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# Social Collaborative Media in Software Development

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## Synonyms

Collaborative project, Project management media, Social collaborative media, Software development

## Glossary

### *Collaborative media*

The forms of media which enable people (or participants) to collaborate and exchange information. Examples of collaborative media discussed in this entry are application software and online tools/media

### *Software projects*

Projects in which software products are planned, developed, and monitored. Software projects have defined goals and methodology to follow in order to achieve the goals

### *Software development process*

Process which is related to the development steps in software projects including designing, planning, management, and monitoring in realizing the project goals

## Definition

In this entry, we discuss various collaborative media which are commonly used among software developers. We start by discussing common communication channels developers used. These communication channels are discussed in two groups: public and enterprise-wide media. We then elaborate project management media in coordinating and managing project activities. Finally, we discuss a number of online knowledge resources, i.e., collaborative/individual knowledge resources and social networks.

## **Introduction**

In the past decade, a wide variety of collaborative media have been utilized by software developers in their projects. Regardless of the size of projects, typically multiple software developers participate in a software project. Interactions among software developers, which include communication and project coordination, play an important role in determining project outcome. These interactions are often supported by multiple collaborative media.

Communication, project management, and knowledge management are three main things that play important roles in determining project success (Kraut and Streeter 1995; Surian et al. 2010, 2013; Frese and Sauter 2014). Understanding different collaborative media that can effectively facilitate communication, project management, and knowledge management is an important first step before starting any software project. We believe that in order to facilitate effective interactions to achieve project goals, software developers should choose the correct collaborative media that suit the need of team members and the project itself.

## **Key Points**

Collaboration is a key factor in software development. Collaborations could be manifested in various ways such as asking others for help, sharing ideas, exchanging information (Deal 2009), etc. Interactions among software developers often become a cornerstone in a software project as more and more software projects are developed in a collaborative fashion involving more than one developer. Moreover, many software projects today are developed by developers spread around the globe working on distributed teams. Even in the extreme case where a project only involves one developer, he/she may need to communicate with others to get feedback and help. This phenomenon creates an environment where information exchange process becomes crucial to the success of projects.

Collaborative media constitute the development process, especially in the planning, management, and monitoring steps where active involvement of the participants/collaborators is essential and being part of the process itself. Likewise, it is very nature that any methodology in software projects may still be redefined and refactored along the development process. As the participants become the focus of process, therefore, communication and information flow among the participants have to be carefully treated.

## **Historical Background**

Software development activities need both individual commitments and socio-technical interactions (Kilamo et al. 2015). Therefore, a collaboration among software developers in a software project could be interpreted as a collective effort of a group of people who work together aiming for a common goal (i.e., project success) and sharing a common passion to improve the quality of their work by regular interactions. This definition puts collaborations among software developers to share common characteristics as collaborations in other communities of practice (Wenger and Snyder 2000), where:

1. Each member shares a common domain of interest with other members and shows a commitment to help one another.
2. Each member interacts, communicates, and builds relationships with the other members.
3. Each member engages with the other members and is involved in various problem-solving activities.

Numerous tools are available today to support the collaboration activities in a software development process (Singer and Schneider 2012; Storey et al. 2010). These tools come with various features to help developer to interact more effectively. The incorporation of social dimension to the software development process creates what is referred to as a “participatory culture” or “collaborative software development” (Whitehead et al.

2010) and which is also one important aspect in popular software development methodologies such as Agile (Larman 2004) and DevOps (Erich et al. 2014).

## **Communication Media**

### **Public Media**

In the early years of the twenty-first century, interactions among software developers mostly use basic voice-based and text-based communication technologies, e.g., telephone and SMS (Thurlow et al. 2004). While telephone and SMS are still among the most widely used communication tools, in recent years Internet-based communication tools such as instant messaging, video chat, e-mail, etc. gain much traction and are also widely used. Instant messaging services are prevalent nowadays as they provide a convenient and practical way for one-to-one interaction and group chat. Some of them provide multiple ways for their users to access the services (e.g., via web browsers and apps) and support multiple communication mode (e.g., text and voice calls). Some examples of these tools, which are publicly available, are Google Hangouts, Facebook messenger, Yahoo! messenger, Skype, eBuddy, ICQ, Tencent QQ (or known as QQ), Gadu-Gadu, Meebo, WhatsApp, Paltalk, Xfire, Viber, WeChat, LINE, KakaoTalk, Kik messenger, Tango, Nimbuzz, Hike messenger, MessageMe, Digsby, Adium, Pidgin, etc.

While instant messaging services are mainly used as communication tools, several of them have been equipped with file-sharing and document-editing capability, which allow developers to better collaborate with one another. Several examples of file-sharing/file-hosting services provided by big companies are Google Drive, Dropbox, Microsoft OneDrive, etc.

### **Enterprise-Wide Media**

The use of social collaborative media to foster communication among employees has been implemented in many enterprises (DiMicco et al. 2008). This practice is generally known as “enterprise social networking” or “enterprise 2.0” (Makkonen and Virtanen 2015). While communication among employees through this media may lead to informal nonwork conversations, it has been shown that informal nonwork-related conversations (or commonly termed as e-cheap talk) help to promote cooperation and trust in software development teams (Wang and Redmiles 2015). The following list presents examples of social collaborative media developed by several companies:

1. IBM: Notes and Domino (e-mail client with social collaboration and business applications), Connections (business social network platform), Connections Cloud S1 (e-mail, instant messaging, online document editing, web conferencing, file-sharing and social business services), Sametime (instant messaging with integrated voice, data, and video), Forms (data collection)
2. Box Inc.: Box (file sharing)
3. Citrix: Podio (online collaboration), OpenVoice (audio conference), GoToMeeting (online meetings)
4. Atlassian: Confluence (document collaboration), HipChat (team chat, video, file sharing)
5. Microsoft: SharePoint and Yammer (company’s private social network)
6. Jive: Jive-n (social collaboration), Jive Daily (company’s social community), Jive Chime (company’s instant messaging), Jive Circle (company’s expertise finder)
7. Salesforce: Chatter (company’s social network with file-sharing and expertise finder capabilities)
8. SAP: Jam Collaboration (cloud-based social collaboration)

### **Project Management Media**

Software development process is a series of actions and steps including planning, organizing, staffing, directing, and controlling a software project to realize a working software system (Thayer and Yourdon 2000). This process includes a requirement to document, track, and record all project activities including project design and information changes. Face-to-face meeting and note keeping (by meeting notes, e-mails, etc.) are mostly used in facilitating project development. These two methods may be effective for small-scale software projects with small number of participants/collaborators. However, many software projects nowadays involve a large number of developers and stakeholders and have fast-changing needs. Furthermore, many software projects today are developed by software developers from geographically diverse locations.

In the past decades, more and more tools have been built to allow developers to better coordinate and manage projects. These tools incorporate various features to maximize the productivity and efficiency of developers in a software development process. One example tool that is commonly used in developing software is an integrated development environment (IDE). Some IDEs are platform independent and highly support collaborative software development. The social aspect of IDE has been shown to support effective coordination in a software team (Dourish and Bellotti 1992; Treude and Storey 2009).

In recent years, many web-based source code management platforms arise and are publicly available. Several of these platforms include SourceForge.net (<http://sourceforge.net/>), GitHub, Bitbucket, and many more. SourceForge.net was introduced as a platform which hosts many source code repositories with various features such as integrated issue tracking, discussion forum, and many more. Another web-based source code management system is GitHub. GitHub is based on Git system which enables distributed revision control to support parallel workflows and version tracking. Several previous studies have studied the collaboration among GitHub users (Dabbish et al. 2012; Marlow et al. 2013). Similar to GitHub, Bitbucket is also a web-based source code management platform that supports both Mercurial and Git. GNU Savannah is a collaborative software development management system which also supports Git, Subversion, and many other distributed revision control systems. Launchpad, Tigris.org (<http://tigris.org/>), and BerliOS (Berlin Open Source) are some other examples of software management platforms for open-source software. Some platforms are equipped with additional features such as crowdfunding (e.g., Bountysource) and with Agile project management feature (e.g., JavaForge). RubyForge is another platform dedicated to the Ruby programming language.

## **Online Knowledge Resources**

With the emergence and growth of the Internet, many online knowledge resources are publicly available today. Some of these knowledge resources are individually managed, while others are community-driven services. In this section we discuss several online knowledge resources, i.e., (i) collaborative/individual knowledge resources and (ii) social networks.

### **Collaborative/Individual Knowledge Resources**

A collaborative/individual knowledge resource is a website that allows a user or a group of users to add, delete, or modify a piece of content. An example of this resource is a wiki. A wiki is built using a wiki software/engine such as MediaWiki. Generally, each programming language may have its own wiki as a knowledge base for its users, such as [wiki.python.org](https://wiki.python.org/) (<https://wiki.python.org/>) which provides knowledge resources for Python users. Some online sites such as [code.wikia.com](http://code.wikia.com/) (<http://code.wikia.com/>) provide knowledge resources for several programming languages such as Java, Python, C++, Sawfish, etc.

Another knowledge resource media are news websites such as Slashdot, reddit, and Hacker News. Several studies have analyzed these news websites as a collaborative media (Lampe and Resnick 2004; Kunegis et al. 2009; Gilbert 2013). Slashdot was developed initially as a news website, but often discussions on Slashdot are valuable knowledge resources for software developers. Another example of a community-driven news website

is reddit, which also allows discussions/comments by its users. Hacker News is a similar site focusing on computer science and entrepreneurship.

A blog (or weblog) is often designed by a single individual who would like to post something on the Internet. There are also multiauthor blogs where a group of people collaboratively write, manage, and edit the contents of a blog. Blogs are commonly used in software developer community as a documentation media and a discussion forum (Park and Maurer 2009; Parnin et al. 2013; Blood 2004; Cayzer 2004). Blogs are one of the important media which support software development as many developers often share their personal experiences such as API usages, bugs, solutions, and tutorials on their blogs to the benefit of many others.

A question-and-answer (Q&A) website is another form of knowledge resource which effectively supports knowledge transfer among people (crowdsourced knowledge) in a question/answer format. Like a discussion forum, people post questions on a Q&A website, and other users would answer the questions. Several Q&A websites which are frequently used as a knowledge sharing medium by software developers are Stack Overflow, Google Groups, Quora, Yahoo! Answers, WikiAnswers, etc. A recent study by Barua et al. shows that the discussion on a Q&A website varies, and discussions on some topics may lead to other discussions in some other topics (Barua et al. 2014). Wang et al. investigated interactions among software developers on Stack Overflow (Wang et al. 2013). A study by Vasilescu et al. shows that the question-and-answer activity rates of developers correlate with their code changing activities in GitHub (Vasilescu et al. 2013).

## **Social Networks**

Online social networks have also been used as collaborative media for software developers. The heterogeneous social structure of social networks contributes and plays an important role in determining how far and fast information spreads (Romero et al. 2013). Software developers have been using online social networks and creating virtual communities among them. One example of social networks is a microblogging service such as Twitter. Twitter has been used in software development process such as for sharing idea, discussing software/project issues, promoting blogs or other knowledge resources, etc. Several studies have investigated Twitter as one of the important media supporting software development (Bougie et al. 2011; Tian et al. 2012; Prasetyo et al. 2012; Wang et al. 2014). While some software developers are not hesitant to discuss their projects on public social networks, others are concerned on potentially disclosing confidential information on such networks; thus a number of social networks have been built for internal use in a company such as Confluence, Yammer, Jive, tibbr, etc.

## **Key Applications**

Various types of social collaborative media have been used in practice to support the software development process. From the use of more common communication technologies such as telephone and SMS (Thurlow et al. 2004) to more specific tools such as collaborative-supported IDE, if it is chosen carefully by the development team, social collaborative media have been shown to be very useful to support the development process (Treude and Storey 2010). Our discussion in this entry only focuses on software development process; however, the application of social collaborative media could also be applied to other projects that involve collaborations among people.

## **Future Directions**

As more and more collaboration media are available to support software developers in their software projects, there are several promising future research directions. Some collaboration media feature a ranking of their users (gamification). It is interesting to investigate the role and impact of high-status developers (developers

who gain high rank based on their contributions), especially to project success/failure. Another interesting study would be an analysis on collaboration patterns on public collaboration media and internal-use (enterprise-wide) collaboration media. Yet another interesting direction is to develop automated systems to promote further collaborations on such media, e.g., by making recommendations or by sending suitable messages tailored to one's needs.

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