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Organizational productivity metrics from document collaboration

ABSTRACT

Research has identified many characteristics of productive teams, e.g., initiative, helpfulness, time efficiency, work quality, etc. A metric for productivity that provides a measure of team productivity can help teams identify specific areas of improvement.

Techniques disclosed herein identify different aspects of productivity that can be observed in online communication and document creation/management systems. For example, such aspects can include creation of documents, collaborative editing of documents, and communication between users. Further, these aspects are measured to compute a productivity metric. A multigraph is constructed with nodes representing users and edges representing the weight (quality) of creation, collaboration, and communication events. The productivity metric is computed based on the connectivity of the multigraph, the quality of the edges, and the individual nodes.

KEYWORDS

- Productivity metric
- Productivity graph
- Collaboration software
- Document collaboration
- Organizational productivity

BACKGROUND

Research has shown that, in highly productive organizations, team members collaborate intensely. Productivity has been shown to increase when team members collaborate across departmental or company boundaries. For example, at a company where sales, marketing,

research and development, operations, and even customers and suppliers work together, the productivity tends to be high. An important characteristic of high performing teams is “psychological safety.” Psychological safety arises when team members know their ideas and opinions will be respected and considered, even when such ideas and opinions conflict with those of the rest of the team. In teams with high psychological safety, the team members’ natural sense of vulnerability is diminished, and they express their ideas openly regardless of rank. In such organizations, collaborations occur between employees of different levels, and a good fraction of employees participate in collaborative activities.

The productivity of an organization is of great interest to multiple stakeholders. Yet there is no readily available metric to assess the productivity of an organization. Nor is there a way to easily visualize the causes of low productivity.

DESCRIPTION

Techniques of this disclosure leverage the causative relationship between collaboration and productivity in order to measure productivity. Typically, members of an organization use multiple systems for collaboration, e.g., corporate social networks, e-mail, document creation and management systems, collaboration tools, code repositories, etc.

The techniques disclosed here in automatically observe various aspects related to use of collaboration systems by members of an organization to compute productivity metrics. For example, the aspects can relate to how the systems are utilized to generate documents, and to collaborate and communicate with other members. Such aspects are observed specifically upon consent of individual users, such as employees, contractors, business partners, etc. Further, organizations can choose to selectively enable observation of such aspects in certain systems and not in other systems, and limit the observations to a subset of data within such systems. The

techniques can utilize content of documents and communication only upon specific consent. The techniques are automated and compliant with organizational policies and norms related to use of organizational information.

The creation of documents, e.g., reports, spreadsheets, presentations, videos, images, blog-posts, social media commentary, etc., is used to measure the “initiative” aspect of productivity. The quality of the documents measures the “quality” aspect of productivity.

Collaboration events that occur over documents, e.g., sharing, joint editing, commenting, commenting-on-comments, etc., are used to measure collaboration. Collaboration events measure the “helpfulness” aspect of productivity. Not all collaboration events have the same value; typically, cross-collaborations across functional or organizational boundaries, or collaborations with an expert, contribute more to productivity.

Communication events are triggered by the transmittal or receipt of email, messages, chats, etc. Like collaboration, who is communicating, and the medium of communication (e.g., email, chat, etc.) have an impact on the measured productivity. For example, the use of chat applications for short communications is indicative of a healthier/more productive culture.

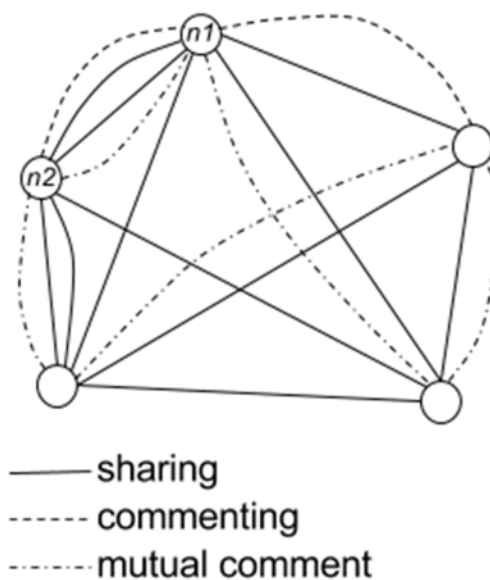


Fig. 1: Productivity multigraph of an organization

The contributions to productivity of creation, collaboration and communication are captured by defining a “productivity multigraph,” an example of which is shown in Fig. 1. The productivity multigraph is a snapshot of the level of creativity of employees, and how closely employees work together to achieve company goals. The nodes of the multigraph represent employees, and the edges represent collaborations between the nodes. The properties of a node include organizational attributes of the employee, e.g., title, reportees, rank, etc. Edges may be of differing types, as follows.

- If a node $n1$ created a document with identity doc_id , and shared it with node $n2$, then the edge between nodes $n1$ and $n2$ is of type “sharing,” and is identified by the notation $(doc_id, sharing)$. Such a type of edge is shown in Fig. 1 by solid lines. In that figure, the two solid lines between two nodes $n1$ and $n2$ are each associated with distinct documents shared between $n1$ and $n2$.
- If a node $n1$ created a document with identity doc_id , and node $n2$ commented on that document, then the edge between nodes $n1$ and $n2$ is of type “commenting,” and is identified by the notation $(doc_id, commenting)$. Such a type of edge is shown in Fig. 1 by dashed lines.
- If a node $n1$ created a document with identity doc_id , node $n2$ commented on that document, and node $n1$ responded to the comment of node $n2$, then the edge between nodes $n1$ and $n2$ is of type “mutual comment,” and is identified by the notation $(doc_id, mutual\ comment)$. Such a type of edge is shown in Fig. 1 by dotted-and-dashed lines.

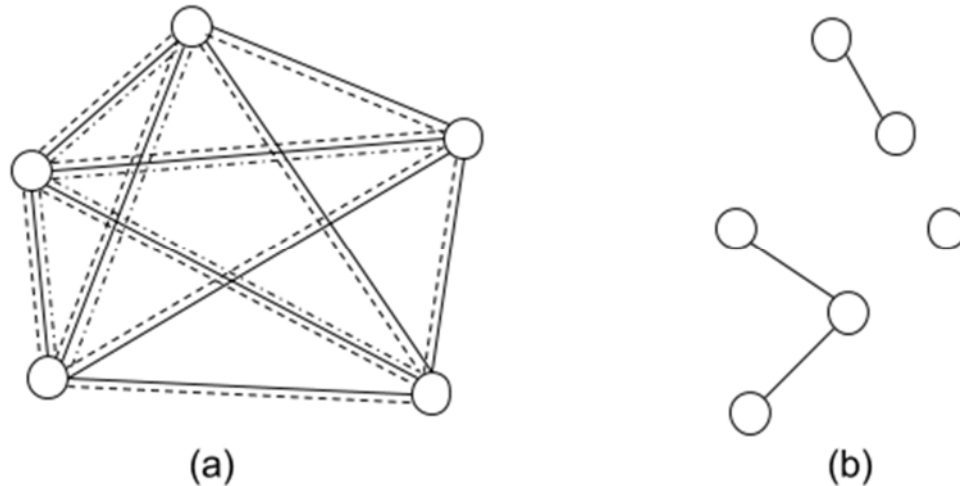


Fig. 2: Productivity multigraphs of two organizations. (a) A highly collaborative, productive organization (b) An un-collaborative, low-productivity organization

The form of the multigraph gives an indication of the level of collaboration within the company. A more productive enterprise has more cross organizational and cross-hierarchy collaboration than a less productive enterprise. An example of a highly collaborative, hence productive, organization is Fig. 2(a), which shows a nearly complete multigraph. Such would be the multigraph of, for example, an early-stage startup, which has few employees (nodes), and wherein everyone collaborates with everyone else and the organization is at the peak of its productivity. An example of an organization with poor collaboration is shown in Fig. 2(b), which is a multigraph with a very low degree of connectivity.

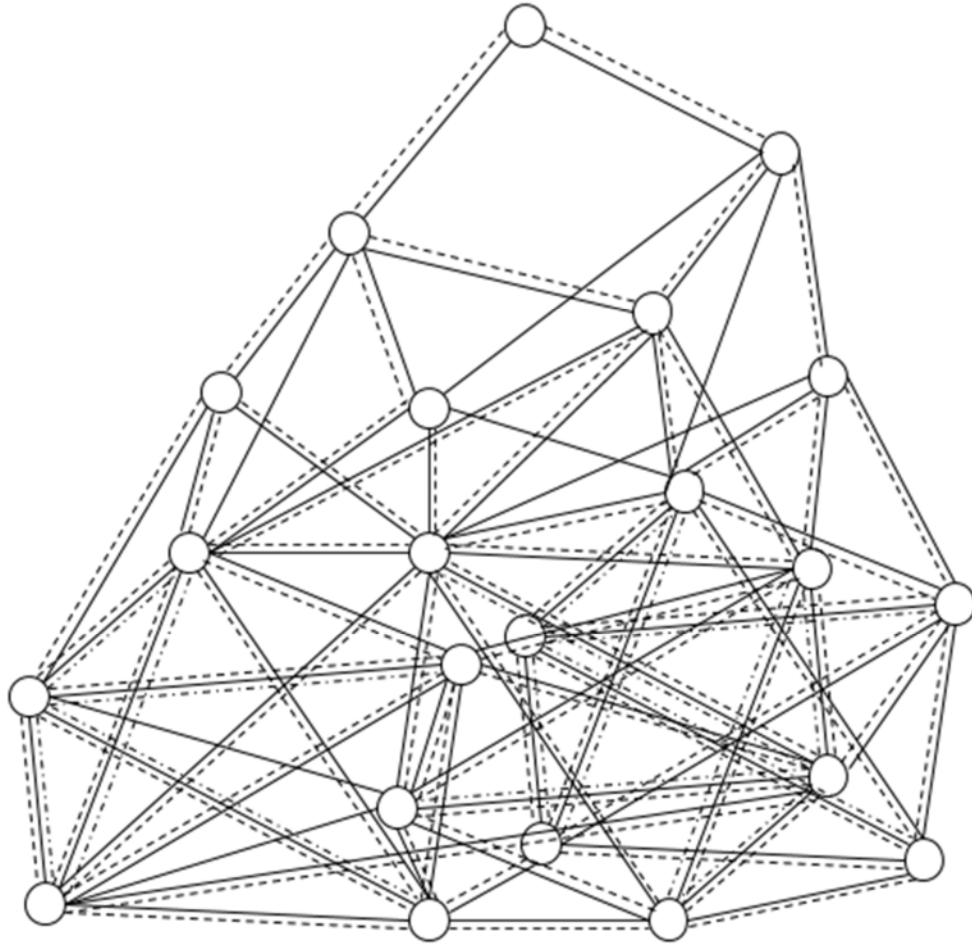


Fig. 3: A productivity multigraph of a mature organization

As an organization grows, the productivity multigraph starts resembling a tree, for example, as shown in Fig. 3.

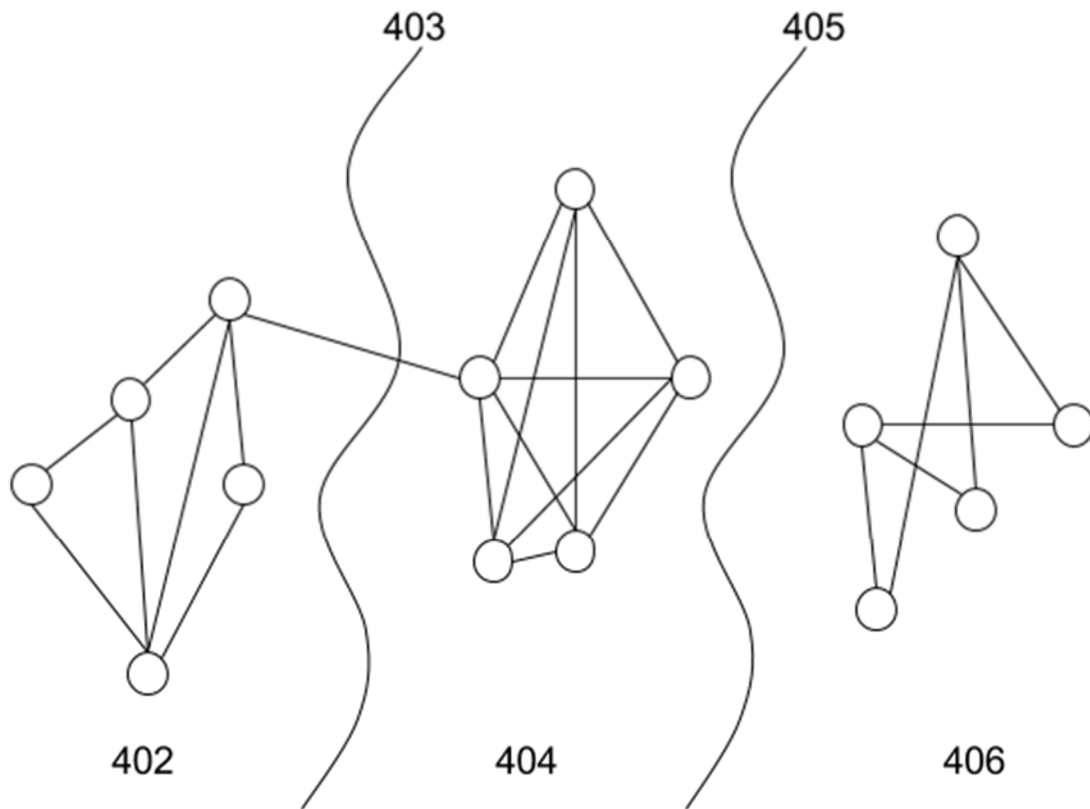


Fig. 4: A siloed organization

A siloed organization, e.g., one in which there is not much collaboration across departmental or functional boundaries, is shown in Fig. 4. In this figure, departments 402, 404 and 406 have relatively high levels of internal collaboration, but they hardly collaborate across boundaries 403 and 405. A siloed organization is less productive, as it has less cross-organizational and cross-hierarchical collaboration.

In order to capture the effectiveness of collaboration, a weight (quality) of a collaboration between two nodes (employees) is defined as follows. The weight of a collaboration between nodes $n1$ and $n2$ is proportional to:

- The length of the path between the nodes in the organizational tree (longer the path, more cross-organizational the collaboration).

- The rank of the nodes within the organization (higher the rank of the document creator $n1$, or the collaborator $n2$, greater the impact).
- The square of the difference between the heights of $n1$ and $n2$ in the organizational tree (to capture the higher impact of multi-level on the collaboration).

The weight (quality) of a document is computed as being proportional to the following.

- Content of the document, determined for example by semantic or syntactic analysis of the document, page-rank analysis, etc.
- Size of the document, such that too short or too long a document has lower weight.
- Collaborations on the document, e.g., who/how many people collaborated on the document.
- The weighted sum of individual collaborations like editing, commenting, sharing, etc., wherein individual collaborations are weighted according to their quality.

The weight of actions on a document depends on the action, e.g., an edit is more valuable than a comment, which in turn is more valuable than a share. The weight of communication is evaluated similar to the weight of a document. For example, the content of communication is treated as the content of a document. Sharing of communication occurs when a communication, e.g., email is forwarded. Editing of a communication occurs when a communication is replied to or edited.

Having defined the weights of collaboration, document, communication, and action, productivity metrics are defined via the following equations.

$$(I) \text{ weight of edge in collaboration multigraph} = \\ \text{weight of document} \times \text{weight of collaboration} \times \text{weight of action};$$

$$(II) \text{ productivity of a node}$$

= creativity + collaboration

= sum of weights of documents authored by node +
sum of weights of outgoing and incoming edges;

(III) productivity of organization = sum of productivities of employees /
number of employees.

In this manner, a metric is obtained for the productivity of an organization.

Certain implementations discussed herein may collect or use information relating to organizations and/or their employees, members, etc. (collectively referred to as users). In such situations, information about users (e.g., user's data, information about a user's social network, user's location and time at the location, user's biometric information, user's activities, user-generated data, user's documents, meta-data relating to user-generated data, user's online history and demographic information, etc.) is collected and used with the consent and permission of users. Users are provided with one or more opportunities to control whether information is collected, whether the information is stored, whether the information is used, and how the information is collected about the user, stored and used. That is, the systems and methods discussed herein collect, store and/or use user information specifically upon receiving explicit authorization from the relevant users to do so. For example, a user is provided with control over whether programs or features collect user information about that particular user or other users relevant to the program or feature. Each user for which information is to be collected is presented with one or more options to allow control over the information collection relevant to that user, to provide permission or authorization as to whether the information is collected and as to which portions of the information are to be collected. For example, users can be provided with one or more such control options over a communication network. In

addition, certain data may be treated in one or more ways before it is stored or used so that personally identifiable information is removed. As one example, a user's identity may be treated so that no personally identifiable information can be determined. As another example, a user's geographic location may be generalized to a larger region so that the user's particular location cannot be determined.

CONCLUSION

Productivity of an organization arises from the events of creation, collaboration and communication within the organization. Techniques of this disclosure provide productivity metrics and visualizations of organizational productivity. A productivity multigraph is defined that maps the collaborations between employees of an organization. The productivity multigraph can be used to visualize how closely people within an organization work together. It can be used, for example, to check for the existence of cross-organizational or cross-hierarchical collaboration, or lack thereof. A productivity metric based on the quality and quantity of creation, collaboration and communication is computed. The techniques of this disclosure provide simple real-time measurement of the productivity of an organization.