge: -100



Gravity: 0.2



Friction: 0.4



Enter the rate of connected nodes to display in the graph, according to the metric value.

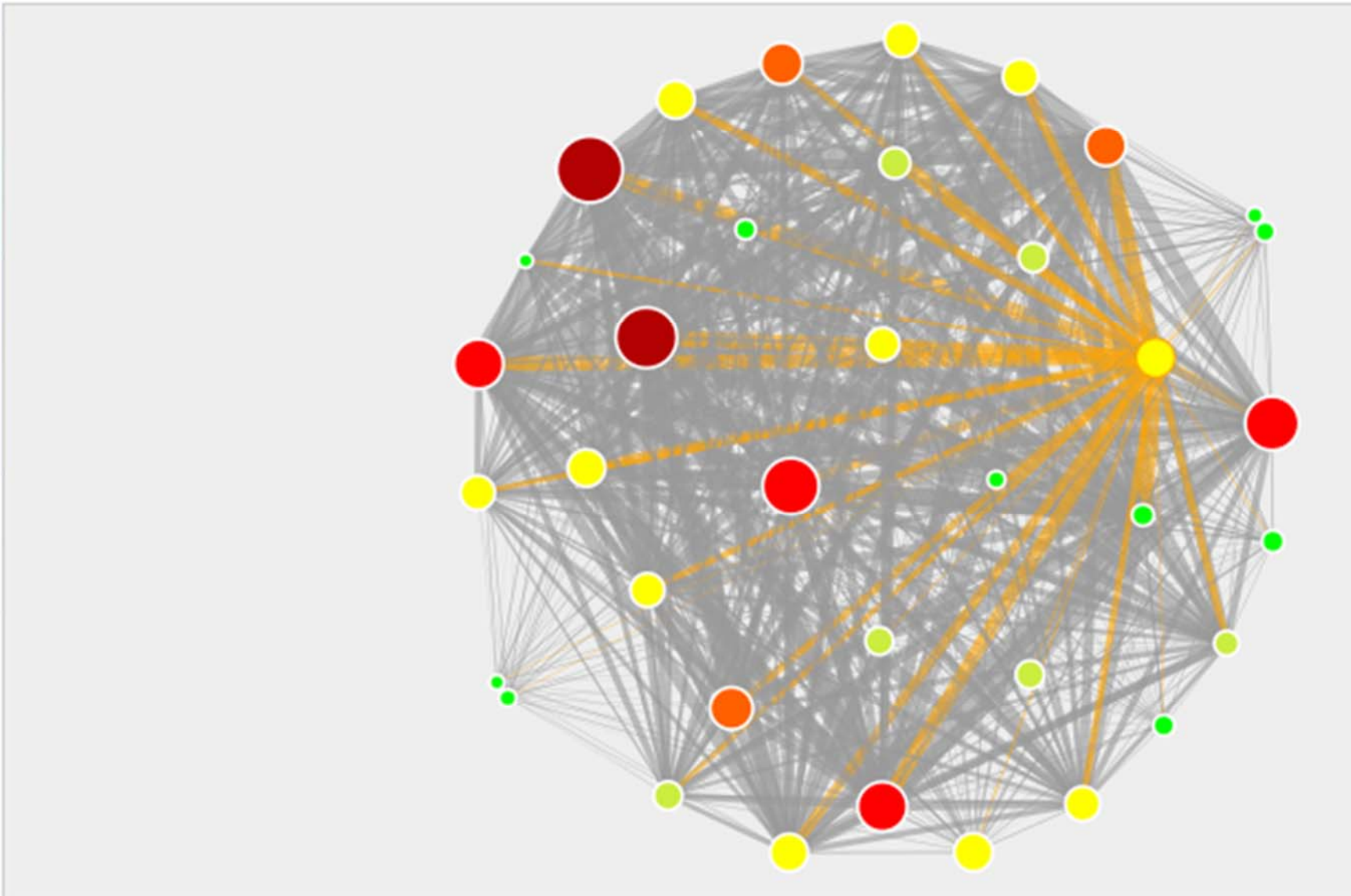
Color map	
Color	Value range
	0 - 10.67
	10.67 - 21.33
	21.33 - 32
	32 - 42.67
	42.67 - 53.33
	53.33 - 64





# Group Connectivity

Groups Graph





# Anonymity vs Relationships

- ❑ Given a certain user, the graph of his relationships with other users and action make it quite unique in the network.
- ❑ For this reason, SN have difficulties at providing data related to SN users even if names, email, location, etc. are removed.
- ❑ There is a business in de-anonymize the social network data for data intelligence and user behavior discovering
- ❑ Therefore, there are also algorithms for obfuscating the data for making the Anonymity process more effective without destroying the meaning of the data.



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- Numbers of Social Networks

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- Embedding
- Authentication



Nov 2014

Nov 2015

Nov 2016







# Top Web in Italia

2013 in italia

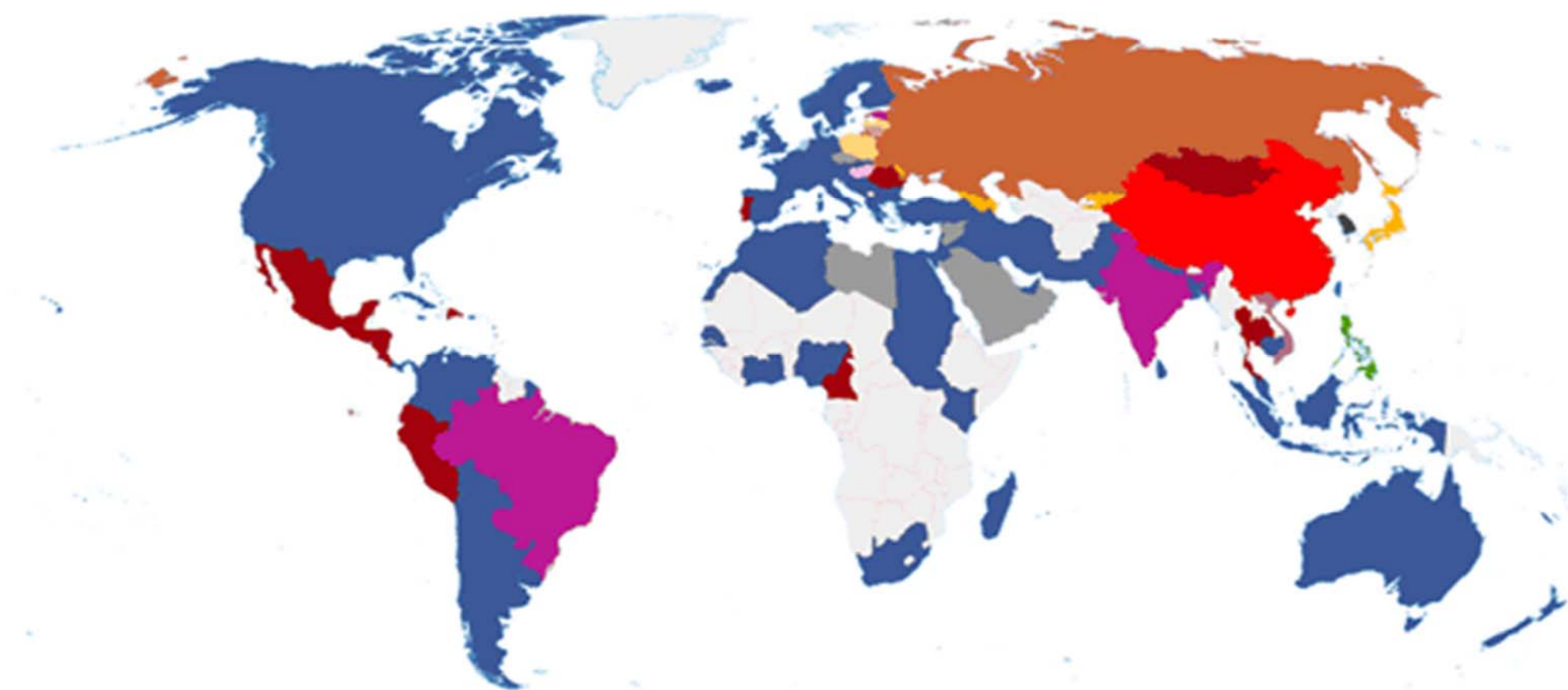
2014 in italia

2015 in italia

1 Google	→	1 Google.it	→	1 Google.it
2 facebook	→	2 facebook.com	→	2 facebook.com
3 Google.com	→	3 Google.com	→	3 Google.com
4 YouTube	→	4 YouTube.com	→	4 YouTube.com
5 Yahoo	→	5 amazon.it	→	5 amazon.it
6 Wikipedia	→	6 Yahoo.com	→	6 Wikipedia.org
7 Libero	→	7 Libero.it	→	7 Yahoo.com
8 ebay	→	8 Wikipedia.org	→	8 ebay.it
9 repubblica	→	9 ebay.it	→	9 Libero.it
10 Amazon	→	10 repubblica.it	→	10 repubblica.it
11 Corriere	→	11 subito.it	→	11 Corriere.it
12 Live.com	→	12 live.com	→	12 subito.it
13 LinkedIn.com	→	13 Corriere.it	→	13 live.com
14 Virgilio	→	14 virgilio.it	→	14 twitter.com
	→	15 LinkedIn.com	→	15 LinkedIn.com

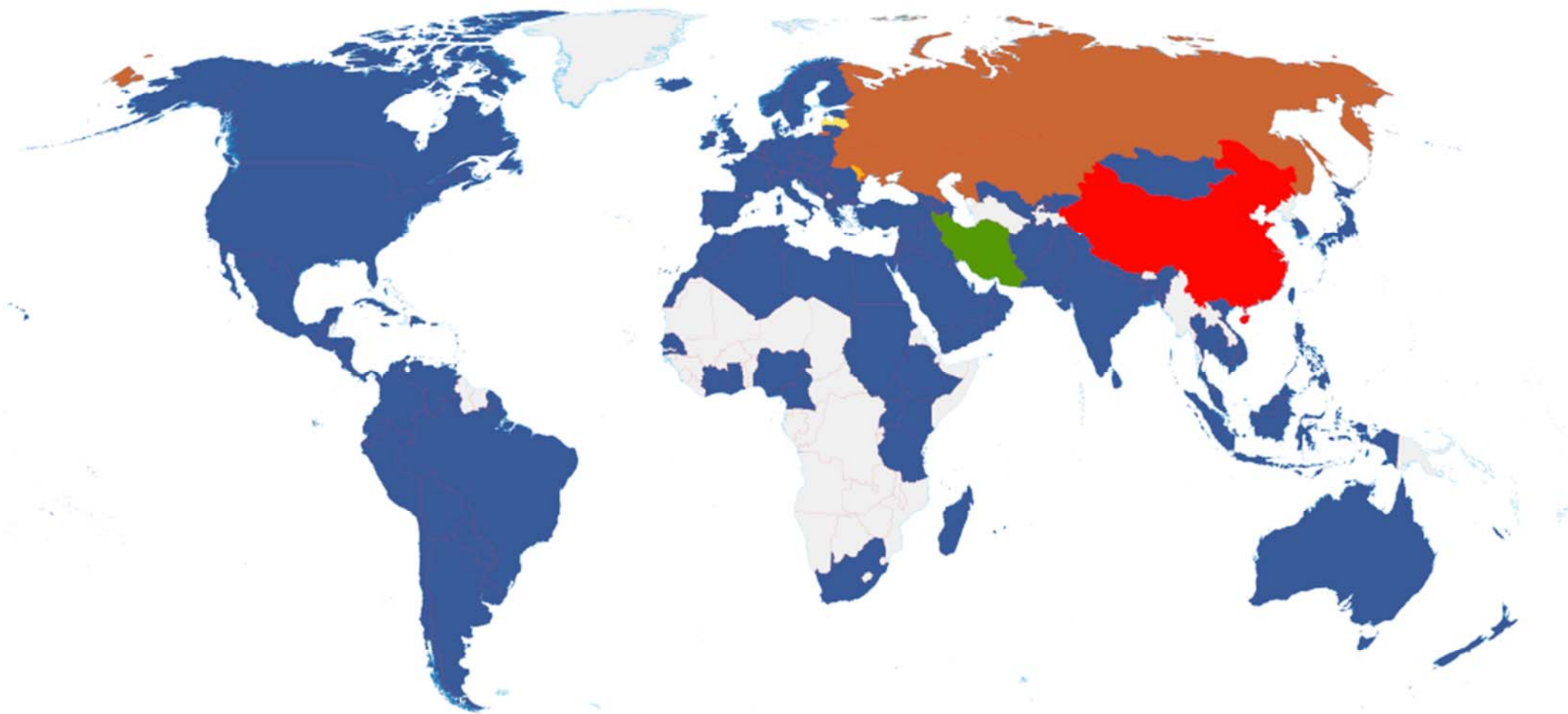
# WORLD MAP OF SOCIAL NETWORKS

June 2009



# WORLD MAP OF SOCIAL NETWORKS

June 2013



Facebook QZone V Kontakte Odnoklassniki Cloob Draugiem

credits: Vincenzo Cosenza vincos.it

license: CC-BY-NC

source: Alexa



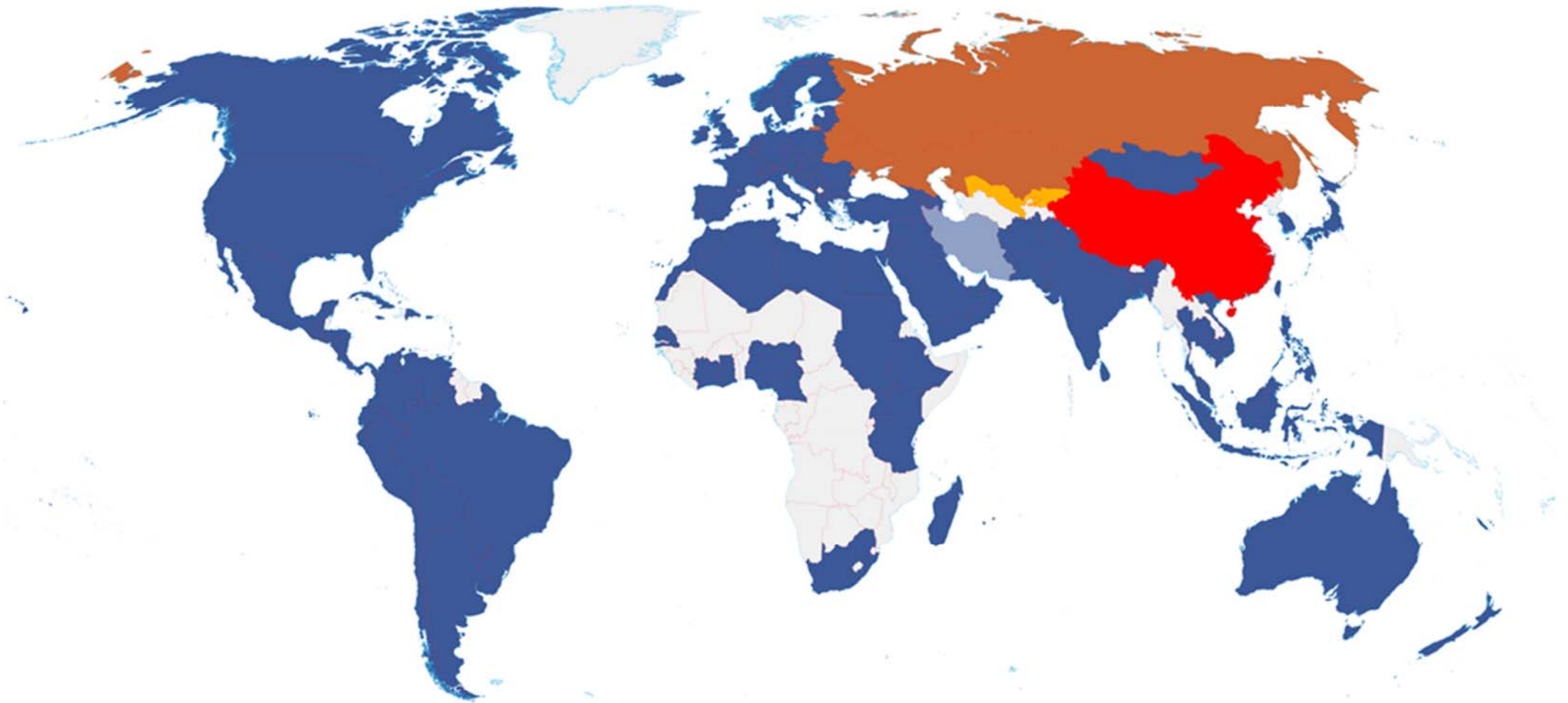
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# WORLD MAP OF SOCIAL NETWORKS

July 2014



Facebook QZone V Kontakte Odnoklassniki Facenama

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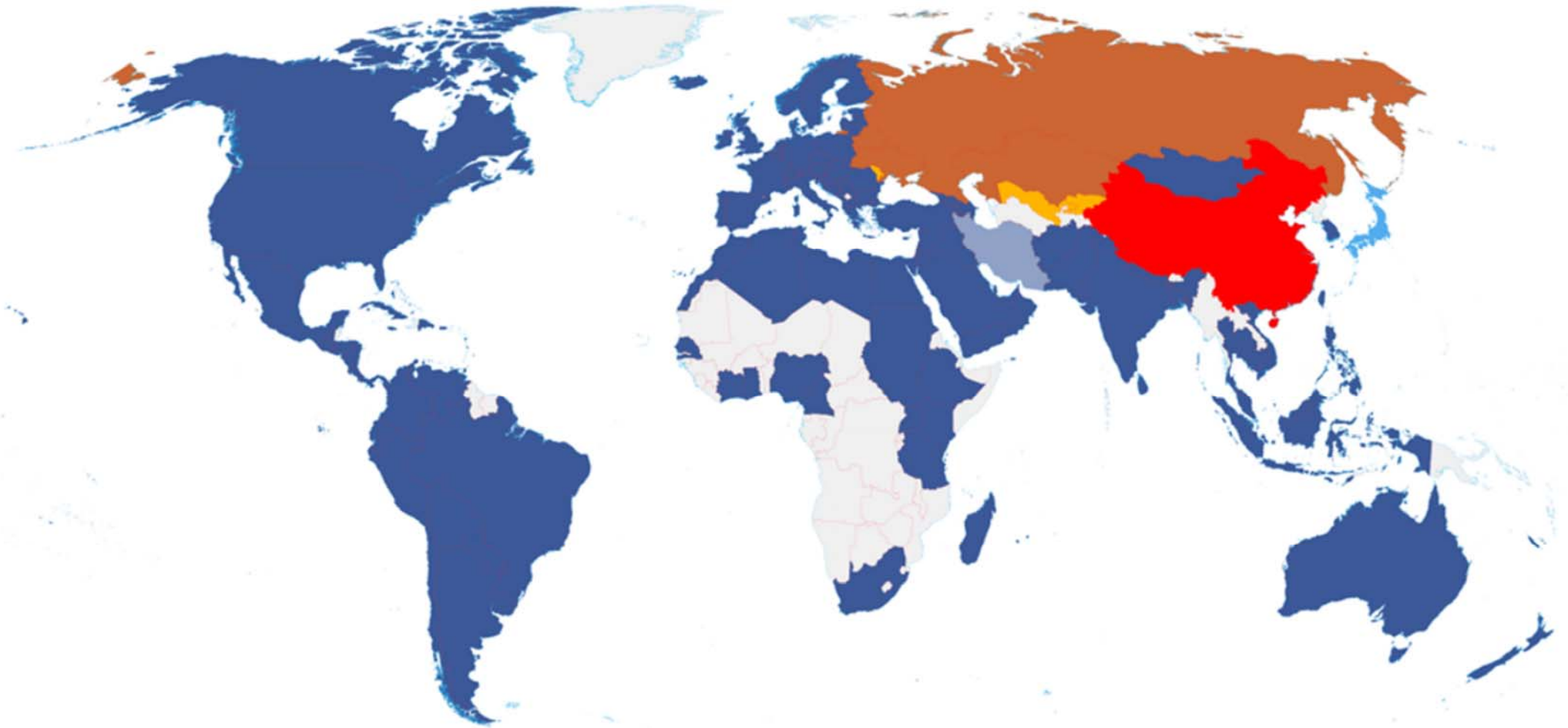
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# WORLD MAP OF SOCIAL NETWORKS

August 2015



Facebook

QZone

V Kontakte

Odnoklassniki

Twitter

Facenama

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source: Alexa



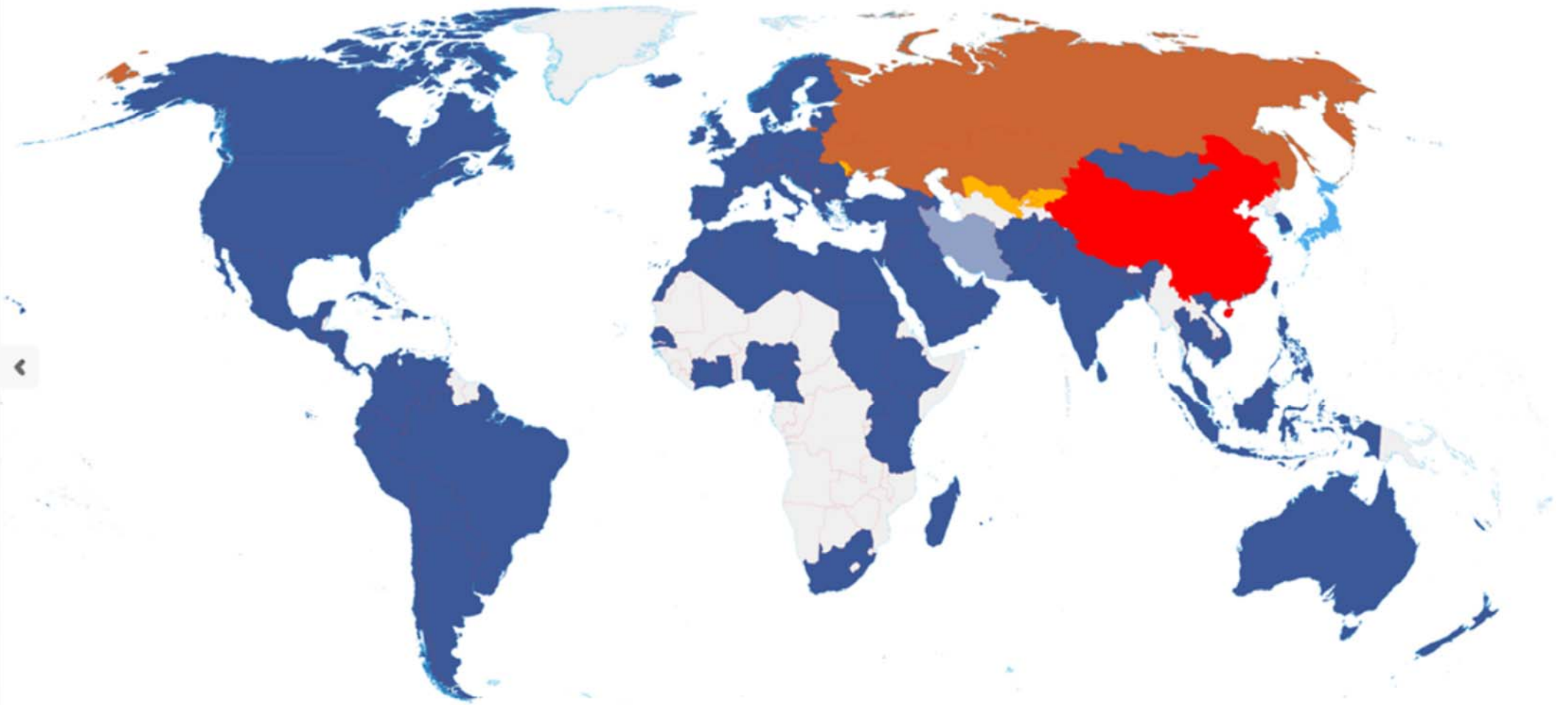
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INGEGNERIA  
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# WORLD MAP OF SOCIAL NETWORKS

January 2016



Facebook

QZone

V Kontakte

Odnoklassniki

Twitter

Facenama

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source: Alexa/SimilarWeb



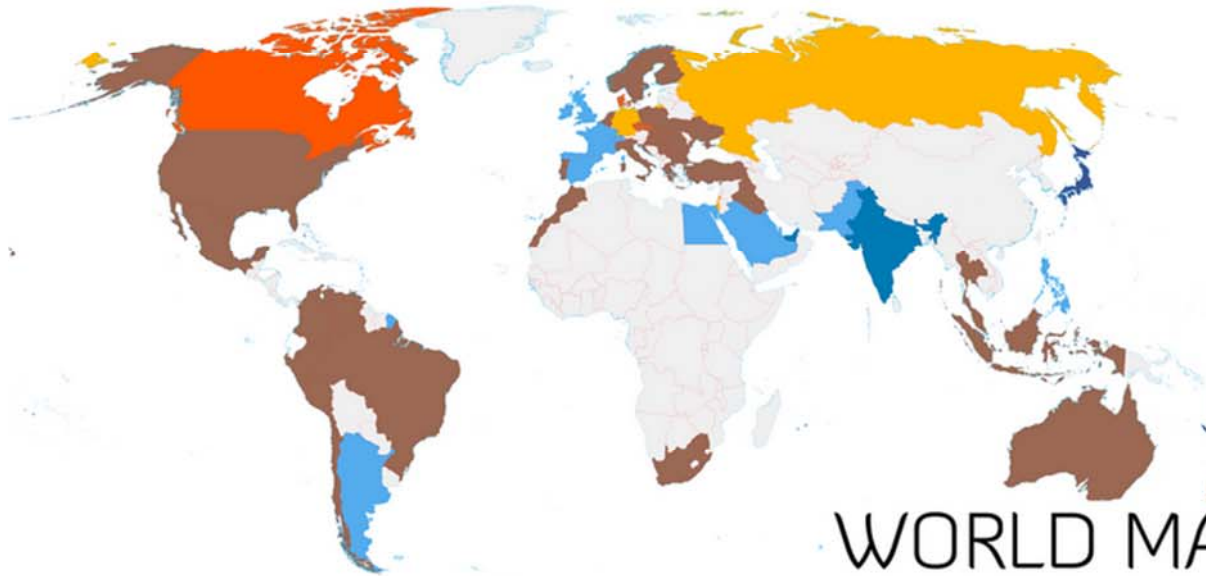
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# WORLD MAP OF SOCIAL NETWORKS

Ranked 2nd - August 2015



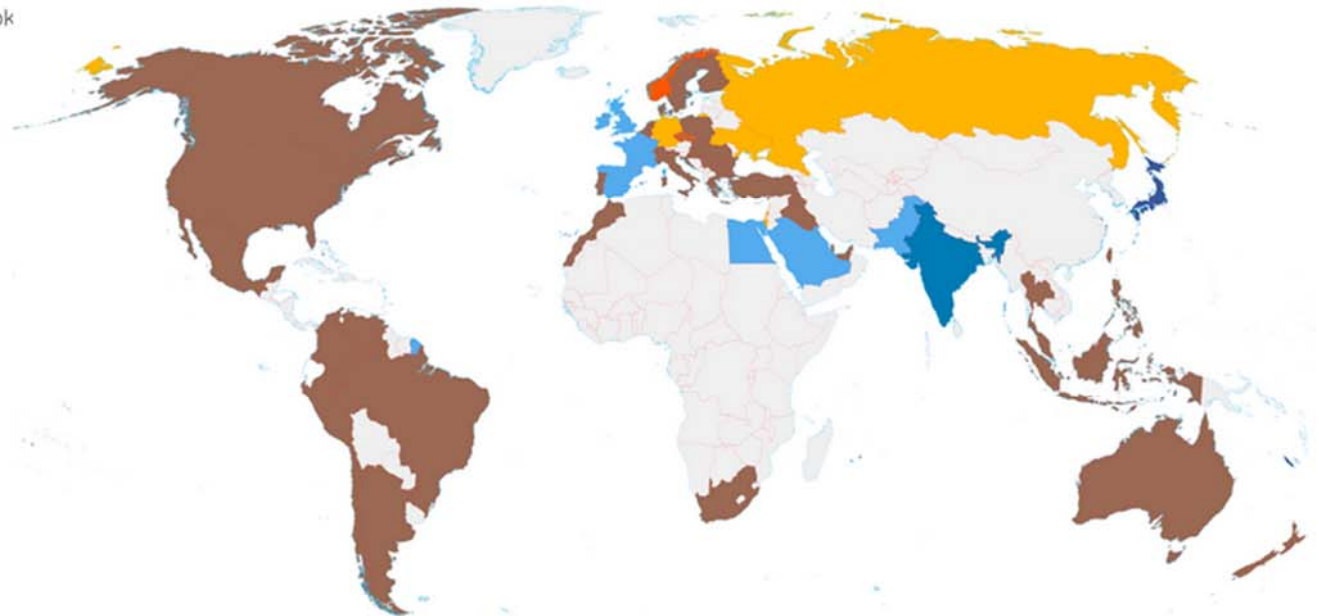
Instagram Twitter V Kontakt  
Linkedin Facebook

credits: Vincenzo Cosenza vincos.it

license: CC-BY-NC

# WORLD MAP OF SOCIAL NETWORKS

Ranked 2nd - January 2016



Instagram Twitter V Kontakte Odnoklassniki  
Linkedin Facebook Reddit

credits: Vincenzo Cosenza vincos.it

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source: SimilarWeb/Alexa



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**DINFO**  
DIPARTIMENTO DI  
INGEGNERIA  
DELL'INFORMAZIONE

**DISIT**  
DISTRIBUTED SYSTEMS  
AND INTERNET  
TECHNOLOGIES LAB





# Estimated Unique Monthly Visitor

## □ In 2012

- ♣ Facebook: **750,000,000**
- ♣ Twitter: **250,000,000**
- ♣ LinkedIn 110.000.000
- ♣ MySpace: 70.500.000
- ♣ GooglePlus 65.000.000
- ♣ DevianArt: 25.500.000
- ♣ LiveJournal: 20.500.000
- ♣ Tagged: 19.500.000
- ♣ Orkut: 17.500.000
- ♣ PinInterest: 15.500.000
- ♣ ...
- ♣ Badoo: 2.500.000

## ⊗ In 2014

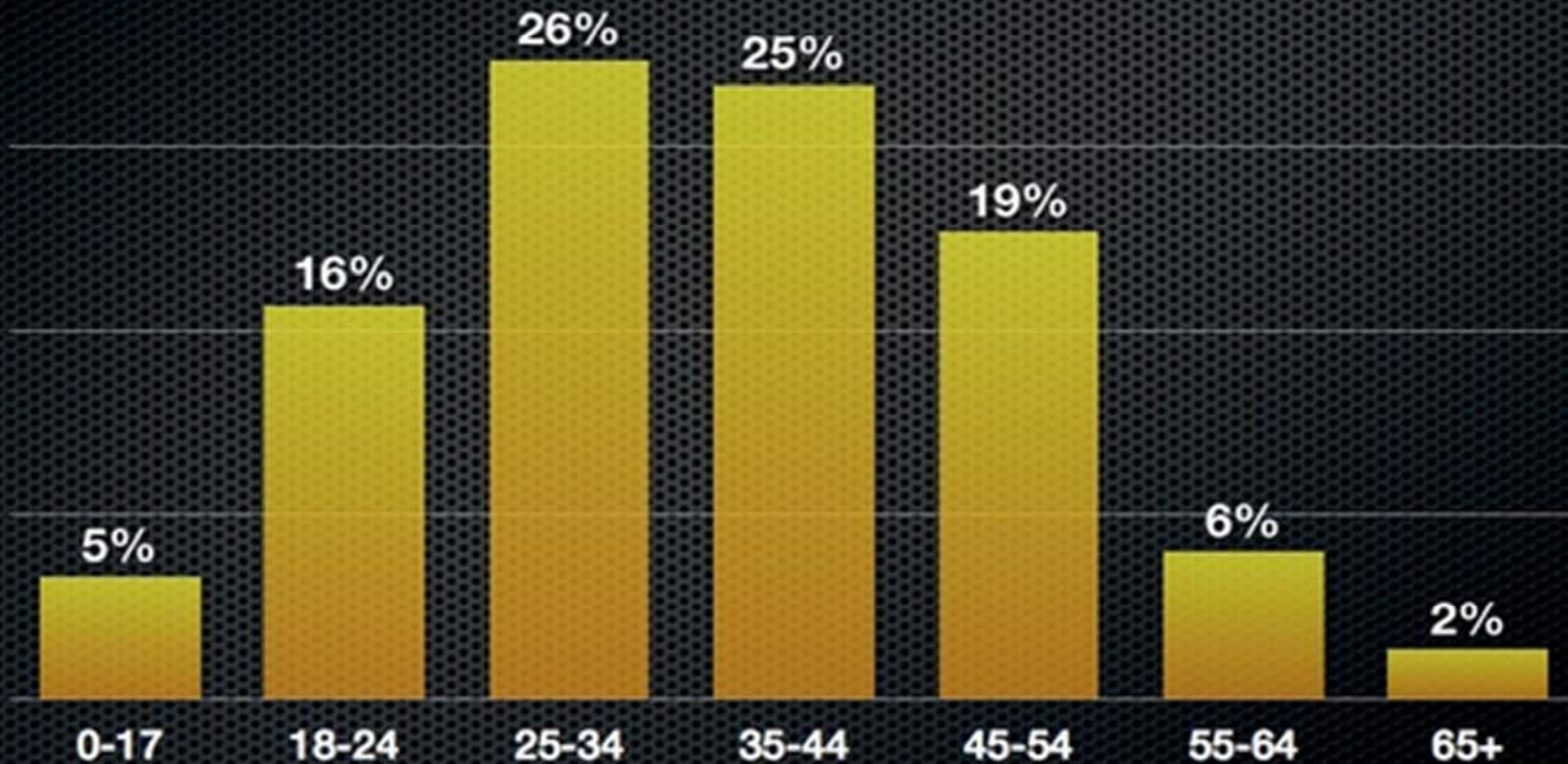
- ♣ Google: 1.100 M
- ♣ YouTube: 1.000 M
- ♣ FaceBook: 900 M
- ♣ Yahoo: 750 M
- ♣ Amazon: 500 M
- ♣ Wikipedia: 475 M
- ♣ Twitter: 290 M
- ♣ Bing: 285 M
- ♣ eBay: 285 M
- ♣ MSN 280 M
- ♣ Microsoft: 270 M
- ♣ LinkedIn 260 M
- ♣ PinInterest: 250 M





## Age distribution on social networks & online communities

Average based on the 24 sites included in this survey.



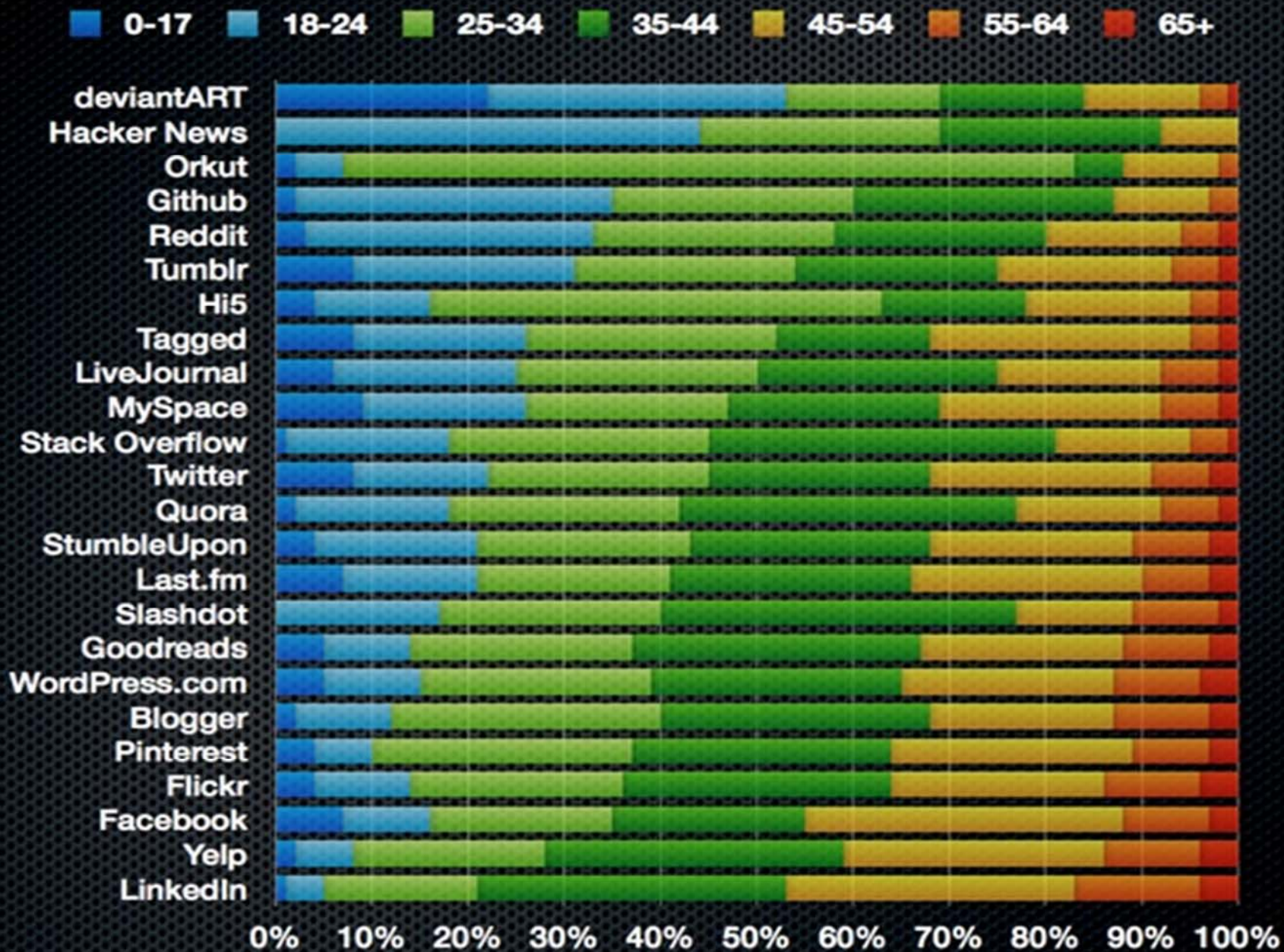
Data source: DoubleClick Ad Planner (Google), U.S. demographics, June 2012.

[www.pingdom.com](http://www.pingdom.com)





# Age distribution on social networks & online communities



Sorted by average age, lowest at the top.

Data source: DoubleClick Ad Planner (Google), U.S. demographics, June 2012.

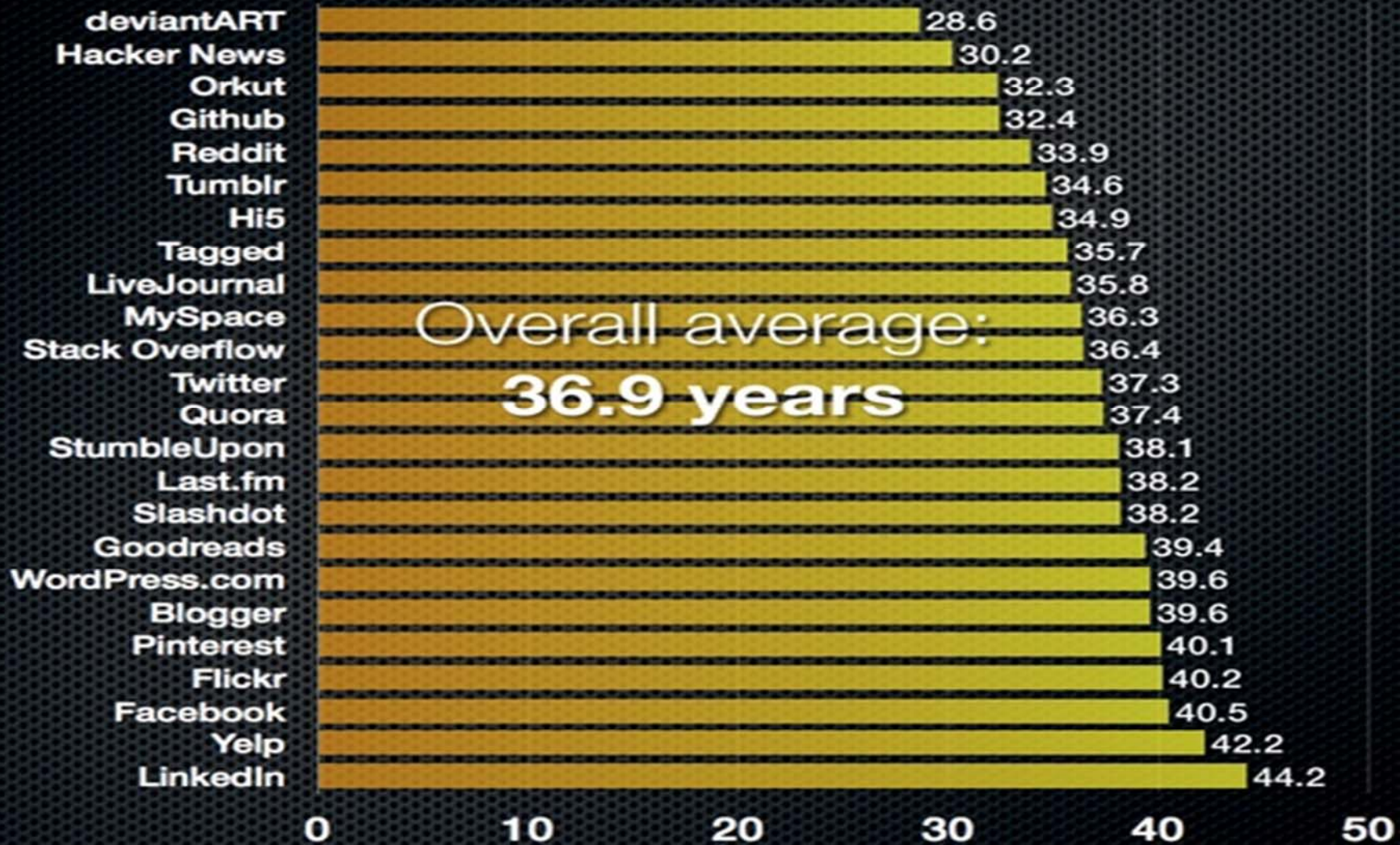
www.pingdom.com



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## Average age on social networks & online communities



This is an estimate based on age data from Ad Planner.

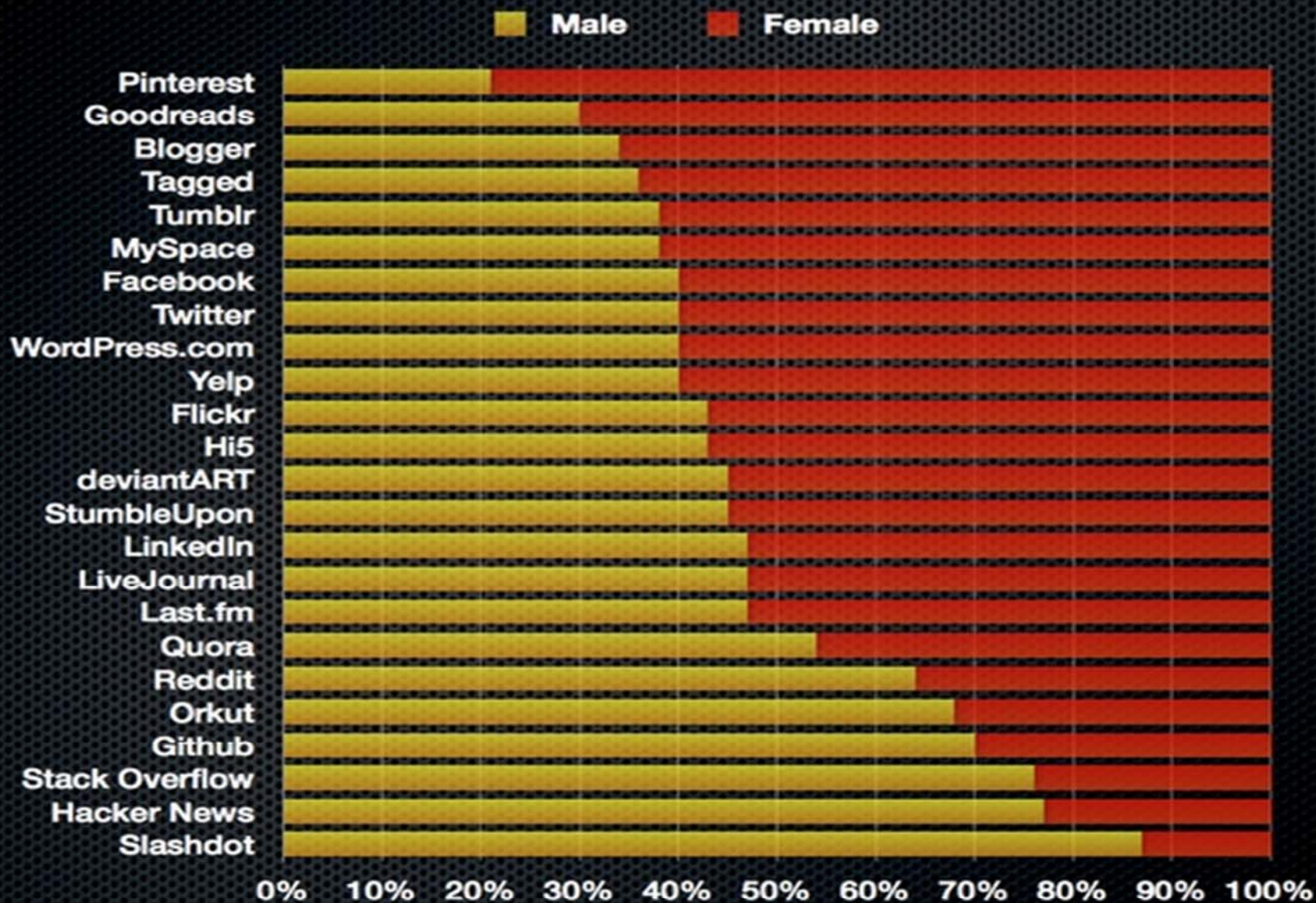
Data source: DoubleClick Ad Planner (Google), U.S. demographics, June 2012.

[www.pingdom.com](http://www.pingdom.com)





# Gender distribution on social networks & online communities



Data source: DoubleClick Ad Planner (Google), U.S. demographics, June 2012.

www.pingdom.com







# Part 6: *Social Media Technologies and Solutions*

## ❑ Collaborative systems

- ⌚ Definition and Terminology

## ❑ Social Network

- ♣ Forrester Trend for Social Networking
- ♣ Motivations for Social Networking
- ♣ Application, classification of Social Networking
- ♣ Examples of Social Networks
- ♣ factors of Social Networks

## ❑ User/Content Social Network

- ♣ User classification and behavior
- ♣ User Generated Content, UGC
- ♣ Content descriptors
- ♣ User and group descriptors



## ⌚ *Measures of Social Networks*

- ♣ User profile problems
- ♣ Measures of Social Networks
- ♣ Metrics and examples: Centrality, Clustering, ....
- ♣ Direct measures of user actions

## ⌚ *Business of Social Networks*

- ♣ Penetration of social networks
- ♣ Numbers of Social Networks

## ⌚ *interoperability and standards*

- ♣ Social icons
- ♣ Embedding
- ♣ Authentication



# Interoperability among Social Networks

- ❑ **SN may be interoperable** with other portals and SN
- ❑ **Allowing:**
  - ♣ **posting** comments and contributions via the so called ***Social Icon*** interface
  - ♣ **importing** user registration/profile and info or directly with some SSO
  - ♣ **exporting** SN content in other portals, for example via some API.
  - ♣ **hosting** SN players into other WEB portal pages, via some HTML segment to be copied
  - ♣ **hosting** widgets/applications into the WEB pages of the Social Network, via some programming model



# Interoperability and standards

- ❑ Interoperability for user profiles
  - ♣ migration/interchange
  - ♣ Authentication
  
- ❑ Lack of standards to cope with these aspects
- ❑ Possible future standards coming from W3C

# Posting Content via Social Icon



- ❑ Social Share/ Social Icon/ .....
- ❑ A portal may:
  - ♣ expose some Social Icon
  - ♣ Call the SN with a rest call with a set of information: image link, title, description, etc.
- ❑ If you are logged into the SN
  - ♣ the post is directly included asking you some information to complete the post: groups, comments, etc.
- ❑ If you are not logged into SN
  - ♣ A login dialog is presented to ask you log into the SN, then...





# Interoperability for Users

## ❑ Interchange of user profiles

- ♣ **OpenID**: user identity standard, to allow user profile and credential interoperability among portals, is SSO method
- ♣ **OAuth**: delegation protocol for accessing to credentials, user authentication
- ♣ **OpenSocial** (by **Google** with MySpace): exchange of user profile.
  - ➔ Many big Social Networks have joined the OpenSocial API movement, including hi5, LinkedIn, Netlog, Ning, Plaxo, Orkut, Friendster, Salesforce, Yahoo, Ning, SixApart, XING, etc.
- ♣ **Facebook Connect** is in competition with OpenSocial
- ♣ Other technologies:
  - ➔ XUP of W3C, XMPP, FOAF, XFN, etc..



# Exporting SN content

- ❑ Most of the Social Networks allow to access their content and information via specific API,
  - ♣ http or WS
  - ♣ YouTube and Flickr
  
- ❑ The interoperability API allow to:
  - ♣ Make queries (see Europeana)
  - ♣ Get metadata and statistical results about the number of plays
  - ♣ Get/post content (in some case)
  - ♣ make play from other remote pages to create related applications by using their content repositories and servers
  - ♣ Create other applications that can exploit their SN infrastructure
  - ♣ Get open data (see dbPedia, Europeana)



# Hosting SN players

- ❑ Some of the SNs present their own API on the basis of which third party portals can access to their players.
- ❑ For example the players of YouTube can be embedded into third party web portals by taking the HTTP segment from the You Tube page
- ❑ Esempio di Media Player Embedding from ECLAP
  - ♣ `<iframe src='http://www.eclap.eu/drupal/?q=en-US/embed&axoid=urn%3Aaxmedis%3A00000%3Aobj%3A6e73ab5c-be18-4523-9ca5-916d5505e7fa' width='300' height='200' frameborder='0'></iframe>`
- ❑ From YouTube
  - ♣ `<iframe width="420" height="315" src="http://www.youtube.com/embed/f6rx6TLBXAY" frameborder="0" allowfullscreen></iframe>`



# Hosting Widget

- ❑ Twitter, Facebook and MySpace allow to create applications directly shown into their pages, we call them Widgets
- ❑ The users may select these applications to use and to be shown in their preferred pages.
  - ♣ The SN promote the widget to the user via several different kinds: I like, I share, etc.
- ❑ The Widgets have to be created by using a specific standard.
  - ♣ The widget are typically iFrames generated by a third party portal and embedded into the SN.
- ❑ Once the user install an application/widget, the SN ask to the user if the widget can access to its own information. The accessed information can be passed to the third party portal.





THE END

