USNB:
Enabling Universal Online Social Interactions
(*Best Paper Award*)

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Inria

Agenda

- Introduction
- Background
- USNB
- USNB prototype
- Conclusions and future work

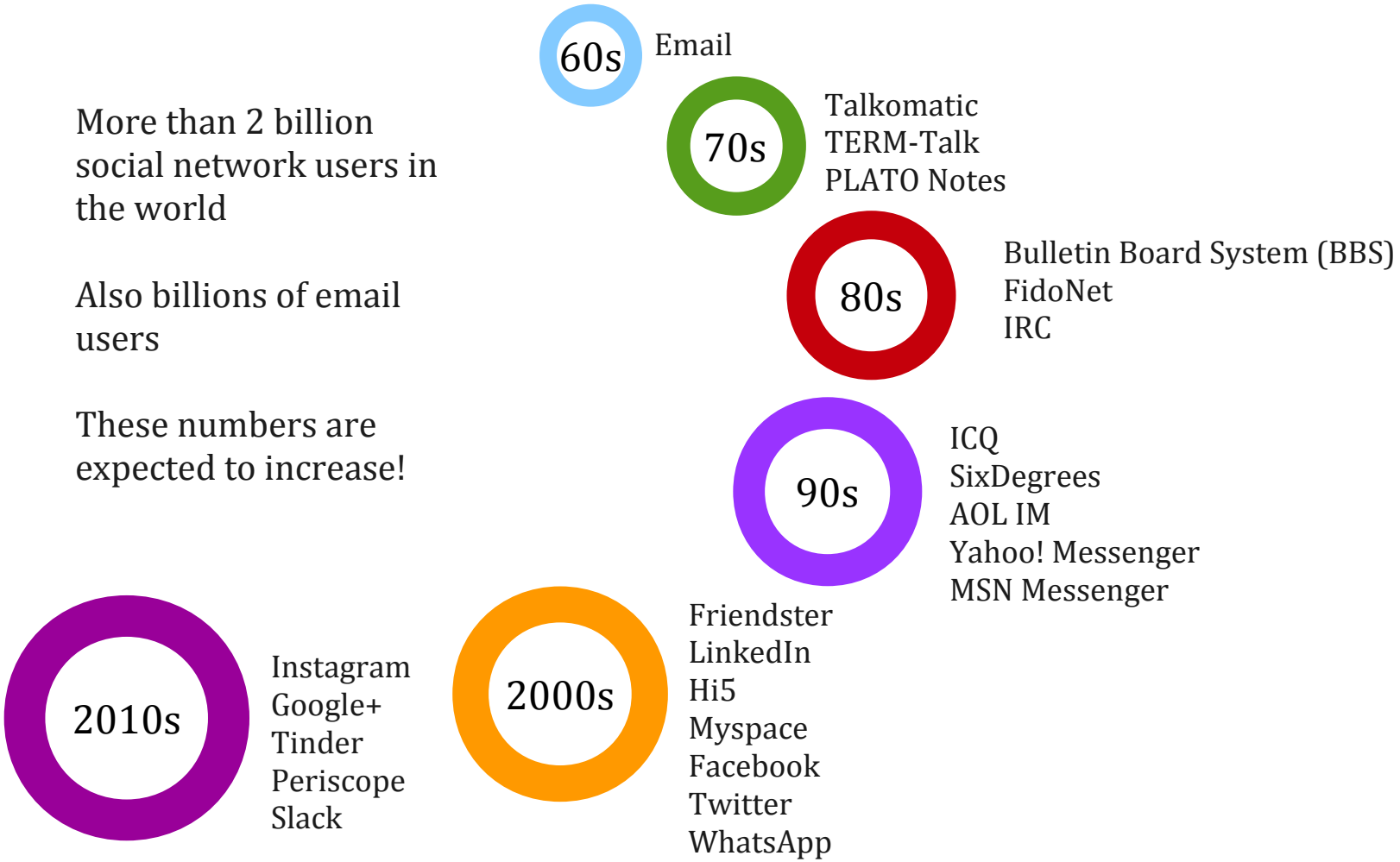
Introduction

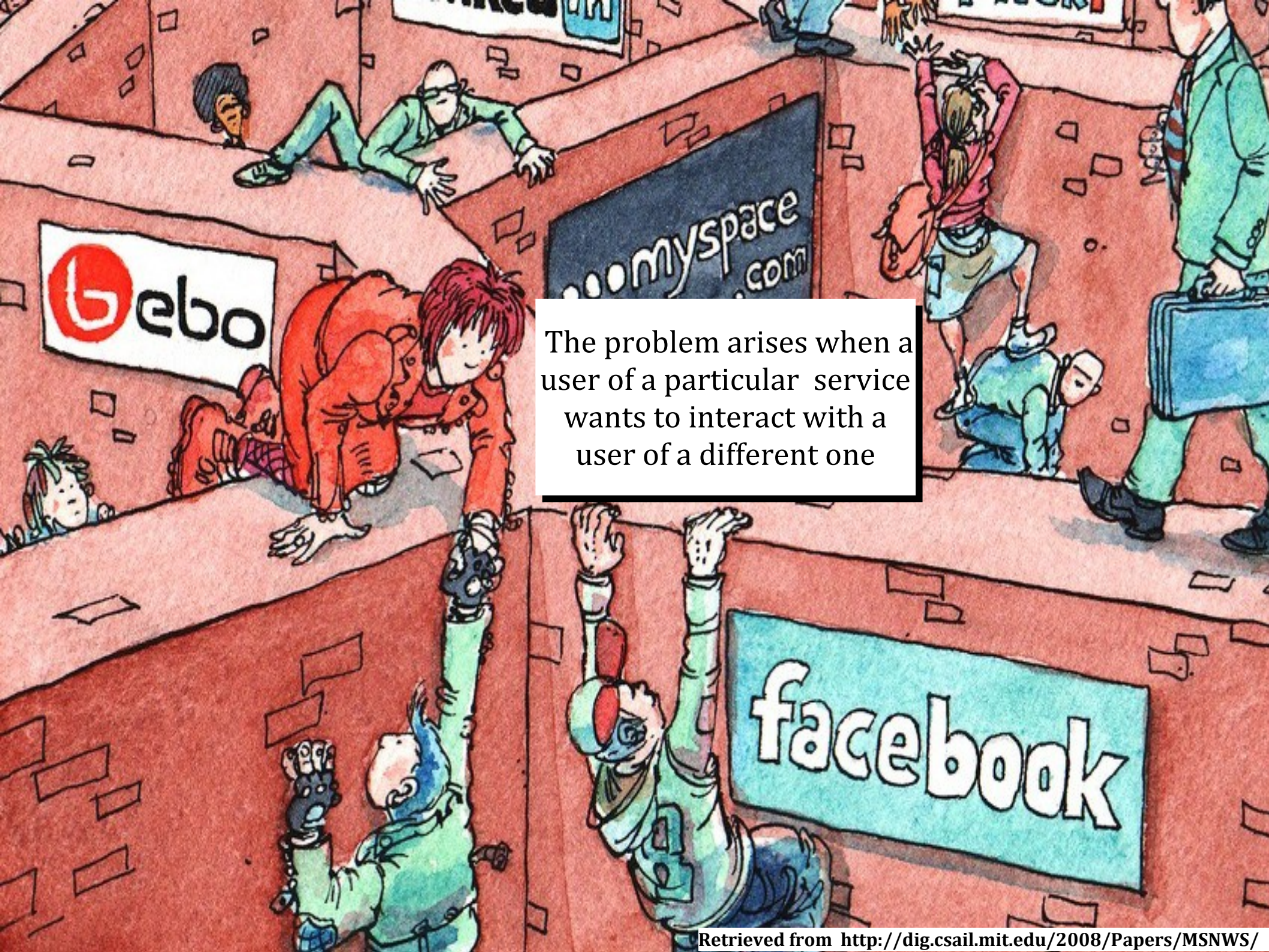
The emergence of the Internet has led to the creation of a plethora of software applications focused on *social interactivity*

More than 2 billion social network users in the world

Also billions of email users

These numbers are expected to increase!





The problem arises when a user of a particular service wants to interact with a user of a different one

Retrieved from http://dig.csail.mit.edu/2008/Papers/MSNWS/

Retrieved from http://www.economist.com/node/10880516

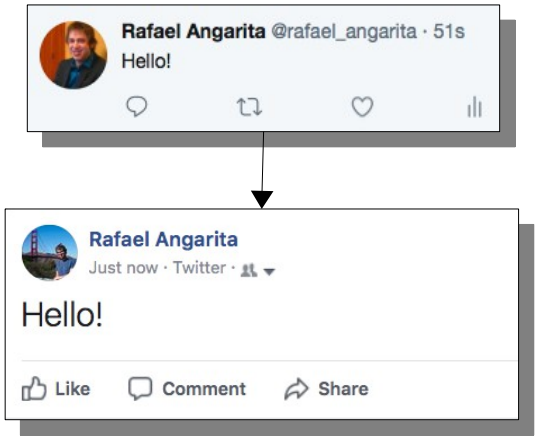
The burden of multiple services

Users:

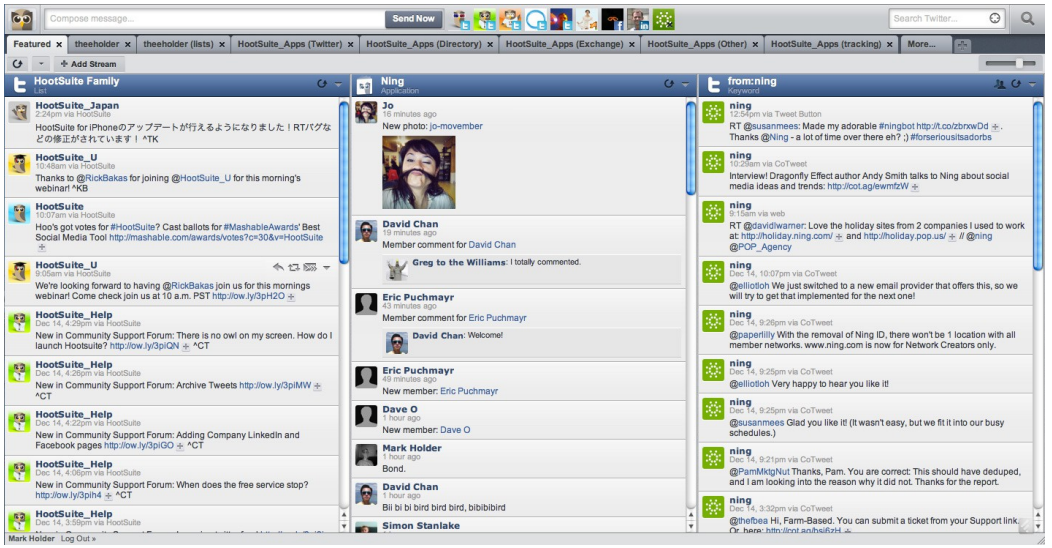
- are overwhelmed
- consider taking a break from one or more
- wish there was a solution to this problems

Background

Account linkage

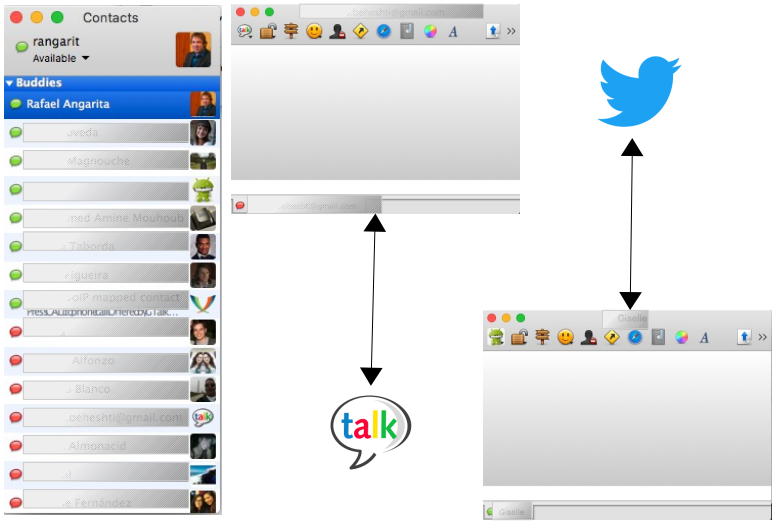


Aggregation or management service

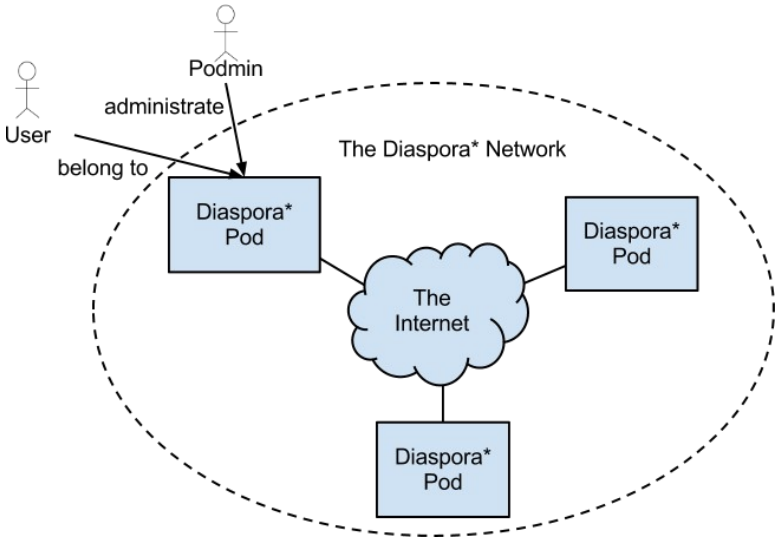


Retrieved from https://blog.hootsuite.com/app-directory-ning-salesforce-news/

Universal instant messaging client

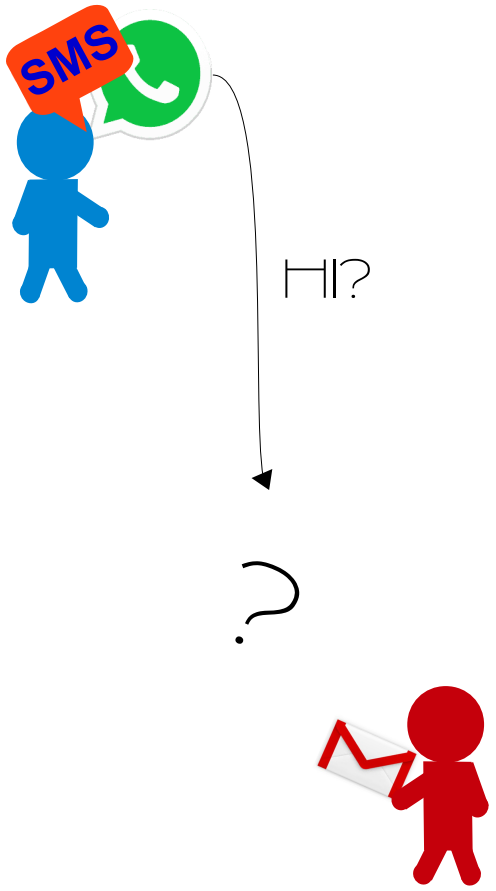


Distributed or federated social network



Retrieved from https://wiki.diasporafoundation.org/Architecture_overview

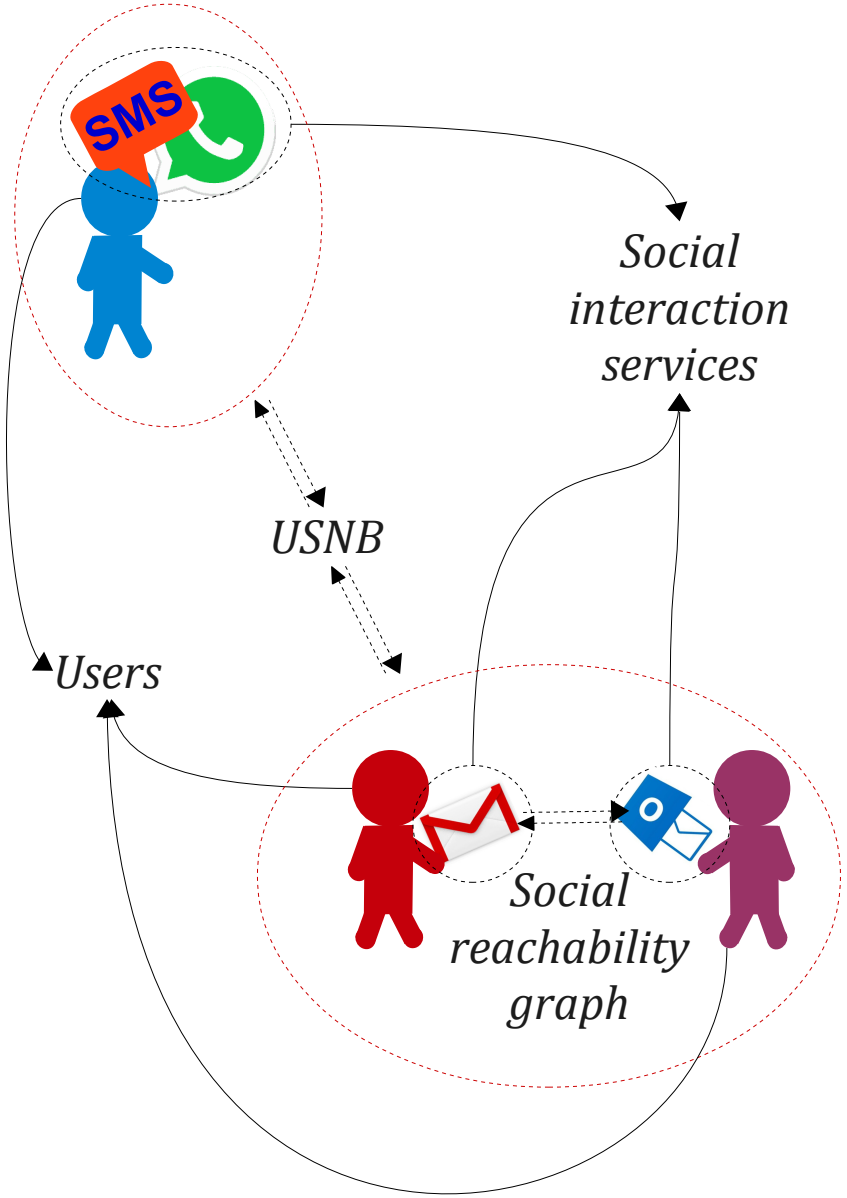
Background



Limitations

- they either introduce yet another service or coordinate existing ones
- they do not fully address interoperability across them

Overview of USNB



Main concepts:

- ***users*** interact through a set of ***social interaction services*** with other users in the *same* ***social reachability graph***
- ***social interaction services*** define the interaction capabilities of users:
  - which information they can *send* and *receive*
  - and, their *availability,* which can also be impacted by the user behavior
- ***USNB*** aims to let people interact beyond the boundaries created by technology

Social interaction service

Definition

A *social interaction service* is any application allowing users to send messages to other users or systems

$$s = \langle name,\ I,\ O,\ \tau \rangle$$

- *name* is a unique identifier representing *s*
- *I* is a set of inputs defining the information a user can receive using *s*
- *O* is a set of outputs defining the information a user can send using *s*
- τ indicates whether s handles offline messaging (τ = *true*) or users must be online at the same time to interact (τ = *false*).

The log in and out behavior of users defines the user presence for a given social interaction service:

Definition

$$Z_{u,s}(t) = \begin{cases} \text{true}, & \textit{if user } u \textit{ is logged in } s \textit{ at time } t \\ \text{false}, & \textit{otherwise} \end{cases}$$

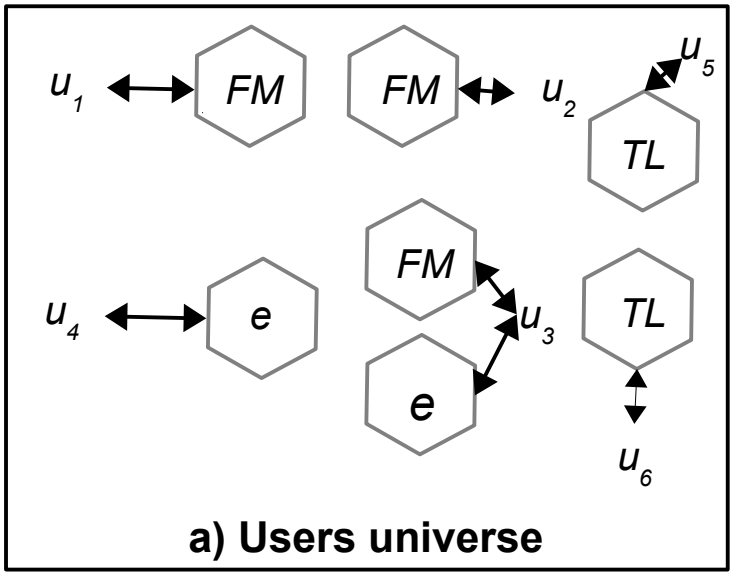
Example for *email*:

$$I = O = \{\langle subject, MessageSubject\rangle, \langle body, MessageBody\rangle, \langle attachment, MessageAttachment\rangle\}$$

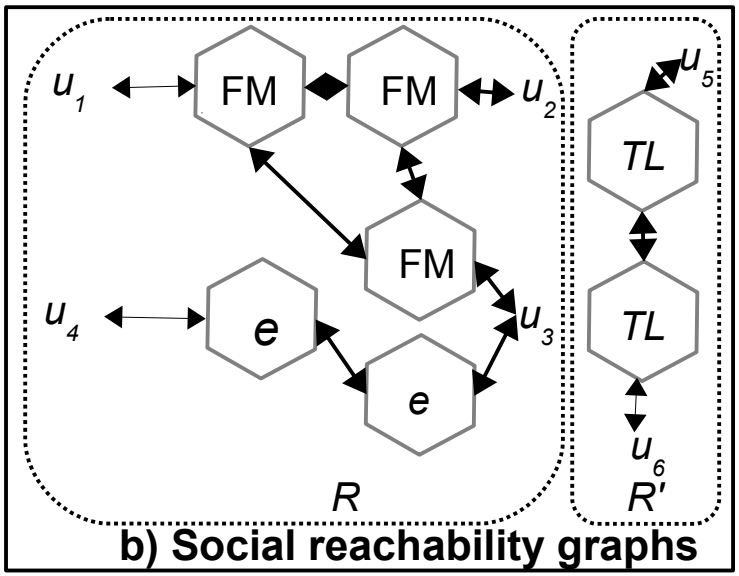
$$\tau = true$$

Social reachability graph

With whom can a user interact?



a) Users universe



b) Social reachability graphs

Interaction path between users

$$\mathcal{P}(u_0, u_k) = u_0 \underset{s_{0,1}}{\overset{s_{1,0}}{\leftrightarrows}} u_1 \underset{s_{1,2}}{\overset{s_{2,1}}{\leftrightarrows}} u_2 \underset{s_{\ldots,2}}{\overset{s_{2,\ldots}}{\leftrightarrows}} \ldots u_{k-1} \underset{s_{k,k-1}}{\overset{s_{k-1,k}}{\leftrightarrows}} u_k$$

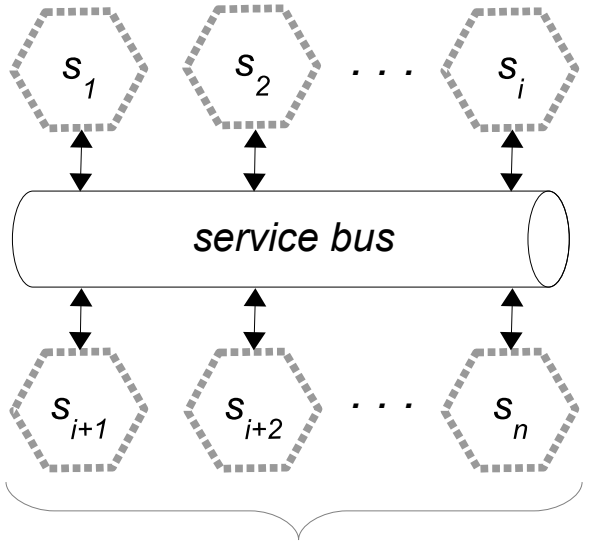
Interaction conditions

$$\exists \mathcal{P}(u,v) \in R :$$
$$\forall < u_i, v_j > \in E(\mathcal{P}(u,v)),$$
$$\exists t_k \in T_{s_{u_i,v_j}} : \; (Z_{u_i,s_{u_i,v_j}}(t_k) \wedge Z_{v_j,s_{u_i,v_j}}(t_k))$$
$$\vee$$
$$\tau_{s_{u_i,v_j}}$$

USNB

Revisiting the *service bus* paradigm:

- arising heterogeneity among distributed services
- introduced by the distributed system community
- *loosely coupled service* components can exchange messages transparently through an intermediary representation



In our case, we are interested in the interoperability between *social interaction services*

Definition

The ***universal social network bus*** (***USNB***), denoted β , is an entity allowing to integrate siloed social interaction services over a service bus-like paradigm by featuring a reference abstract social interaction service, $s_{\beta:}$, and enacting a social reachability graph, $R_{\beta:}$.

Persona

Definition

- p is in the social reachability graphs R_β (of β) and R_n (of n):

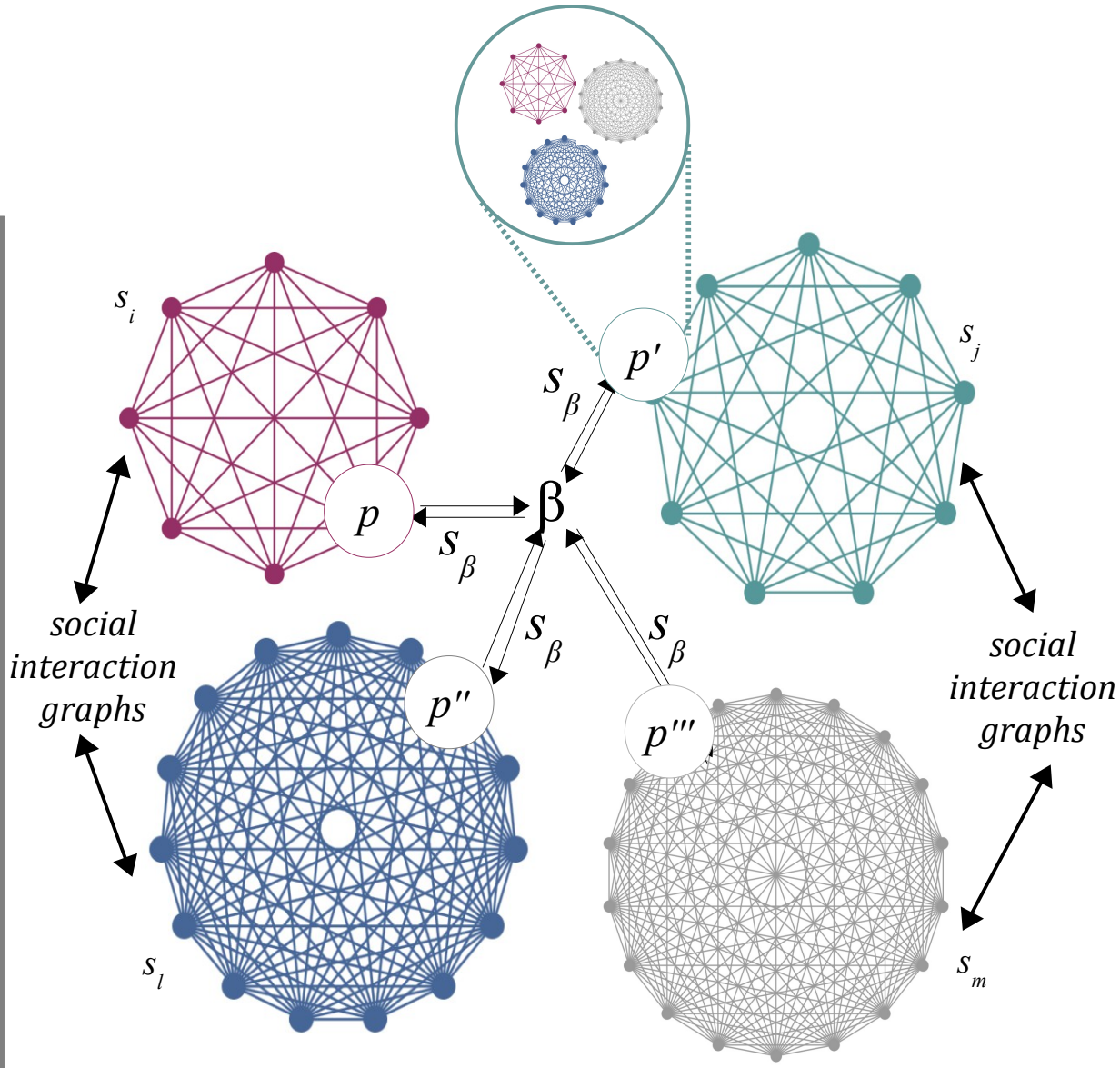
$$p \in V(R_\mathcal{B}) \ \wedge \ p \in V(R_n)$$

- p is present in $R_{\beta:}$

$$\forall t \in T_{s_\mathcal{B}} : \ Z_{p,s_\mathcal{B}}(t)$$

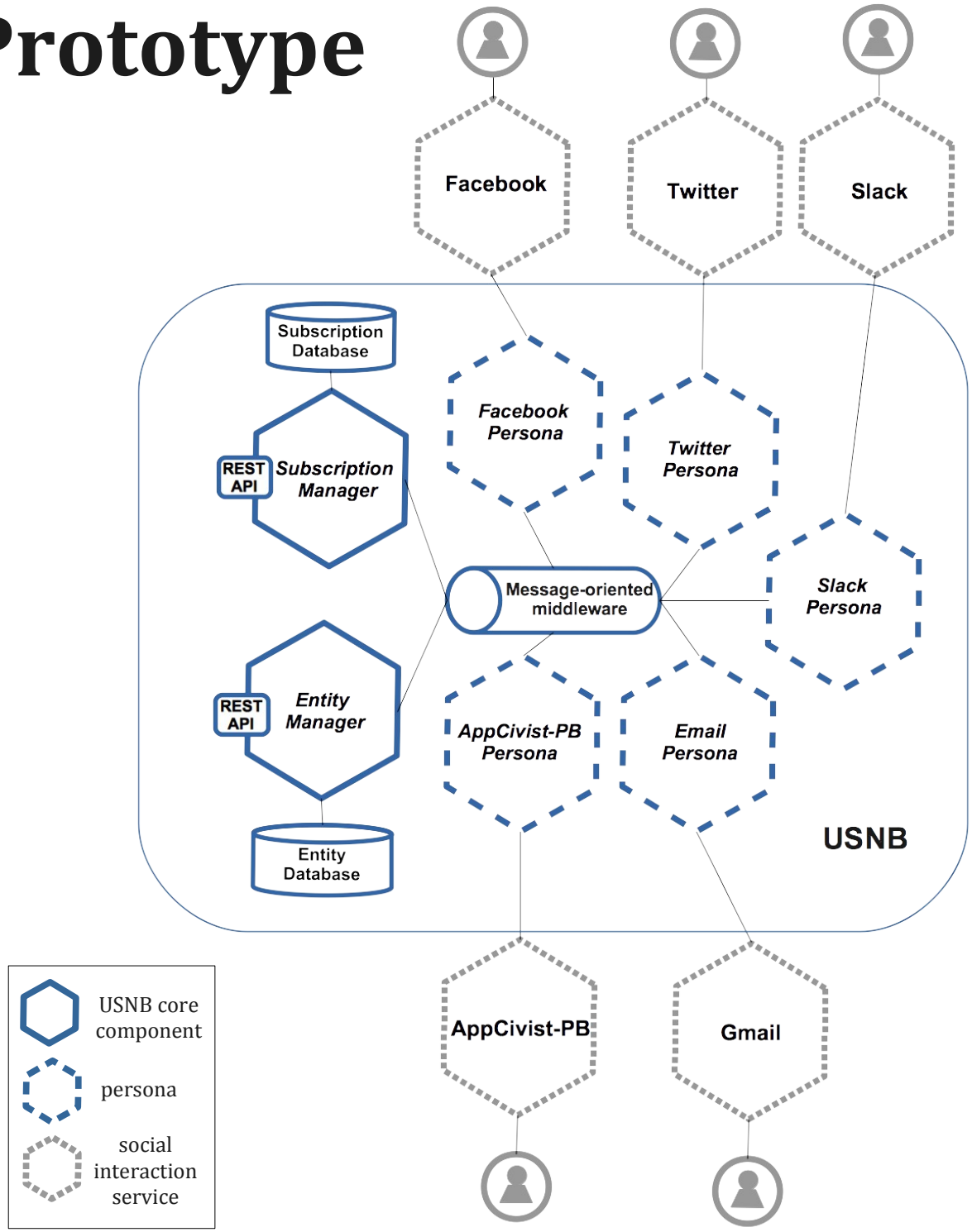
- p is present in a social interaction service, s, of R_n:

$$\exists s \in E(R_n), \ \forall t \in T_s : \ Z_{p,s}(t)$$



$$\mathcal{P}(u,v) = u \overset{s_i}{\underset{s_i}{\leftrightarrows}} p \overset{s_\mathcal{B}}{\underset{s_\mathcal{B}}{\leftrightarrows}} p' \overset{s_j}{\underset{s_j}{\leftrightarrows}} v$$

Prototype

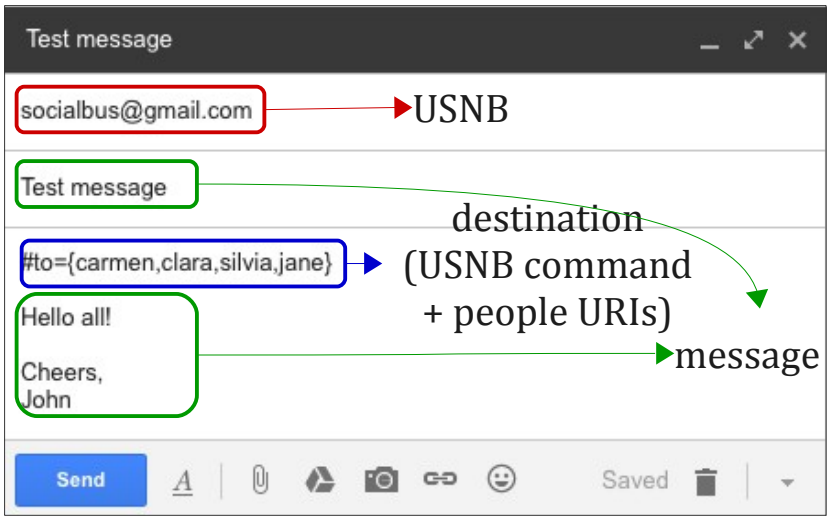


Human-persona interaction

- Get information about USNB:
  `#about`
- Get help about the USNB usage:
  `#help`
- Link identity to USNB:
  `#login`
- Set identity as the favorite one:
  `#prefer`
- List USNB entity:
  `#ls`
- Get information about an entity:
  `#more` *entity*
- Send message:
  `#to={`*entity*$_1$`,`
  `...,`*entity*$_n$`}`

Prototype example

Sending a message



different ways to
interact with personae

Receiving a message

Evaluation & challenges

Evaluation goals

(i), are users willing to interact with personae?

(ii), what do users expect from this interaction?

(iii), what are the main challenges?

Participants

50 participants from diverse backgrounds

Some results

	agree (%)	*neutral (%)*	*disagree (%)*
usefulness	91.66	5	2.5
ease of use	67.87	23.63	7.27
satisfaction	86.66	4.66	6.00

TABLE I
Simplified view of the survey results where *agree* corresponds to rates from 5 to 7, *neutral* to rate 4, and *disagree* to rates from 1 to 3, and percentages are the averages of questions in each category

Participants also provided comments, and positive and negative aspects of the experience

Assessment

Overall

- virtual social interaction interoperability
- users are interested in and had fun using the prototype

Technical challenges

- personae can be complex
- APIs availability, changes and rate limits
- access & privacy control

Usability challenges

- Mechanism to interact with personae via immutable user interfaces

Conclusions and future work

Main contributions:

- model of social interaction services
- prototype for virtual social interaction interoperability
- initial feedback of the prototype

Future work:

- automatic (or semi-) synthesis of personae
- interactions with personae in natural language
- access control, privacy, user searching across networks
- USNB applications such as participatory processes

Questions?

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