Towards Social Network Support for an Applied Gaming Ecosystem

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ABSTRACT
The EU-based industry for non-leisure games (applied games) is an emerging business. As such it is still fragmented and needs to achieve critical mass to compete globally. Nevertheless its growth potential is widely recognized and even suggested to exceed the growth potential of the leisure games market. The European project *Realizing an Applied Gaming Ecosystem (RAGE)* is aiming at supporting this challenge. RAGE will help to seize these opportunities by making available an interoperable set of advanced technology assets, tuned to applied gaming, as well as proven practices of using asset-based applied games in various real-world contexts, and finally a centralized access to a wide range of applied gaming software modules, services and related document, media, and educational resources within an online community portal called the *RAGE Ecosystem*. Besides this, an integration between the RAGE Ecosystem and relevant social network interaction spaces that arranges and facilitates collaboration that underlie research and development (R&D) as well as market-oriented innovation and exploitation will be created in order to support community building as well as collaborative asset exploitation of the contents of the Ecosystem. In this paper we will outline a conceptual approach exploring methods to first of all integrate content management and community collaboration support portal technologies based on *Digital Library (DL), Media Archive (MA),* and *Learning Management System (LMS)* infrastructures with social network support technologies. This will allow for a seamless integration of social network advantages within community portal operation. On the other hand it will support information, content, and knowledge sharing, as well as persistency of social interaction threads within *Social Networking Sites (SNSs)* that are connected to the RAGE Ecosystem. The paper reviews possible alternative architectural integration concepts as well as related authentication, access, and information integration challenges. In this way on the one hand a qualitative evaluation regarding an optimal technical integration approach is facilitated while on the other hand design approaches towards support features of resulting user interfaces are initiated.

KEYWORDS
Applied games, Social Network Environments, Digital Ecosystem, Data Sharing, Access and Information Integration, Integration Architectures

INTRODUCTION AND MOTIVATION

The EU-based industry for non-leisure games (applied games) is an emerging business. As such it is still fragmented and needs to achieve critical mass to compete globally. Nevertheless its growth potential is widely recognized and even suggested to exceed the growth potential of the leisure games market. The European project *Realizing an Applied Gaming Ecosystem (RAGE)* (RAGE, 2015) is aiming at supporting this challenge. RAGE will help to seize these opportunities by making available an interoperable set of advanced technology assets, tuned to applied gaming, as well as proven practices of using asset-based applied games in various real-world contexts. This will be achieved by enabling a centralized access to a wide range of applied gaming software modules, services and related document, media, and educational resources within an online community portal called the *RAGE Ecosystem*. Furthermore, the RAGE project aims to boost the collaboration of diverse actors in the applied gaming environment. Therefore, the main objectives of the RAGE Ecosystem are to allow its participants to get hold of advanced, usable gaming assets (technology push), to get access to the associated business cases (commercial opportunity), to create bonds with peers, suppliers and customers (alliance formation), to advocate their expertise and demands (publicity), to develop and publish their own assets (trade), and to contribute to creating a joint agenda and road-map (harmonization and focus).

This means, that seen as a whole the RAGE project is a technology and know-how driven research and innovation project. Its main driver is to be able to equip industry players (e.g. game developers) with a set of technology resources (so-called *Assets*) and strategies (i.e. know-how) to strengthen their capacities to penetrate a market (non-leisure) which is new for most of them, and to consolidate a competitive position in it. Figure 1 represents the positioning of the project in the spectrum from 'theory to application'.

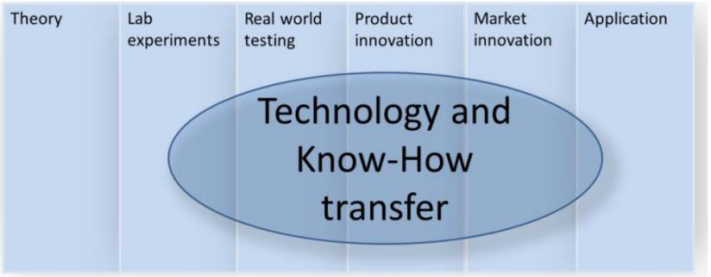

Figure 1: Technology and Know-How transfer (RAGE, 2015)

In consequence, the RAGE Ecosystem and its integration with social networks of game-developing- , gaming-, and applied-gaming communities will on the one hand become an enabler to harvest community knowledge and on the other hand it will support the access to the RAGE Ecosystem as a knowledge resource for such communities. As *Game-Based Learning (GBL)* communities are applied gaming communities, too, they are also representing target communities of the RAGE Ecosystem. In more detail, GBL communities are interested in games and the effectiveness of learning activities supported by GBL technologies and application scenarios.

Therefore, within the remainder of this paper the focus is on supporting content and knowledge management, community building, and collaboration in the RAGE ecosystem. Accordingly, the corresponding research question addressed in this paper is: How is such knowledge captured or developed and how can such knowledge be shared, maintained and utilized? To ensure the capturing, sharing, and exchange of knowledge, the RAGE Ecosystem

will first of all be instantiated through its social dimension supporting content and knowledge management (including education and training), collaboration, annotation, creativity, and matchmaking. Besides content and knowledge management, the RAGE Ecosystem will later also support Social Network Analysis (SNA) by means of applying technologies supporting Natural Language Analysis (NLA) for discourse analysis as well as Named Entity Recognition and Semantic Representation and Annotation. This will enable users to extend the envisioned Ecosystem with features of a social mediation engine going beyond content syndication, i.e., it will serve as a social space that mediates collaboration partners, while content remains the main attractor. Finally, an interactive map of supply- and demand-side stakeholders and resources will be provided for orientation and access support.

The remainder of this paper will first of all provide a short introduction of a set of exemplar target communities. It will then review the integration possibilities of social network technologies and their interfaces that could possibly support an integration with the RAGE Ecosystem. Furthermore, it will investigate how to support access to resources and assets from SNSs. In addition, it will outline design approaches towards supporting users in the target communities by services provided by the RAGE Ecosystem by means of outlining several use case scenarios for using *Social Networking Features (SNFs)* within the RAGE Ecosystem user interface. Finally, it will present conclusions and future work.

TARGET USER STEREOTYPES AND CORRESPONDING EXEMPLAR SNS USER COMMUNITIES

As outlined above, the EU-based industry for applied gaming is an emerging business which is still fragmented and needs to achieve critical mass for global competition. The applied gaming industry and developer groups want to keep their developments innovative, i.e., attractive and technologically in good condition. These groups already have a very good understanding of their competitive advantage and corresponding assets (e.g., software, documents, and media objects etc.). However, they also need innovative ideas to develop innovative applied games in order to stay competitive. Therefore, they look for possibilities to cooperate with applied gaming research groups. Besides this, the applied games that researchers create within research projects produce a lot of applied gaming research assets and prototypes which need to be fully developed and deployed by applied gaming software developers to become marketable. Apart from applied game developers and researchers there are also applied game customers and players who on the one hand want to learn about or contract the development of applied games and on the other hand can also contribute to the development of applied game usage scenarios. Many of these communities (applied game developers, researchers, customers and players) are already fragmented into groups in several SNSs. Table 1 displays some examples of such communities in, e.g., LinkedIn and Twitter.

LinkedIn	**members**
(Serious Games Group, 2015)	5.103
(Serious Games Research, 2015)	1.430
(CAREERS IN GAMES , 2015)	45.437
(People in Games , 2015)	37.342
(World Gaming Executives, 2015)	26.748
(Games Producers, 2015)	7.983
(Names in Games, 2015)	7.335

Twitter	followers
(Serious Games, 2015)	1.201
(Gamification , 2015)	15.500
(Learning Games , 2015)	6.135
(Games and Learning , 2015)	1.753
(Game Based Learning , 2015)	3.656
(Game. Play. Learn! , 2015)	1.277

Table 1: Examples of applied game communities in social networking sites

RAGE will help to overcome this fragmentation and aims to exchange knowledge through its Ecosystem. Therefore, the integration of SNEs hosting such target communities with the RAGE-Ecosystem and at the same time enabling the connectivity between SNEs and the RAGE-Ecosystem will connect research-, gaming industry-, intermediary-, education provider-, policy maker- and end-user communities. Furthermore, it will facilitate the centralized access to the valuable assets beyond the SNEs.

RELEVANT STARTING POINTS WITHIN THE STATE OF THE ART IN SCIENCE AND TECHNOLOGY

SNS were defined as "*Internet or mobile-device based social spaces designed to facilitate communication, collaboration, and content sharing across networks of contacts. SNS allows its users to become content creators and content consumers at the same time, thus allowing instant participation, sharing of thoughts or information and personalised communication*" (Childnet International, 2008).

Furthermore, SNSs have changed the way of information sharing and learning processes by adding innovative features to social communication. Therefore, SNSs are becoming increasingly important. This holds especially true for various SNFs like, e.g., rating, commenting, tagging, chatting, liking, posting new content, following actors or celebrities, playing games etc. These SNFs are not only entertaining and exciting but also useful for learning and for information enrichment. Research has shown that distance education courses are often more successful when they develop communities of practice (Barab, 2000). Furthermore, GOLBECK (2010) performed a study over a two-year period of collecting data on every social network he could identify. He also gathered daily information on thirteen networks over a 47-day period to understand how networks grow and change. This study indicates that the way, how people communicate and share their experience, interests, and information over SNEs, is becoming more and more popular (GOLBECK, 2007)].

Today, most SNSs provide application programming interfaces (APIs) for developers to integrate the SNSs into their systems. Although, the SNEs are different in their functionality, i.e., their SNF support, their software architecture for the communication with distributed other systems is similar. Most of the SNEs offer REST API (Gero Decker, 2009) (Mangler J., 2010) which can be used for integration with other systems. In the following, the description of the LinkedIn REST API software architecture will be cited as an exemplary, illustrative, and at the same time representative example. "*LinkedIn has become a powerful content platform, with B2B marketers telling us that half*

of the traffic they receive from social networks comes from LinkedIn. Make sure your content reaches an audience of professionals who are looking for relevant articles and information. The REST API is the heart of all programmatic interactions with LinkedIn. All other methods of interacting, such as the JavaScript and Mobile SDKs, are simply wrappers around the REST API to provide an added level of convenience for developers. As a result, even if you are doing mobile or JavaScript development, it's still worth taking the time to familiarize yourself with how the REST API works and what it can do for you. … The following features can be accomplished with the LinkedIn self-service APIs and mobile SDK: Sign in with LinkedIn, Apply with LinkedIn, Share on LinkedIn, Manage Company Pages. … One of the most important LinkedIn APIs is the share content on LinkedIn. There are two methods for sharing content via the REST API. The API endpoint is the same, regardless of the method you choose — only the format of the request body differs.

- *Post a comment that includes a URL to the content which should be shared— LinkedIn analyzes the included URL and automatically identifies the title, description, image, etc.*
- *Share with specific values — developer should provide the title, description, image, etc., directly via the parameters of the API call*" (LinkedIn, 2015).

Table 2 displays the API attributes and their values which can be included in the request body and Figure 2 displays a coding example for sharing content with specific values on LinkedIn (LinkedIn, 2015).

Attribute	Field Description	Max Length (chars)
Content	A collection of fields describing the shared content.	
Title	The title of the content being shared.	200
Deskription	The description of the content being shared.	256
Submitted-url	A fully qualified URL for the content being shared.	n/a
Submitted-image-url	A fully qualified URL to a thumbnail image to accompany the shared content. The image should be at least 80 x 150px for best results.	n/a
Comment	A comment by the member to associated with the share. If none of the above content parameters are provided, the comment must contain a URL to the content you want to share. If the comment contains multiple URLs, only the first one will be analyzed for content to share.	700
Visibility	A collection of visibility information about the share.	
Code	One of the following values: ▪ Anyone: Share will be visible to all members. ▪ Connections-only: Share will only be visible to connections of the member performing the share. This field is required in all sharing calls.	n/a

Table 2: Attribute and values of the LinkedIn request body (LinkedIn, 2015)

```
{
   "comment": "Check out developer.linkedin.com!", "content": {
      "title": "LinkedIn Developers Resources",
      "description": "Leverage LinkedIn's APIs to maximize engagement", "submitted-url":
      "https://developer.linkedin.com",
      "submitted-image-url":"https://example.com/logo.png"
   },
   "visibility": { "code": "anyone"
   }
}
```


Figure 2: Sharing content with specific values on LinkedIn (LinkedIn, 2015)

In summary, it is a big advantage to aim at supporting the integration of SNFs through their REST API into the RAGE Ecosystem (AGE). This will on the one hand facilitate to extend the envisioned RAGE Ecosystem with features of a social mediation engine going beyond content syndication, i.e. it can serve a social space that mediates collaboration partners, while content remains the main attractor. On the other hand it focuses on identifying collaboration opportunities between individuals and among groups, to support matchmaking and collaboration between stakeholders, and to identify and provide support for innovation opportunities and creativity efforts. That allows communities (such as technology providers, game developers and educators, game industries, researchers) to create their own assets and post them to the Ecosystem's repository without major effort. Besides, social network analysis and discourse analysis could be conducted and used to feedback relevant information to the communities. This feedback can e.g. first help gaming companies to develop new markets in applied gaming.

INTEGRATION APPROACH AND METHODOLOGY

The following section presents the main technical integration possibilities in the backend as well as in frontend. In this way, our integration approach and methodology is enabling us to differentiate between how to get access to resources and assets in the RAGE Ecosystem from external SNS communities and how to push contents from the RAGE Ecosystem to the external SNSs in order to improve user acceptance of services provided by the RAGE Ecosystem. Figure 3 displays the concept of a bi-directional integration approach of the RAGE Ecosystem with SNSs using a REST API.

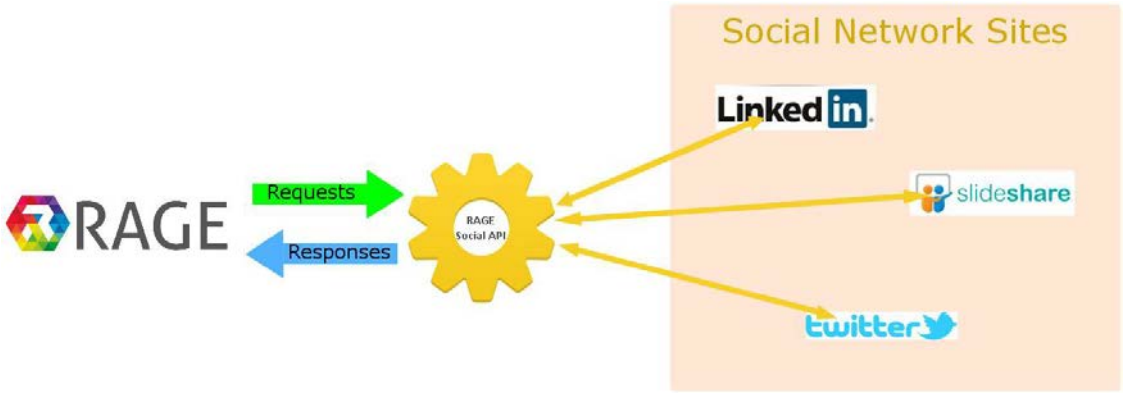

Figure 3: Integration Approach of RAGE Ecosystem with SNSs

Corresponding to this bi-directional integration approach, table 3 details scenarios following possible Tight and Loose Coupling (Suxia Liu, 2004)methodologies that have to be considered for achieving an integration of SNS to RAGE and vice versa.

Method	**FROM SNS TO RAGE ECOSYSTEM**	**FROM RAGE ECOSYSTEM TO SNS**
Tight Coupling	Integration of RAGE-Interface within the SNS, user does not need to leave the SNS Environment (e.g. user posts a content to the RAGE Ecosystem without leaving the SN-Environment; user remains on the SNS)	Integration of SN-Interface within the RAGE Ecosystem, user doesn't leave the RAGE Environment (e.g. user posts, likes etc. a content without switching to the SNS; user remains on the RAGE Ecosystem)
Loose Coupling	SNFs are related to SNS (links from RAGE to the SNS) User lefts the RAGE Environment and switches to the SNS; user has to complete the action on the SNS, not on the RAGE Ecosystem	SNFs are only related to SNS (link from RAGE to the SNS) User leaves the RAGE Environment and switches to the SNS; user has to complete the action on the SNS, not on the RAGE Ecosystem

Table 3: Loose and tight coupling integration methods between SNS and the RAGE Ecosystem

SNF USAGE SCENARIOS AND DESIGN CONCEPT

In addition to outlining our SNS integration approach and methodology, Figure 4 displays how the SNF usage scenarios can be integrated into the RAGE Ecosystem itself. RAGE Ecosystem users can visit content and knowledge management support within the RAGE Ecosystem's a Digital Library, Media Archive, Software Repository, and Learning Management System. Here, users have the opportunity to:

a. Rate **(1)**, like **(2),** and Comment **(3)**: these SNFs are e.g. important for the recommendation system to get more useful suggestions.
b. Tell a friend **(4)**: users can send links to selected content (or the content itself) through email. Email addresses can be selected either from the RAGE address book or from users' address books which are located in SNEs.
c. Share and post **(5)**: Users can share the selected content to one of their favourite SNSs (SNSs) or on the fly to more than one by selecting them from the share button  .
   Users also have the possibility to publish content to a repository (e.g., GitHub's repository) or to cloud storage (e.g., into Dropbox).

d. Favourite **(6)**: Users can add content to their favourite lists which facilitates to later, e.g., share/post their entire favourite list to a community.
e. Share and post to RAGE Communities **(7)** within the RAGE Ecosystem and also from any other platforms outside the RAGE Ecosystem. A RAGE Share-Button can be released and, e.g., be integrated by developers into other portals, homepages, ecosystems etc. to provide the possibility to Internet Users to share and post their content to the RAGE-Ecosystem.
f. RAGE Follow-me **(8)**: RAGE users can follow other users, groups or content in order to keep themselves up-to-date.

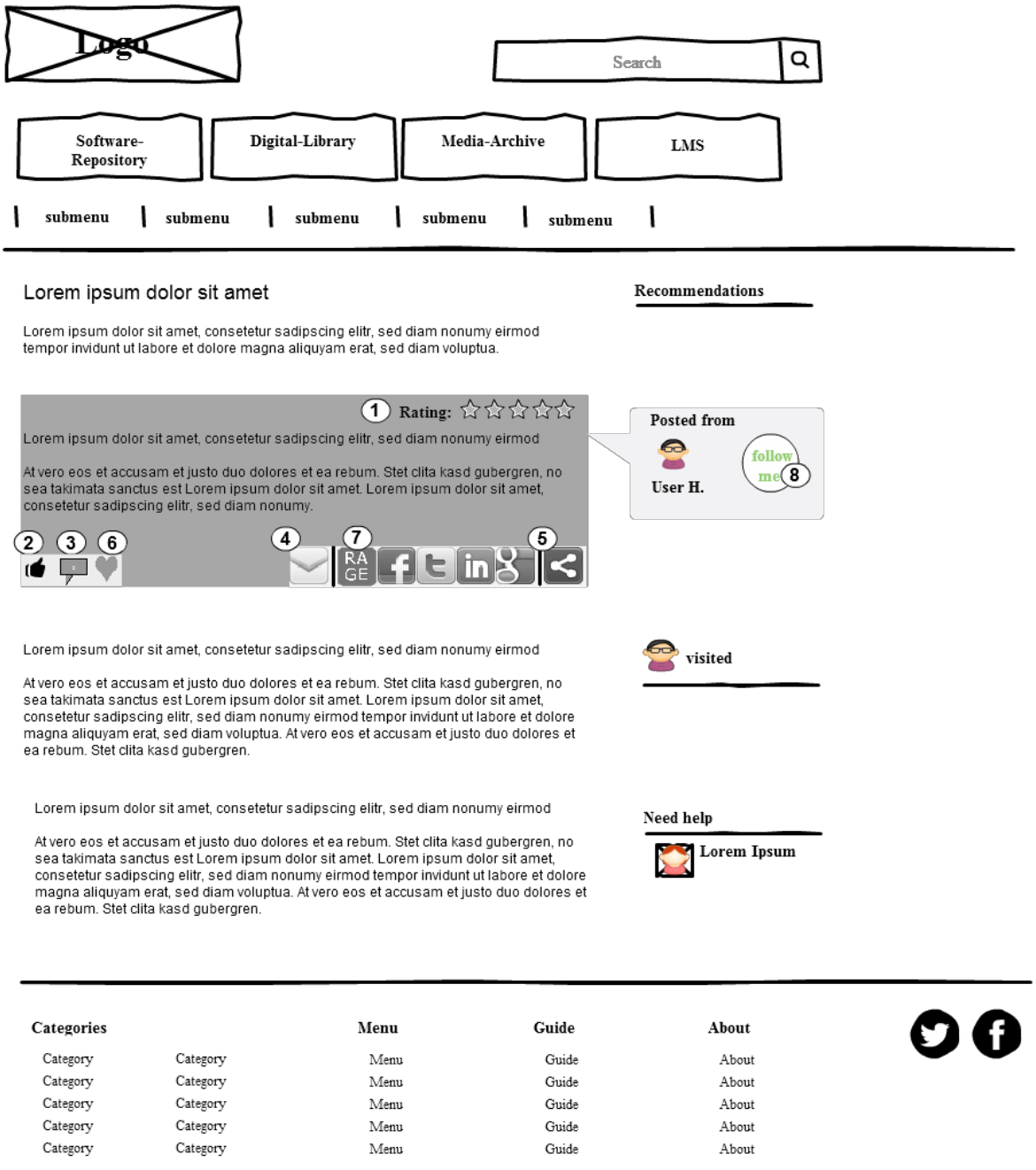

Figure 4: SNF Usage Scenario in the RAGE Ecosystem

CONCLUSION AND OUTLOOK

In this paper, we have introduced the concept and initial design of the RAGE Ecosystem supporting community-based content and knowledge management. In detail it will support the collection, sharing, access, and re-use of applied gaming research and development assets, resources as well as academic, industry, and end user best practice knowhow. In this way, the RAGE Ecosystem will provide applied gaming communities, and therefore GBL communities, too, an opportunity to interact, share and re-use knowledge as well as communicate and collaborate using the RAGE Ecosystem. Besides this introduction, we have presented how integration between the RAGE Ecosystem and SNSs can be achieved to reduce the fragmentation and to increase the knowledge exchange among applied game communities (such as applied game developer, researchers and players). The RAGE Ecosystem and its SNS and SNF integration are currently under development. In the future, RAGE is aiming at increasing outreach and take-up of the RAGE Ecosystem through further SNS integration and SNF implementation. For example, the SNA and discourse analysis will be used for collecting, analyzing, and presenting data about various patterns of relationships among people, objects and knowledge flows within the RAGE Ecosystem and will provide additional functionality and sophisticated services for end-users, enhancing the emergence of communities. In particular, future developments will focus on identifying collaboration opportunities among individuals and groups, to support matchmaking and collaboration among main stakeholders, and to identify and provide support for innovation opportunities and creativity efforts. In this way, the RAGE project currently anticipates the following additional tools and services as part of its future work:

a) The RAGE Diagnostic tool based on various metrics for analyzing the usage of resources, the formation of different users groups, the level of social interactions, etc.,
b) the RAGE awareness tool can increase participation of different target groups in the Ecosystem,
c) the RAGE Knowledge Mapping tool builds and analyses knowledge maps for all kind of resources available in the Ecosystem.
d) the RAGE Professional support tool will support the users by letting them know whom or where to ask for support in different situations,
e) the RAGE Community detection tool will use available clustering algorithms (also called ‘‘community detection algorithms’’) that automatically identify and locate existing communities, in order to enhance the communication between gaming practitioners,
f) the RAGE Ecosystem analysis tool will apply network analysis including many algorithms for identifying the most important, or central in some sense, nodes within a network,
g) the RAGE Recommendation may generate value interventions towards stimulating the participation of users. Such interventions include suggesting connections among users, setting up groups, closing the gaps in people’s knowledge of other members’ expertise and experience, and strengthening the cohesiveness within existing teams. Social media data such as tags, comments, purchasing patterns, and ratings can be used to link related gaming assets and users together into networks,
h) the RAGE Social learning tool applies SNA to online learning environments as well, focusing on the structural relationships between all learning objects and users, that support learning communities.

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