Dynamic Community

A New Approach to Collaborative Knowledge Construction

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Outline

► The DynC (Dynamic Community) project
► What’s dynamic community and why?
► A generic scenario of forming a dynamic community
► Dynamic community theory applied to software reuse
► Challenges ahead
Background of the DynC (Dynamic Community) Project

► Funding agency: Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan


► Members

- PI: Kouichi Kishida, SRA-KTL
- Co-PI: Yunwen Ye, SRA-KTL
  - Kumiyo Nakakoji, University of Tokyo
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  - Ken-ichi Matsumoto, NAIST
- Senior Consultant: Yasuhiro Yamamoto
Overall research goal

Collaborative knowledge construction

Theory of and implementation techniques for dynamic community
Current collaborative knowledge construction approaches

**Knowledge management**
- Knowledge as commodity
- Achieving collaborative knowledge construction via collecting, managing, and sharing knowledge

**Community**
- Knowledge inseparable from the owner
- Achieving collaborative knowledge construction by supporting communications within a community

Knowledge and knowledge-owners are separated.
Knowledge management

► Knowledge is a thing that is
  ▪ Independent of context and knowledge owners
  ▪ Specifiable
  ▪ Transferrable

► The KM cycle
  ▪ Creation – Capture – Retrieval – Use
Community-based knowledge collaboration

► Knowledge is not a thing; it’s
  ▪ Fundamentally tacit
  ▪ Highly contextualized and individualized to knowledge-owners
  ▪ Always reconstructed in a new context

► Sharing in a community
  ▪ Knowledge transfers along social networks
    ▶ Stories are effective tools
    ▶ Individual mentoring
Dynamic community: an integrated approach

Three dimensions of relationship

- Knowledge to knowledge
- Knowledge to human
- Human to human

Integrating knowledge and knowledge-owners
The formation of a dynamic community
The formation of a dynamic community: 
from information to people
The formation of a dynamic community: *from information to information*
The formation of a dynamic community: from information to information to people
Problems with community of practice

► Communities exist for a relative long time once formulated

► Experts and novices are regarded as personal attributes and their roles remain stable for a long time
  ▪ One-direction information flow from experts to novices
  ▪ Overload of experts

► No consideration for the difference of individual tasks
  ▪ Not dependent on the diversity and situatedness of an individual’s task and information needs

► Little consideration of social relationship between members
  ▪ Member relationship is not differentiated
  ▪ Member relationship outside of the community is not considered
Characteristics of dynamic community

► Ad hoc and On-demand
  ▪ A social network of knowing that provides a specific platform for knowledge sharing and collaborative construction for a particular **individual** with a particular **task**
  ▪ It is formed dynamically when the needs arise

► Task-specific
  ▪ The network is formed for a specific task

► Member-specific
  ▪ The network is formed for a specific member
Task-specific and Member-specific

Task specific: for the same member, different task leads to a different community

Member-specific: for the same task, different member leads to a different community
A generic scenario

The process of forming a dynamic community
Knowledge accumulation

Knowledge repository

Relation among info.

Relation between info. and people

Relation among people
Relevant info

Info. retrieval

Knowledge repository

- Relation among info.
- Relation between info. and people
- Relation among people
Knowledge repository

Relation among info.

Relation between info. and people

Relation among people

Info. retrieval

Finding experts

Relevant info.
Knowledge repository

- Relation among info.
- Relation between info. and people
- Relation among people

Info. retrieval

- Finding experts
- Choosing experts

Relevant info
Knowledge repository

Relation among info.

Relation between info. and people

Relation among people

Info retrieval

Finding experts

Choosing experts

Relevant info.

Ambient notice
Knowledge repository

- Relation among info.
- Relation between info. and people
- Relation among people

Info. retrieval

Finding experts

Choosing experts

Ambient notice

Participation
Creating dynamic communities that support software reuse

A more concrete example in CodeBroker
Delivery of task-relevant components
From component to the document
From component to example

(a) Java code snippet:
```java
import java.lang.*;

class Chi2Eng {
    /** constructor */
    void Chi2Eng (String initVal) {
    }
    /** just set the internal value */
    void setValue (String val) {
    }
    /** translate to the English format and return it */
    return (d);
}
/** print a double */
public static void print(double d, int n) {
    NumberFormat nf = NumberFormat.getInstance();
    nf.setMaximumFractionDigits(n);
    nf.setGroupingUsed(true);
    System.out.print(nf.format(d) + " ");
    System.out.flush();
}
```

(b) CLI output:
```
1 0.23 isGroupingUsed Returns true if grouping is used in this format
2 0.18 isParseIntegerOnly Returns true if this format will parse numb
3 0.15 format Returns pattern with formatted objects.
4 0.15 getCurrencyInstance Returns a currency format for the specified
5 0.15 getPercentInstance Returns a percentage format for the specified
6 0.15 format Specialization of format.
7 0.15 format Specialization of format.
8 0.15 format Specialization of format.
9 0.15 format Specialization of format.
10 0.15 format Specialization of format.
```

(c) CLI display:
Finding experts with Choochoo Messenger

Request for help on format

Existing relationship established not over the task of "format"
Offering help

Request for help on format

Subject: format
Sender: Jack@Colorado.EDU

> This is Jack. I want to use java.text.NumberFormat.format
> to convert a number written in Chinese format to Western
> format. Could you help me with this? Thank you.

Okay, come to my office or call me at 123-4567.

---
Mary@Colorado.EDU

if content_length > 0:
    m=f read(content_length)
Collaboration

Request for help on format
Research challenges ahead

Theoretical questions
Technical questions
Social questions
Theoretical questions

- Relationship with community of practice, community of interest, intensional network and other similar theories

<table>
<thead>
<tr>
<th></th>
<th>Community of Practice</th>
<th>Community of Interest</th>
<th>Intensional network</th>
<th>Dynamic Community</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Granularity</strong></td>
<td>Domain</td>
<td>Problem</td>
<td>Project</td>
<td>Task</td>
</tr>
<tr>
<td><strong>Bonding factor</strong></td>
<td>Shared identity</td>
<td>Symmetry of ignorance</td>
<td>Shared work history</td>
<td>General reciprocity</td>
</tr>
<tr>
<td><strong>Focus of relationship</strong></td>
<td>Individual to community</td>
<td>Individual to community</td>
<td>Individual to individual</td>
<td>Individual to individual</td>
</tr>
<tr>
<td><strong>Motivation</strong></td>
<td>Learning to be</td>
<td>Shared understanding</td>
<td>Divided labor and roles</td>
<td>Asynchronous mutual learning</td>
</tr>
<tr>
<td><strong>Persistence</strong></td>
<td>Long-term</td>
<td>Short-term</td>
<td>Long-term</td>
<td>Short-term (shortest)</td>
</tr>
</tbody>
</table>
Technical problems

- Methods of capturing and representing the relationship between
  - knowledge and knowledge owners
  - people
- Retrieval of relevant information
- To achieve task-specificity, identifying experts for the specific task
- To achieve member-specificity, identifying experts who are willing to help the specific member based on their past interaction history over different tasks or even in different domains
Social problems

► Experts’ attention economy:
  ▪ Unobtrusive ambient peripheral notification mechanisms
  ▪ Recipient preference
    ► Experts decide to participate in the dynamic community or not
  ▪ Workload balancing
    ► Don’t always ask for help from the same experts

► Motivation to participation
  ▪ Explicit recognition of community participation
  ▪ Community participation = accumulation of social capital
    ► Representation of social capital
    ► Paying the social capital debit by returning individual favor
    ► Investing in social capital for future gain
Social capital of individual and community

► Individual social capital: social resources that can be drawn from others by an individual
  - $SC_j = \text{Sum(favors to others by } j) - \text{Sum(favors owed by } j)$
  - $\text{Sum}(SC_j) = 0$

► Social bonding force
  - $SBF_{ij} = \text{Sum(favors from } i \text{ to } j) + \text{Sum(favors from } j \text{ to } i)$
  - $= \text{Sum(social capital transaction between } i \text{ and } j)$

► Gross community capital: a measurement of the strength and liveliness of a community
  - $GCC = \text{Sum(favors to others by } j) + \text{Sum(favor owed by } j)$
  - $= \text{Sum}(SBF_{ij})$
  - $= \text{Sum(social capital exchanged in each transaction)}$
Summary

Dynamic community is

- ad hoc
- on-demand
- temporal
- task-specific
- member-specific

It’s not “it’s what you know; it’s who you know”; it’s both.