Divergence Awareness in Distributed Semantic MediaWiki

Hala Skaf-Molli and Pascal Molli SCORE Team Inria Nancy-Grand Est Nancy University, France www.loria.fr/~skaf skaf@loria.fr, molli@loria.fr

Divergence Awareness in Distributed <u>Semantic Wikis</u>

Semantic wikis

Content of wiki page of "France"Content of semantic wiki page of "France"France is located in [Europe]France is located in [locatedIn::Europe]The capital of France is [Paris]The capital of France is [hasCapital:: Paris]

- Next, semantic queries can be performed:
 - [[LocatedIn::Europe]][[HasCapital::Paris]]
 - Return the semantic wiki page « France ».
- Wikis can be used as knowledge base used by humans and computers...

Problems

- Centralized architecture:
 - Content is unavailable in case of failure
 - Scalability
 - Performances
 - Security
- As a collaborative editing tool, wikis does not support Multi-synchronous editing [Dourish95] :

"Working activities proceed in parallel(multiple streams of activity), during which time the participants are disconnected (divergence occurs); and periodically their individual efforts will be integrated (synchronization) in order to achieve a consistent state and progress the activity of the group".

A real problem ? Yes especially for semantic wikis...

- No transactional change support : Impossible to change several semantic wiki pages atomically
 - Semantic wikis restructuration requires to change many pages atomically
 - Intermediate state are visible to users and reasonners !
- No process support:
 - How to implement a simple edit/review/publish process ?
 - Semantic wikis allow to build ontology, quality of the ontology is dependent of the process used to build this ontology.

Divergence Awareness in Distributed Semantic Wikis

Our approach : DSMW Distributed Semantic Media Wiki

- From a single semantic wiki server to a network of semantic wiki server (Peer-to-peer semantic wikis)
- Build the multisynchronous editing feature directly inside an existing semantic wiki (Semantic MediaWiki)



DSMW approach

- Multi-synchronous means:
 - A network a semantic wikis servers (DSMW nodes)
 - An update is produced on one server
 - It is broadcasted to other servers
 - Others servers receives and re-execute it
- The system (all network) is correct if it ensures CCI consistency.

DSMW approach

- The broadcast is based on the publish/subscribe model
 - Server administrators can choose what they publish
 - Server administrators can choose what they consume
- Publish/Subscribe as a Web Service
- Logoot ensure CCI if broadcast ensures causality. We proved (in the paper) this is true, with our publish/subscribe mechanism.

Charbel Rahhal, Hala Skaf-Molli, Pascal Molli and Stéphane Weiss. **Multi-synchronous Collaborative Semantic Wikis.** In 10th International Conference on Web Information Systems-Wise 2009, Lecture Notes in Computer Science 5802, Springer, Poznan, Poland, October 2009



Push Service

On CreatePushFeed(name:**String**,request:**String**): PushFeed(name) hasSemanticQuery(name,request) hasPush(site,name) **call** Push(name)

t

$Published \equiv \exists (hasPatch^{-1}). \exists (inPushFeed^{-1}). PushFeed$

DSMW video

http://dsmw.org

Now you can make your own dataflows



Divergence <u>Awareness</u> in Distributed Semantic Wikis

Awareness

- "Awareness understanding of the activities of the others which provides a context for your own activity" [Dourish92]
- Questions ?
 - Who? Where? What? When? Why?

P. Dourish and V. Bellotti. Awareness and coordination in shared workspaces. In Proceedings of the ACM Conference on Computer-Supported Cooperative Work (CSCW'92), pages 107–114, Toronto, Ontario, Canada, 1992. ACM Press.

Workspace awareness for realtime

Category	Element	Specific questions
Who	Presence	Is anyone in the workspace?
	Identity	Who is participating? Who is that?
	Authorship	Who is doing that?
What	Action	What are they doing?
	Intention	What goal is that action part of?
	Artifact	What object are they working on?
Where	Location	Where are they working?
	Gaze	Where are they looking?
	View	Where can they see?
	Reach	Where can they reach?

Workspace awareness





Gsliders, Hill, Gutwin 03

Workspace awareness of the past

Category	Element	Specific questions
How	Action history Artifact history	How did that operation happen? How did this Artifact come to be in this state?
When Who (past) Where (past) What (past)	Event history Presence history Location history Action history	When did that event happen? Who was here, and when? Where has a person been? What has a person been doing?



Change awareness

Is anything different since I last looked to the work ?

- 1. Where have changes been made?
- 2. Who has made the changes?
- 3. What changes were made?
- 4. How were things changed?
- 5. When did the changes take place?
- 6. Why were the changes made?
- C. Gutwin. Workspace Awareness in Real-time Groupware Environments. Ph.D. Thesis, Department of Computer Science, University of Calgary, Calgary, Canada, 1997.
- J. Tam and S. Greenberg. A Framework for Asynchronous Change Awareness in Collaborative Documents and Workspaces. International Journal of Human-Computer Studies, 64(7):583–598, July 2006.

Change awareness



Divergence awareness in Distributed Semantic Wikis

Diverence Awareness

Multi-synchronous editing implies divergence

At one time of the system, multiple copies of shared data are existing in different state

• Questions ?

- Where divergence occurs ?
- How much divergence ?
- With who ?

Divergence Awareness: State of the art

State Treemap

- Palantir: same as Treemap but it adds new information "amount of changes among documents"
- Divergence metrics
- Divergence awareness with privacy

State Treemap

- Where divergence occurs ?
- With who ?
- Different states are defined for a document:
 - LOCALLYMODIFIED,
 - POTENTIALLYCONFLICT when two copies of the document are modified and none of the changes are published yet ..

P. Molli, H. Skaf-Molli, and C. Bouthier. State Treemap: an Awareness Widget for Multi-Synchronous Groupware. In Proceedings of the Seventh International Workshop on Groupware (CRIWG'01), pages 106–114, Darmstadt, Germany, September 2001. IEEE Computer Society.

State Treemap



Figure 2: Treemap construction

State Name	Pattern	State meaning
Local Up To Date	white	The local object is identical to the last version of object
		in the repository
Local Modified		The local object is modified
Remotely Modified		It exists at least another user who has uncommitted
		change on that object
Need Update		A new version of the local object is available in the
		repository
Potential Conflict		The local object is modified and it exists at least another user who has uncommitted change on that object
Will Conflict		The local object is modified and a new version of the
		local object is available in the repository

Visulation widget



Divergence Awareness

Questions ?

- Where divergence occurs ?
- How much divergence ?
- With who ?

The Conflict operation itself is structured like this:

```
type Conflict
attributes :
    ops : setof(Primitive);
operations:
    Conflict(Primitivec1, Primitivec2)// type constructor
    addOperation(Primitivep) : void
    getOperations() : setOf(Primitive)
    execute() : void
```

We can write transpositions with *Conflict* operation in a generic way by considering a *conflict* predicate that we will define for all combinations of operations.

proc transpose (Conflict op1, Primitive op2): Operation
 if (conflict(op1, op2))then
 op1.addOperation(op2);
 return op1;
 else
 return op2;
 endif
endproc

```
proc deferred_broadcast ()
for (i = log.LastDelivered())to log.LastElement()do
    op=log.getElement(i);
    if (op.getTicket ()==log.LastDelivered ()+1) then
        log.setLastDelivered (op.getTicket ())
        op.send();
    endif
    endfor
endproc
```

Pascal Molli, Hala Skaf-Molli and Gérald Oster. Divergence Awareness for Virtual Team Through the Web. In Integrated Design and Process Technology, IDPT 2002, Pasadena, CA, USA. Society for Desing and Process Science, June 2002.

Divergence Visualization



Fig. 2. Shared Objects View



(a) Divergence Mapped on Objects without any Consolidation

(b) Divergence Mapped on Objects with Consolidation

Divergence Visualization

5



Fig. 5. Divergence Mapped on Users

Work to do

- Extends the ontology of DSMW to compute new metrics for awareness
- Validate by Computing all existing divergence metrics with DSMW ontology
- Compute new ones specific to fully decentralized work