Enterprise Social Systems: The What, the Why, and the How

Mayla Alimam[1,2], Emmanuel Bertin[1,2]
[1]Orange Labs, Caen, France
{firstname.lastname}@orange.com

Noël Crepi[2]
[2] Telecom SudParis, Evry, France
{firstname.lastname}@telecom-sudparis.eu

***Abstract*— Enterprise Social Systems (ESSs) are aimed at assisting the social collaboration across the organization and hence enhancing its productivity and business outcomes. Nevertheless, current ESS products do not actually fully meet these expectations. This paper thus develops a deeper understanding of the concept of ESS in the workplace starting from the characterization of social and collaboration tools. We evaluate current ESS products in accordance with a new typology of these tools. While highlighting some design issues, we conceptualize two scenarios for future ESSs: merging all of the coordination functionalities within a single ESS tool, or on the contrary spreading ESS's features within existing tools.**

Keywords- Enterprise Social Systems; social and collaboration tools; workplace tools;

I. INTRODUCTION

Flexibility has become a must for enterprises facing internal and external challenges such as growing size or competitive environment. Today's management is thus becoming less about commanding and controlling; it is moving towards more horizontality and support for collaboration between employees [1], [2], empowered by innovative digital technologies [3], [4]. This coupling of business need and technological solutions is referred to by a variety of terms: Enterprise Social Software [5], Enterprise Social Media systems [6], Emergent Social Software Platform [7], Enterprise Social System [8], etc. In this article, we have adopted the last terms (Enterprise Social System - ESS), as it underlies their systemic nature.

Basically, ESSs aim to incorporate social relations within enterprise business processes and activities [9]. They embrace a collection of tools, mainly focusing on two goals [6]:

- Collaboration and teaming support, aligned with work activities and interactions across stakeholders;
- Social support, aimed at connecting workers around a common interest or a set of tasks.

Market studies are showing a growing demand for ESS products. In a survey covering 4,200 companies around the world, McKinsey Global Institute reported that 70% of them are using social technologies [10].

The deployment of these technologies for business purposes, frequently labeled as "Enterprise 2.0", has been considered as an evolution from direct communication methods toward platforms following a publish/subscribe interaction model [11]. This evolution has been the main discursive argument of Enterprise Social Network providers (ESN providers) for promoting their products. This marketing strategy is being supported by aggressive adoption previsions: 50% of large organizations are predicted to deploy ESNs by 2016 [12]. Nevertheless, assessments of these deployments are identifying a gap between the forecasts and what is actually occurring [3]. Companies do not seem to be deriving from those products what they expected [12].

This paper develops a deeper understanding of ESSs in the workplace that goes beyond the scope of online social networking, by characterizing each social and collaboration tool. It develops an explanatory typology [13] of these tools, in order to evaluate current ESSs and elaborate future scenarios for a better business performance.

The rest of the paper is organized as follows: Part II details the related work. Part III presents our typological work. Part IV evaluates current ESS products according to this typology. Part V discusses the evaluation results. Finally, part VI introduces scenarios for designing future ESSs.

II. RELATED WORK

A. Enterprise Social Systems

The importance of social and collaboration tools in ESSs have been widely discussed. Their usage is becoming pervasive, as introduced in [6]. Moreover, McAfee describes in [11] how those tools exert powerful effects on the organization's ways of communicating with external stakeholders, as well as between internal collaborators. He outlines, however, in [7] the risk of integrating all these tools into a single platform which could become too complicated to be used. In [9], [14] and [15], the potential benefits and possible risks of embracing these tools in enterprise operations are discussed. For instance, these tools enable quicker access to resources but could cause information overload. As no tool owns all the required features, [9] suggests that the company should start from its business activities to determine the best mix of products.

A multitude of contributions and consulting reports [12] has been examining ESSs, often through the lens of online social networking sites. In [16], the authors approach integrating user's context and information like availability

from his preferred social network with the enterprise core communication services. While keeping identities separated, unified communication session views are presented to the end-user binding the various contexts. In [17], ESN products are described from a customer perspective, and grouped based on customer-facing business model elements to capture their value. The authors suggest adopting hybrid models where both consumer choices and corporate decisions are involved in the product adoption.

To better support collaboration, some studies propose extending ESN data model to incorporate business applications. For example, [18] proposes extensions focusing on application interaction to support business process execution and monitoring within the context of ESN, taking into account users' roles and responsibilities.

These studies are completed by researches on the adoption of ESSs. They aim to identify factors and best practices influencing end-user adoption. Integration with the company's platform and migration from older tools along with product promotion are outlined in [19] and [20]. [20] suggests several online promotional channels based on a categorized view of customers and outlines the software design and interface among the factors to be considered by providers for a better adoption of e-business products. However, these studies should be completed by a focus on ESS architecture, starting from a deeper understanding of the features of collaboration and social tools.

B. *Categorizing Social and Collaboration Tools*

Tentative classifications of ESS features stem from different research communities.

From the perspective of Computer-Supported Cooperative Work (CSCW), Johansen [21] introduces the earliest and the most common base for categorizing CSCW and groupware systems. He provides a time-space matrix comprising the following: the location dimension, differentiating whether the interaction takes place in the same physical space or is geographically distributed and, the temporal dimension, differentiating whether an interaction takes place in real time or asynchronously. This classification is extended in various frameworks such as in [22], where a process perspective is added differentiating person interchange processes, task-oriented processes and group oriented processes.

Grudin and Poltrock propose, in their latest framework [23], a complementary approach to the classification by crossing time and process dimensions. While retaining the temporal dimension, they evaluate the second dimension based on three variables describing behavior contributions in CSCW technologies: communication, information sharing and coordination. They suggest a distribution of the tools according to the six derived categories.

[14] focuses on six groups of social media applications and provides a classification among them. The derived categories are characterized by two dimensions: social presence / media richness and self-presentation / self-disclosure.

However, [24] proposes a framework classifying and comparing Enterprise 2.0 projects themselves, taking into account their business context. The two zones composing the framework represent the specific project goals and the key aspects of the wider enterprise context.

In the following section, we start from these previous contributions to build a comprehensive typology that encompasses all the social and collaboration tools.

III. TYPOLOGY OF WORKPLACE TOOLS IN ESSS

Workplace tools in ESSs are divergent. They have different nature and structure. Some are based on telecommunication systems such as phones, voicemail, etc. Some implement Web 2.0 technologies. Some are small services designed to be integrated in broader tools (e.g., location trackers, Rich Site Summary - RSS feed, etc.). Some others are implemented as standalone applications (e.g. chatting tools, web-conferencing, etc.). Due to their diversity, we propose combining all the workplace tools in one list in order to classify them, next, in a typology, taking into account a whole set of criteria.

A. *List of Considered Tools*

As we intend to study the collaboration aspect within the organization, we focus in this article on computer-based tools deployed in companies at the work-unit level as standalone applications, or otherwise as integrated services. Other tools involving external stakeholders (such as Customers Relationship Management) or aimed to monitor and manage the business activity (such as Business Intelligence) are out of our scope. Moreover, as far as business applications are concerned (i.e. applications that are directly related to business processes execution and management such as invoicing and employee scheduling), they present such a wide diversity that they cannot be considered in a typology focused on social and collaboration tools. However, some of their features (i.e. social and collaboration features) are of course included.

Our list is combining essential telecommunication tools, collaboration tools such as groupware and CSCW as well as social tools i.e. Enterprise 2.0 tools, appearing in academic researches [14], [23] and key market analyses [25], [26], [27]:

- Phones (desktop phones, softphones and mobile phones),
- Voicemail,
- Chatting (instant messengers and online chatting such as chatting websites or services),
- Text messaging via telecom operators,
- Email systems,
- Search tools,
- Social search, i.e. involving a user's social graph in the

search process,

- Activity streams and RSS, i.e. displaying updated web content or user activity in a timely order, alternatively called news feed,
- Podcasts and streaming, i.e. delivering audio and video content progressively to end-users,
- Wikis, blogs and micro blogs, i.e. a web service provided by a social website to enable its subscribers to broadcast messages to other subscribers,
- Online whiteboards, i.e. drawing sketches collaboratively with other users,
- Forums, communities and group discussions,
- Social bookmarks, i.e. sharing web bookmarks with other subscribers of the service with the possibility of editing the bookmark, annotating it, tagging it, etc.
- Conferencing (data and video conferences),
- File sharing,
- Collaborative planning, i.e. planning projects and activities collaboratively between users,
- Ideas banks, i.e. shared resources for posting new ideas, exchanging and discussing them, etc.
- Social profiles, i.e. profiles of users, connected together in the form of a social graph, displaying each user's information (interests, expertise, etc.), activity stream and his/her personal social graph,
- Calendars and scheduling,
- Location trackers, i.e. using GPS technology to provide information about the geographical position of a user's device,
- Content Management Systems (CMSs), i.e. controlling documents, workflows, etc.; this includes providing an interface that allows a user to control content on web pages,
- Enterprise mashups, i.e. resources combining other existing resources including content, data or applications' functionalities.

B. Methodology for Building the Typology

Looking to classify the workplace tools into subsets with descriptive labels, we build a typology of them. The method we followed is referred to as explanatory typology, i.e. multidimensional conceptual classification based on an explicitly stated theory. An explanatory typology is aimed at categorizing the patterns and themes that emerge while analyzing data about the tools. This type of typologies invokes both functions: the descriptive and the classificatory functions [13].

As a starting point, we define dimensional measures that serve as criteria in describing our tools; each criterion is then examined based on two or more variables. For instance, one criterion is the method for accessing information using the tool; it is examined based on two variables while asking the following question: does this tool have a send-receive or a deposit-retrieve method?

We rely on Grudin & Poltrock's two dimensions [23] and apply them as the first two criteria in our typology, as follows:

(1) Main behavior that is enabled by the tool; for this criterion, we detail the rough division in the framework and propose additional variables to have the following: (a) *communication* (e.g. voicemail), (b) *information sharing* (e.g. chatting), (c) *information browsing* (e.g. search tools), (d) *information editing* (e.g. blogs), (e) *organizing*[1] (e.g. calendar scheduling). For instance, text messaging tools have observation values that correspond to each of the previous variables as follows: (1,1,1,1,1) whereas values for RSS & activity streams are (0,1,1,0,0);

(2) Interaction method between users of the tool; it is done (a) *asynchronously* where users interact at different times (e.g. email systems), or (b) in *real-time* (e.g. phones).

Moreover, we searched for further measures that also characterize the tools. As a result, we identified eleven additional criteria; some measure behavioral aspects of the tools and others are about their technical aspect. We list them as follows:

(3) Information diffusion model within the tool; it is based on a traditional interaction scheme [29] following (a) a *sender-to-destination(s)* approach (e.g. text messaging), or (b) a *publisher-to-subscriber(s)/to-public* model (e.g. video conferences),

(4) Information access method in the tool: (a) *send-receive* (e.g. chatting), or (b) *deposit-retrieve* (e.g. file sharing),

(5) Design of Graphical User Interface (GUI) and human-computer interaction which influences the perceived user acceptance of the tool [30]; the design model of the tool either conforms to (a) a *common mental model* already constructed by users about the tool's design which facilitates the acceptance and the usage of the tool (e.g. email systems), or has (b) a *particular design* formed of the designer's creation for each tool individually (e.g. ideas banks),

(6) Object instantiation model, i.e. how the main data objects of the tool are instantiated (e.g. a message in email systems, a file in file sharing tools); it is (a) a *shared instance* to be accessed by different users (e.g. wikis) or (b) *different instances* (e.g. email systems, where the sender's instance is different from the receiver's instance),

(7) Integration level of the tool; the same tool can exist in different forms: as (a) an *integrated functionality* inside an application or another tool (e.g. social bookmarks), or

[1] We prefer using the label "organizing" to "coordination" so it would not be mistaken with the coordination process that links between parts of an organization [28]

as (b) a *standalone application* (e.g. text messaging),

(8) Universality of the tool and its capacity for supporting social collaboration with external users, i.e. users that do not own the same product; it is (a) a *cross-tool* that connects various users with different products (e.g. email systems), or (b) an *exclusive tool*, only for users registered on the same product (e.g. chatting tool),

(9) Artifact that is involved or produced while using the tool; it is one or more of the following: (a) *text* (e.g. in text messaging), (b) *audio* (e.g. in voicemail), (c) *video* (e.g. in podcasts & streaming), (d) *picture* (e.g. in whiteboards, and (e) *document* (e.g. in ideas banks),

(10) Data storage; data is kept locally on the (a) *client side* (e.g. text messages), or on the (b) *server side* (e.g. content management systems),

(11) Appearance of the tool; it has (a) a *static view* with no possibility to modify its display options (e.g. forums), or (b) a *customizable view* (e.g. blogs),

(12) Technical aspect regarding the development of the tool; it is (a) a *web-based tool*, or (b) a *desktop application*,

(13) Delivery model of the tool; it is (a) a *licensed tool*, (b) a *software as a service (SaaS)* for which services are hosted and a license is purchased on a subscription basis, or (c) *hosted*, i.e. purchased by the company and hosted on an external server (e.g. file sharing).

Having the criteria identified and evaluated for each tool using binary values, we apply Jaccard's coefficient calculation on the variables to measure their similarities, as correlation coefficients are not suitable for binary data [31]. We merge the criteria showing high coefficient values (around 90%) between corresponding variables ((3) and (4)). We also eliminate criteria showing a significant absence of negative values ((12), (13)) or high similarities either among all their variables ((7), (9), and (11)) or a part of the variables while having very limited positive values on their other part ((10)). We finally adopt the three most significant criteria of the remaining six in order to avoid producing a typology that is too large to be used [13]. The three classificatory dimensions arbitrating the distribution of tools are: (1) main behavior, (3) information diffusion model, and (5) graphical user interface design. Based on them, we construct our theory as follows: According to the model of information access and diffusion via the tool, do we observe a relation with the design model of the corresponding tool? Is there a predicted tool behavior that appears from intersecting the mentioned criteria? And finally, what is the case of each tool and is there congruence with the predicted theoretical claims?

Answers to these questions lie in the intersecting criteria. We apply empirical compression on the obtained cells in order to delete empty cells and propose our final typology (see Table I).

C. Typology Results

As shown in Table I, the proposed typology separates the tools into two main types, A and B. Each type is described based on the three final independent criteria retained to order the typology: interaction method, design evaluation and main behavior of the identified type.

TABLE I
TYPOLOGY OF WORKPLACE TOOLS IN ESSs

	Interaction Method	Design Evaluation	Main Behavior		Tools
Type A	Information distribution via channels from sender to destination(s)	Mental model-based	Communication & information sharing	Pure	Phones
					Voicemail
					Chatting
				With other behavior	Text messaging
					Email systems
Type B1	Distributed interaction where information is distributed via shared spaces from publisher to subscriber(s) or to public	Mental model-based	Information	Browsing	Search tools
				Sharing & browsing	RSS & Activity streams
					Podcasts / streaming
				Sharing, browsing & editing	Wikis
					Blogs / Microblogs
					Whiteboards
					Forums / communities / group discussions
			Organizing		Social bookmarks
Type B2		Particular design	Communication & information sharing		Conferencing (Data/Video)
			Information	Sharing	File sharing
				Browsing	Social search
				Sharing, browsing & editing	Collaborative planning
					Ideas bank
					Social profiles
			Organizing		Calendars & scheduling
					Location trackers
					Content managing
					Enterprise mashups

The first type, labeled as type A, stands for the tools that interact via channels following a sender-to-destination(s) model; tools of this type share common user beliefs that

correspond to expected mental models of the tools' User Interfaces (UI); they also share the same main behavior which is about communication and information sharing. We equally label tools of this type as private matured communication channels which turn to be: phones, voicemail, chatting, text messaging and email systems.

The second type, labeled as type B, stands for tools that interact differently from tools of type A. They all follow a publish/subscribe interaction model. As for their design evaluation, they are split into the two defined variables of this criterion which produces two subtypes of type B as follows: Type B1 is about tools for which UIs are based on a recognized mental model; their main behavior is about organizing (social bookmarks) and information handling (search tools, RSS & Activity streams, podcasts / streaming, wikis, blogs / microblogs, whiteboards, forums / communities / discussion groups).

Type B2 represents tools that also interact via shared spaces but are, however, difficult to evaluate from a user perspective; each one has a particular UI design; tools of this type are used for communication and information sharing (conferencing), information handling (file sharing, social search, collaborative planning, ideas bank, social profiles) or organizing (calendars & scheduling, location trackers, content managing, enterprise mashups, business applications).

IV. Analyzing Current ESS Products

A. Methodology for Analyzing Current ESS Products

The methodology we propose for analyzing and evaluating ESS products currently on the market consists of the following steps: (1) Choosing a representative sample of industrial products, (2) Examining each selected product, identifying the workplace tools that compose its features, and creating a list of the identified tools, (3) Mapping each product list to the overall list proposed in Section III in a typological form (see Table I), and (4) Combining the multiple lists in one final list that represents the key workplace tools potentially replaced by the studied ESS products.

Based on recent reports of global consulting companies [32], [33], we select as a sample four products that are announced to be the leading ESS products on the market currently:

- **Jive** (www.jivesoftware.com)
  An enterprise social networking platform founded in 2001 and headquartered in the U.S.
- **Yammer** (www.yammer.com)
  A collaboration software for business launched in 2008 as a private online social network and owned by Microsoft Company since 2012.
- **SharePoint**
  (office.microsoft.com/en-gb/sharepoint)
  A web application platform for collaboration and document management, launched in 2001 and developed by Microsoft Company.
- **BlueKiwi** (www.bluekiwi-software.com)
  An enterprise social networking platform owned since 2012 by Atos; a company headquartered in France.
- **Tibbr** (www.tibbr.com)
  An enterprise social networking platform launched in 2011 by TIBCO software, a company founded in 1997 and headquartered in the U.S. It provides add-ons that connect it to business applications and also offers a marketplace of applications that can be integrated in its platform as gadgets,
- **Zimbra** (www.zimbra.com)
  A platform for collaboration subsequently purchased by Yahoo and VMware and currently owned and developed by Zimbra, Inc (formerly Telligent Systems). Zimbra offers an open source email and collaboration solution and an online community solution released in 2014.

At a general level, first observations on the compared products raise a consensus about their core features as follows:

- Public profiles of employees,
- List of contacts who are also registered in the system
- The ability to exchange information (posts, comments, messages),
- Content is generated chronologically in the form of activity stream [34].

However, we need to go beyond the core features to identify the key tools in each product. To be noted here that identifying a specific tool means detecting its main functionality regardless of its supplementary features which can vary from one product to another. For example, a wiki editing tool is identified in ESSs as being the tool that enables a collaborative editing of documents; this is done regardless of the observed variation of this tool's features in each product, e.g. the possibility of tracing previous modifiers of the document, locking up a document for a temporary or no further editing, etc. Again, we emphasize that we are only searching for workplace tools that are related to intra-collaboration between workers.

B. Results of Mapping Current ESSs' Workplace Tools onto the Typology

Identifying tools in the examined products resulted in a specific tool list for each product. We map each list on Table I. We then calculate the average of the multiple lists and present the results in Table II. The right column of the table shows the percentage of the presence of a specific tool in the studied ESS products. For example, the results suggest that none of the ESSs includes phones or voicemail in its features whereas all of them include social profiles and file sharing tools as structural components.

We consider every tool, for which the presence exceeds

TABLE II
PRESENCE OF WORKPLACE TOOLS IN CURRENT ESS PRODUCTS

Type	Tools	Presence in ESS products
Type A	Phones	0%
	Voicemail	0%
	Chatting	**67%**
	Text messaging	0%
	Email systems	**100%**
Type B1	Search tools	17%
	RSS & Activity streams	**83%**
	Podcasts / streaming	0%
	Wikis	**83%**
	Blogs / Microblogs	**83%**
	Whiteboards	0%
	Forums / communities / group discussions	**83%**
	Social bookmarks	**83%**
Type B2	Conferencing (Data/Video)	33%
	File sharing	**100%**
	Social search	**100%**
	Collaborative planning	**67%**
	Ideas bank	17%
	Social profiles	**100%**
	Calendars & scheduling	**83%**
	Location trackers	0%
	Content managing	17%
	Enterprise mashups	17%

or equals a threshold of 50%, as a structural tool. In this context, we propose the following list as the key tools in current ESS products: email systems, RSS & activity streams, wikis, blogs and microblogs, forums with communities and discussion groups, social bookmarks, file sharing, social search, collaborative planning, social profiles and finally calendars & scheduling.

According to the typology proposed in Section III, our findings suggest that current ESS products are a combination of tools belonging to different types. They are mainly composed of type B tools (distribution via shared spaces) with a minor existence of type A (distribution via private channels). This means that ESS products behave mainly as information handlers and organizers. More concretely, our results suggest that the communicational features are only brought by two tools: chatting and email systems. The behavior of these two tools is not confined to communication. This implies that, except for email systems, private communication channels have no existence in ESS products.

As for the rest of tools in current ESSs, which represent the publish/subscribe model of interaction, they are distributed throughout the two subtypes of type B. Some of them have a particular design whereas others conform to a users' predictable mental model that makes them easy-to-use tools with higher user's acceptance probability.

V. EVALUATION

Our findings suggest that ESS products are mainly composed of information handling and organizing tools with a minor presence of pure communication tools. Direct communication methods (i.e. type A) seem to be somehow neglected. We explain this peripheral position as a consequence of the dominant opinion concerning ESS's: they have been designed with the belief that the use of Web 2.0 technologies will shift enterprise communication towards a new form.

However, private communication channels are still highly valuable for the daily work of employees (e.g. phones and voicemails) [7]. Our study indicates that ESS products cannot be widely used if they do not include features from type A. Workers willing to adopt an ESS product are indeed disappointed by the lack of integration of some absolutely necessary communication features [16].

We also observe that ESS products can include, as features, tools that already exist in the company deploying the product; e.g. calendar & scheduling or emailing systems. In fact, when a company decides to deploy an ESS product, it may do it either in a superposition way in parallel with the existing tools or in a substitution way by eliminating the old tools to overcome employees' resistance to the new system and force its adoption [35]. This might lead to a double existence of the feature once the ESS product is deployed: (1) an ancestor tool previously existing as a standalone tool and still being used in the company; (2) a newer tool as part of the new product's platform. In this case, after an adoption period, employees tend basically to use the tool that is perceived as the more effective for their needs (perceived usefulness) and the more easy to use (perceived usability) [36]. But such a comparison between each of the equivalent tools turns usually to the advantage of the standalone tool. For example, in comparison with standalone instant messaging client applications, the online chat service in ESS products lacks some advanced useful features such as conferencing or sending voice messages. Concerning email systems, they exist in the form of private messages and conversations in current ESS products. Indeed, this tool has extra features that differentiate it from the equivalent existing tool in the company, such as automatically indicating when the message has been seen by its receiver. Nonetheless, specialized emailing systems (e.g. Outlook or Gmail) are yet more valuable than their equivalents in ESS products since they provide distinguishable functionalities (increased usefulness). For instance, they enable to reach external collaborators outside of the company's boundaries using the universal email address; they also enable to organize emails within folders, to set up filtering rules and auto-reply messages, etc. These differences between existing and newer products prevent the user adoption of current ESS products, especially since their reachability is

uniquely limited to users registered on the same platform. In addition, standalone tools come along with a dedicated user interface, usually optimized to render this specific service (increased usability).

Moreover, as the typology suggests, current ESS products are designed as a combination of different types and subtypes of tools. User acceptance of an ESS product is the result of his/her perception of this blending. Our typology shows a variation in the design evaluation between the tools; some features in ESS products conform to mental models that are common between all vendors (i.e. type B1 features, e.g. wiki); whereas others are structured with a particular design for each product (i.e. type B2 features, e.g. social profiles). These design issues influence consequently the success of the current deployments of ESS products. For example, handling in the same tool a private communication channel (type A) and activity flows (type B) is rather counter-intuitive, as they rely on completely different mental models.

VI. Conceptual Framework

Drawing upon the previous analysis, we propose two scenarios of possible future ESS structure that take into consideration the pitfalls outlined in the previous evaluation. The two contrasting scenarios reflect the user's interaction with the system which can basically be either through a standalone integrated platform (scenario I) or through a set of standalone tools (scenario II). Nonetheless, other scenarios can be derived from the intersection of scenario I and II

A. Scenario I: Integrated platform

The first scenario is to build a system that encompasses all the types of workplace tools and assembles the entire range in a single integrated platform. This system provides the unique interface that enables employees' interaction with the tools after authentication. Missing tools in current ESS products are included in this structure (e.g. private communication channels along with publish-subscribers (e.g. [15]). As in multi-layered web services platforms [37], [38], the blended tools should be implemented as web-based services, designed as features of the new system (e.g. sharing files, exchanging messages).

A typical example of such a system is illustrated in Figure 1. It represents a web-based application, hosted either on an internal enterprise server or on a cloud-based server – depending on the company's policy. The login procedure, performed by the client's browser, creates an online transaction session. Closing the browser or logging out of the session prevents the user's access to his workplace tools, even when accessing his local machine (i.e. using the operating system account of his machine such as a Windows or Linux account).

Such a system raises the challenge of usage complexity. Deploying it goes beyond the mission of IT executives in the company. A strategic deliberation is required of the top-level management in order to agree on the substitution of

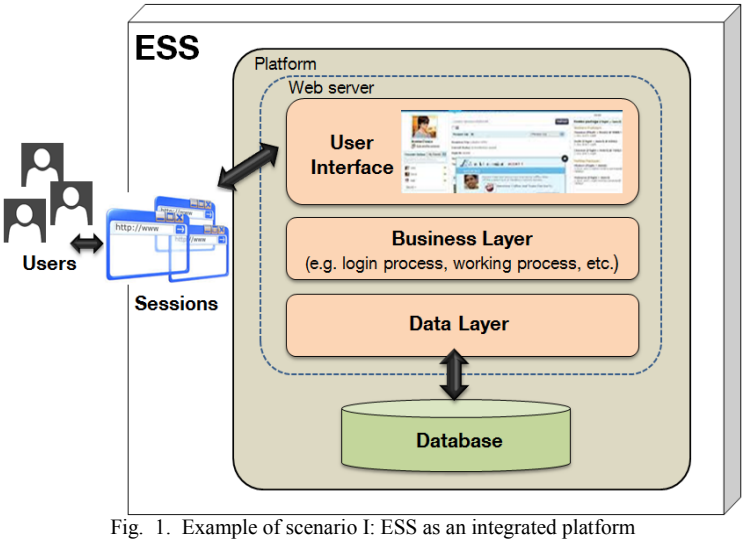

Fig. 1. Example of scenario I: ESS as an integrated platform

the existing workplace tools.

B. Scenario II: Standalone tools

The second scenario consists in building a system that keeps the workplace tools as separate entities while ensuring data synchronization between them. The behavior of each tool takes into account the other interacting tools like in relationship-aware applications and services [39], and like in ubiquitous environments where all sort of devices communicate and share data over the Internet [40].

Figure 2 illustrates an example of this system. In this example, tools coordinate and achieve synchronization across a communication middleware platform [41]. Users' data such as activities and published information, issued by

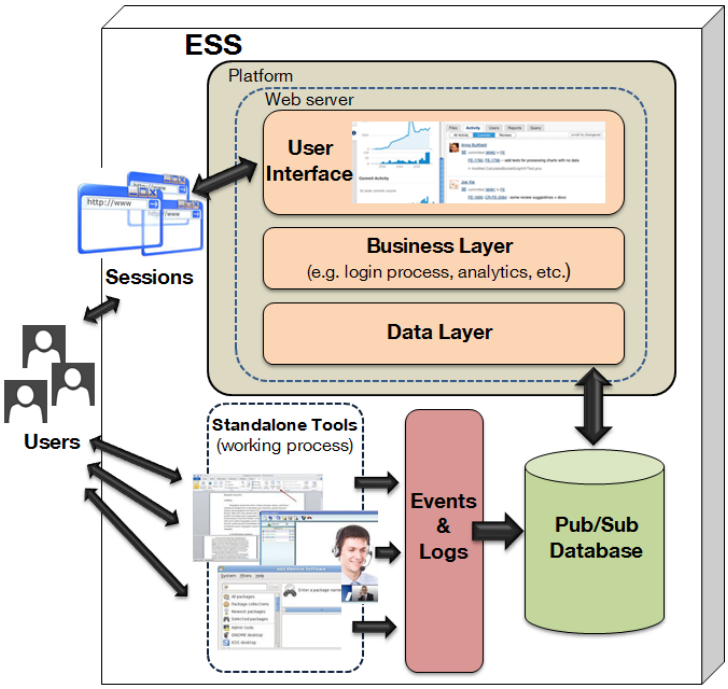

Fig. 2. Example of scenario II: ESS as a federation of standalone tools

each tool, are captured and aggregated through data mining mechanisms. They are sent to the control platform, which provides an interface displaying different users' data along with other features such as users' profiles and personal dashboards.

The logging to the system takes place once a user connects to his work environment, requiring a separate authentication in order to access each tool. Accordingly, data capture is performed on each tool once the user's authentication succeeds, which is independent of being connected to the platform. Users' data issued from their tools, whether on the client or the server side, is then coordinated and synchronized on the platform.

In fact, a kind of coordination already exists within enterprise collaboration tools, but only between client applications from the same software vendor which enables a bidirectional update of data. For example, Microsoft provides compatibility and integration between Lync[2] and Outlook by enabling communications between Lync and Exchange server through Exchange Web Services and Messaging API; thereby, Lync presence information, for instance, can be reported in Microsoft Outlook and likewise, Lync can use Outlook calendar to automatically update that presence information.

However, in this second scenario, the return of updated data towards each tool is hardly implementable. This would indeed require a modification of the architecture of each tool to take into account these returns (typically to be performed by its vendor), while adjusting a product's behavior based on unpredicted data may risk the product's stability

For top management, this scenario prevents having to source and deploy a brand-new solution. But the required compatibility between the existing tools and the new system requires a tight control from the IT department.

C. Intersection

Various new scenarios can result when intersecting the two ones introduced above. A possible scenario is for instance to build a system that aggregates the workplace tools and provides a single point of access to them. Such a system brings together the platform characteristics form scenario I and the feature of retaining the architecture of each tool from scenario II. Different mechanisms exist for adding tools to this single point of access, as for example a widget-based mechanism where widgets get executed as parts of the user interface [42], or a mechanism where applications are installed from a marketplace. In this vein, some tools propose APIs for ESS vendors or third-party programmers.

[2] Enterprise instant messaging client provided by Microsoft for corporate environments (https://products.office.com/en-us/lync/lync-2013-video-conferencing-meeting-software).

VII. CONCLUSION

This paper presented an analysis of today's Enterprise Social Systems that clarifies their real structure and evaluates their design.

We demonstrated that the majority of the ESSs' structuring tools are information handlers that follow a newer interaction paradigm enabling users with new interaction capabilities. We identified a limitation in these systems, which we attribute to the lack of type A tools that we labeled as private communication channels. Furthermore, we found that current ESS products are a combination of tools of different types that are not all perceived equally by users.

We discussed two scenarios for future ESSs: ESS as a complete integrated platform, or as a federation of standalone tools. Academic and industrial works seem today to privilege the first one. We prompt the business informatics community not only to consider ESS as the unification of all social features within a single product, but also to study how existing tools can be federated to answer ESS requirements. In the future, we plan to further investigate these scenarios by implementing them based on existing products and tools.

ACKNOWLEDGMENT

The authors kindly thank Fabrice Bourge who helped achieving this article.

REFERENCES

[1] R. L. Daft, "Fundamentals of Organization Structure," in Organization theory & Design, 11th ed. Mason: South-western cengage learning, 2012.

[2] T. Kuettner, R. Diehl, and P. Schubert. "Change factors in Enterprise 2.0 initiatives: Can we learn from ERP?." *Electronic Markets 23*, no. 4 2013: 329-340.

[3] S. J. Andriole. "Business impact of Web 2.0 technologies. "*Communications of the ACM* 53.12 2010: 67-79.

[4] V. Kulkarni and S. Sagar. "Next Wave of Servicing Enterprise IT Needs." *Business Informatics (CBI)*, 2013.

[5] V. Thompson, Worldwide Enterprise Social Software 2013–2017 Forecast and 2012 Vendor Shares: From ESS to ESN, International Data Corporation (IDC), USA, June 2013.

[6] P. M. Leonardi, M. Huysman and C. Steinfield, "Enterprise social media: Definition, history, and prospects for the study of social technologies in organizations," *Journal of Computer-Mediated Communication*, vol. 19, Issue 1, pp. 1–19, 2013.

[7] A. P. McAfee, "Enterprise 2.0: How to Manage Social Technologies to Transform Your Organization," Harvard Business Press, 2013.

[8] A. Manchester, "Going beyond likes and follows: understanding the key capabilities and opportunities in enterprise social systems," OBS, 2013.

[9] V. Buregio, M. Zakaria, and M. Silvio. "An Architecture and Guiding Framework for the Social Enterprise." *Internet Computing*, IEEE 19.1 - 2015: 64-68.

[10] M. Chui, J. Manyika, J. Bughin, R. Dobbs, C. Roxburgh, H. Sarrazin, G. Sands and M. Westergren, "The social economy: Unlocking value and productivity through social technologies," McKinsey Global Institute, 2012.

[11] A. P. McAfee, “Enterprise 2.0: The Dawn of Emergent Collaboration,” *MIT Sloan Management Review*, vol. 47, no.3, pp. 21-28, 2006.

[12] J. Mann, T. Austin, N. Drakos, C. Rozwell and A. Walls, "Predicts 2013: Social and Collaboration Go Deeper and Wider", Gartner, USA, Novembre 2012.

[13] C. Elman, “Explanatory Typologies in Qualitative Studies of International Politics,” *International Organization*, vol. 59, pp. 293-326, 2005.

[14] A. M. Kaplan and M. Haenlein. “Users of the world, unite! The challenges and opportunities of Social Media.” *Business Horizons*, Volume 53, Issue 1, January–February 2010: 59-68.

[15] S. P. Williams, V. Hausmann, C. Hardy, and P. Schubert. "Enterprise 2.0 Research: Meeting the challenges of practice." *BLED 2013 Proceedings,* 2013.

[16] K.K. Dhara, V. Krishnaswamy and T. Singh, "Reconsidering Social Networks for Enterprise Communication Services," in *GLOBECOM*, pp.1-5, 2010.

[17] P. Mathiesen and E. Fielt, "Enterprise social networks: a business model perspective," in *Proc ACIS*, Melbourne, 2013.

[18] O. Hatzi, G. Meletakis, M. Nikolaidou and D. Anagnostopoulos, "Collaborative management of applications in enterprise social networks," in *RCIS*, Marrakech, 2014, pp.1-9.

[19] M. Yang, W. Michael, and M. R. David. "Best practices for enterprise social software adoption." CHI'13 Extended Abstracts on Human Factors in Computing Systems. ACM, 2013.

[20] M. Komarov, K. Nikolay, and G. Mikhail. "Increasing the Adoption of Social Collaboration Software." *Business Informatics (CBI)*, 2014 IEEE 16th Conference on. Vol. 2. IEEE, 2014.

[21] R. Johansen. “GroupWare: Computer Support for Business Teams,” *The Free Press*, New York, NY, 1988.

[22] E. Andriessen and JH. E. Andriessen. “Working with groupware,” Springer-Verlag, 2002.

[23] J. Grudin and S. Poltrock, “Computer Supported Cooperative Work,” in *The Encyclopedia of Human-Computer Interaction*, 2nd ed. Aarhus, Denmark, The Interaction Design Foundation, 2013.

[24] S. P. Williams. "Enterprise 2.0 and collaborative technologies." Koblenz: Working Report of the Research Group Business Software, University of Koblenz-Landau 2011.

[25] T. O'Reilly, “What is Web 2.0: Design Patterns and Business Models for the Next Generation of Software,” Communications & Strategies, No. 1, p. 17, First Quarter 2007.

[26] Chess Media Group, “State of Enterprise 2.0 Collaboration,” Chess Media Group, spring 2011.

[27] Forrester, “Building the Future of Collaboration,” a commissioned study conducted by Forrester Consulting on behave of Adobe Systems, September 2009.

[28] G.A. Okhuysen and B.A. Bechky. “10 Coordination in Organizations: An Integrative Perspective.” *The Academy of Management Annals*, 3(1), 2009. pp. 463-502.

[29] P. T. Eugster, P. A. Felber, R. Guerraoui and A. Kermarrec, “The many faces of publish/subscribe,” *ACM Computing Surveys (CSUR),* vol. 35 no.2, pp.114-131, 2003.

[30] V. Venkatesh, M. G. Morris, G. B. Davis and F. D. Davis, "User acceptance of information technology: Toward a unified view," *MIS quarterly*, vol. 27, no. 3, pp. 425-478, 2003.

[31] M. J. Warrens, “Similarity Coefficients for Binary Data,” Ph.D. dissertation, Leiden University, 2008.

[32] J. Mann, N. Drakos and M. Gotta, “Critical Capabilities for Social Software in the Workplace," Gartner, USA, September 2013.

[33] R. Koplowitz, P. Burris and N. Wang, “The Forrester Wave™: Enterprise Social Platforms, The 13 Providers That Matter Most And How They Stack Up,” Forrester Research, USA, 2014.

[34] D.M. Boyd and N.B. Ellison, "Social network sites: definition, history, and scholarship," *Engineering Management Review*, IEEE, vol. 38, no.3, pp.16-31, 2010.

[35] J. T. Gourville, "Eager sellers and stony buyers: understanding the psychology of new-product adoption," *Harvard Business Review*, vol. 84, no. 6, pp. 98-106, 2006.

[36] F. D. Davis, "User acceptance of information technology: system characteristics, user perceptions and behavioral impacts," *International journal of man-machine studies*, Vol. 38 Issue 3, pp. 475-487, 1993.

[37] M. Gambhir and M. N. Doja. “Online social network architecture-A push towards users' accountability,” *In Advance Computing Conference (IACC)*, 2013. pp. 341-346.

[38] Z. Guoli and L. Wanjun. “The applied research of cloud computing platform architecture in the E-Learning area,” *In Computer and Automation Engineering (ICCAE)*, 2010. vol. 3, pp. 356-359.

[39] V. A. Burégio, S. R. Meira, N. S. Rosa and V. C. Garcia. "Moving Towards" Relationship-aware" Applications and Services: A Social Machine-oriented Approach." In *Enterprise Distributed Object Computing Conference Workshops (EDOCW)*, 2013, pp. 43-52.

[40] D. Zeng, S. Guo and Z. Cheng. “The web of things: A survey,” *Journal of Communications*, 6(6), 2011. pp. 424-438.

[41] J. Nakazawa, H. Tokuda, W.K. Edwards and U. Ramachandran. “A bridging framework for universal interoperability in pervasive systems.” In *Distributed Computing Systems (ICDCS)*. 2006. pp. 3-3.

[42] N. Laga, E. Bertin and N. Crespi, "Widgets to Facilitate Service Integration in a Pervasive Environment," in *ICC*, South Africa, 2010, pp. 23-27.