

Collaboration in Distributed Software Development

Filippo Lanubile
University of Bari, Italy
Dipartimento di Informatica
Collaborative Development Group
<http://cdg.di.uniba.it>



Outline

- Distributed software development
- Collaboration tools and environments
- Conclusions



Outline



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Terminology



- Distributed Software Development (DSD)
 - Collaborative development of software across different sites
- Also known as
 - Global Software Development (GSD)
 - Global Software Engineering (GSE)



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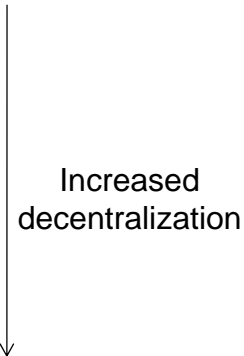
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DSD across organizational models



- Multinational companies
 - Multiple sites owned by the same company
- Outsourcing
 - Client company and external companies as suppliers
- Consortia
 - Multiple independent organizations
- Open source projects
 - Extreme distributed development: independent developers in arbitrary locations



DSD across companies and countries



		Country	
		same	different
Company	same	internal onshoring	internal offshoring
	different	onshore outsourcing	offshore outsourcing (also nearshore outsourcing)



Opportunities driving DSD

Carmel's catalyst factors

- Mergers and acquisitions
- Position as global organizations
- Increase proximity to the market
- Access the most talented developers
 - regardless of their geographical location
- Reduce development costs
 - low-cost programmers from emerging countries
- Reduce time to market
 - round-the-clock or follow-the-sun development

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Communication as the fundamental problem



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Communication challenges



- Misunderstanding/miscommunication
- Decreased frequency of communication
- Increased communication cost (time, money, staff)
- Difficult to initiate communication
- Reduced opportunities

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Types of collaboration within a team



- Communication
 - information exchange between team members
 - formal or informal
 - planned or impromptu interaction
- Coordination
 - act of orchestrating each task and organizational unit, so that they all contribute to the overall objective
- Control
 - process of adhering to goals, policies, standards or quality levels
 - formal (e.g., formal meetings, plans, guidelines) or informal (e.g., team culture, peer pressure)

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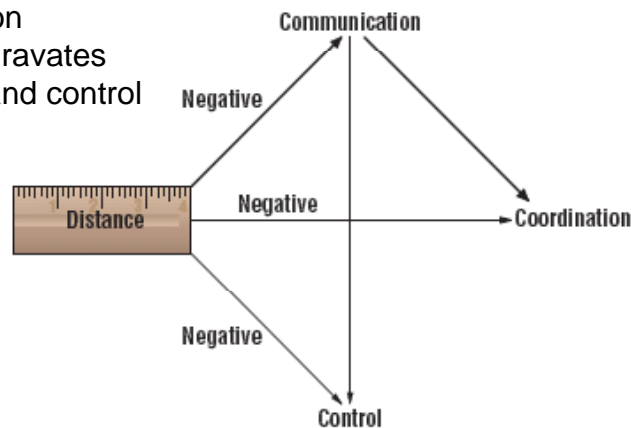
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Impact of distance on collaboration within a team



- Communication disruption aggravates coordination and control breakdowns



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from: Filippo Lanubile
Tactical Approaches for Alleviating Distance in Global Software Development,
Carmel E., and Agarwal, R., IEEE Software, 18(2), 2001. 11

Dimensions of distance



- Geographical distance
 - a measure of the spatial dispersion, occurring when team members are scattered across sites
 - the cost or effort required to exchange visits from one site to another
- Temporal distance
 - a measure of the temporal dispersion, occurring when team members wishing to interact
 - can be caused by time-zone differences or just time shifting work patterns
- Socio-cultural distance
 - a measure of the effort required by team members to understand the organizational and national cultures in remote sites
 - It includes linguistic and accent differences

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A conceptual framework of DSD challenges



	Temporal Distance	Geographical Distance	Sociocultural Distance
Communication	- Reduced opportunities for synchronous communication	- Face-to-face meetings difficult	- Cultural misunderstandings
Coordination	- Typically increased coordination costs	- Reduced informal contact can lead to lack of critical task awareness	- Inconsistent work practices can impinge on effective coordination - Reduced cooperation arising from misunderstandings
Control	- Management of project artifacts may be subject to delays	- Difficult to convey vision and strategy - Perceived threat from training low-cost "rivals"	- Different perceptions of authority can undermine morale - Managers must adapt to local regulations

Adapted from:
March 2009
Flexible and Distributed Software Processes: Old Petunias in New Bowls?,
 Agerfalk, P.J., and Fitzgerald, B., CACM, 49(10), 2006.

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Strategies to cope with distance



From the Ling et al.'s reference model for DSD

- Have a clear distribution rationale
- Clarify all understandings
- Leverage modularity
- Use cultural mediation
- Facilitate human communication
- Manage processes
- Develop a sense of teamness
- Encourage temporary collocation
- Address heterogeneity
- Develop an effective tool base

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Taxonomy of tools to support collaboration in DSD



- Software Configuration Management
 - e.g., CVS, SVN
- Bug & change tracking
 - e.g., Bugzilla, JIRA
- Build and release management
 - e.g., make, Ant, Maven, CruiseControl
- Product and process modeling
 - e.g. ArgoUML, IBM Rational Software Modeler
- Knowledge Center
 - e.g., Linux Documentation Project, developerWorks
- Social software
 - e.g., communication tools, wikis, blogs, social networks

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Build and release management



- Build rules to run compilers, invoke test frameworks, deploy to production systems and send email notifications to developers
- Dashboard to view the status of current and past builds

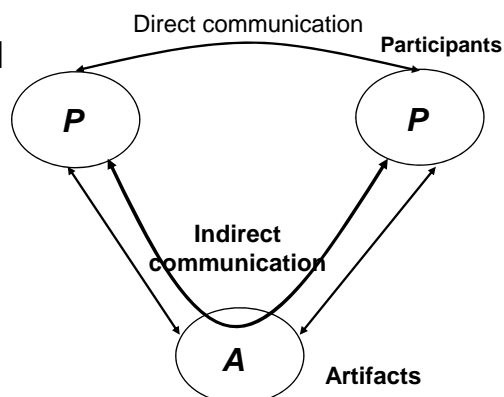
The screenshot shows a build management dashboard with the following elements:

- Build Status:** A green banner indicates "cce-windows passed (44 minutes ago)". Below it, details include "Build Time: 27 Nov 2007 09:51 GMT +08:00", "Duration: 7 minutes 40 seconds", and "Build: build.8".
- Latest Builds:** A sidebar on the right lists recent builds:
 - 7 minutes ago build.9
 - 44 minutes ago build.8
 - about 17 hours ago build.7
 - about 17 hours ago (highlighted in red)
 - about 18 hours ago build.6
 - about 18 hours ago build.5
 - about 19 hours ago build.4
 - 1 day ago build.3
 - 1 day ago build.2
 - 8 days ago build.1
- Modifications:** A section below the main build status shows a commit by "bestfriendchris" [rev. 3847] with the message "[Chris & Gao Li] Fixed issue with queued inactive status." It lists two files: "/branches/cce/cruisecontrol/reporting/dashboard/jsunit/tests/json_to_css_test.html" and "/branches/cce/cruisecontrol/reporting/dashboard/webapp/javascripts/json_to_css.js".

Product and process modeling



- Collaboration around the creation of formal or semiformal software artifacts
- Models are used to create shared meanings



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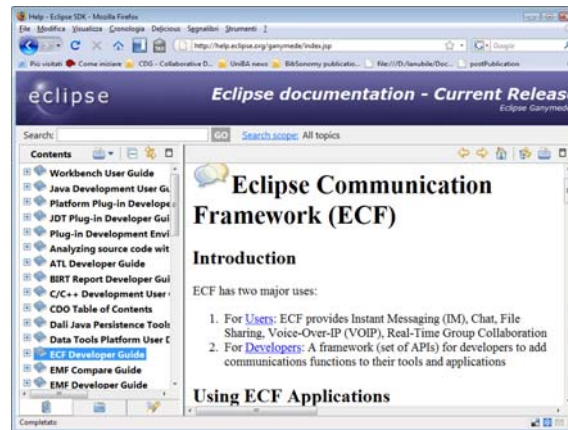
Adapted from:
 Filippo Lanubile
Human-Computer interaction,
 A. Dix, J. Finley, G. Abowd, R. Beale, 3rd Ed, Prentice-Hall, 2003.

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Knowledge Center



- Document-driven
 - Technical refs
 - Standards
 - FAQs
 - Best practices
- Web-enabled
 - From static web sites
 - to sophisticated CMS



<http://help.eclipse.org/qanymede/index.jsp>

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Social Software



- Software applications that enable group interaction and computer-mediated communication
 - Email, mailing lists, newsgroups, discussion forums, data conferencing (e.g., chat, IM), teleconferencing, desktop conferencing, multiuser editors, group decision support systems, shared information spaces, coordination systems (e.g., shared calendars, WFMS), massively-multiplayer online (MMO) games
- Previously known as Groupware
 - Restricted to the software that enables collaborative work functions
 - Social software is also open to software that enables the creation of communities
- Sometimes expressed as Web 2.0
 - But Web 2.0 comprises only the latest form of social software

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Web 2.0



Principles

- Interaction
 - (Web-based) Rich user interfaces
- Participation
 - User generated content+ metadata
- Community
 - Network effects through an "architecture of participation"
- The Web as "the global platform"
 - Sharing of services & data

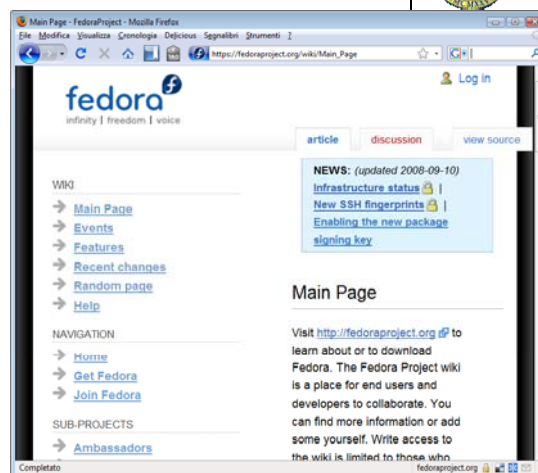
Applications

- Wikis
- Blogs
- Microblogs
- Collaborative tagging systems
- Social network sites
- Mashups

Wikis



- Collaborative authoring
 - No distinction between writers and readers
- Simplified markup language
- WikiMatrix:
 - www.wikimatrix.org/
- Project wikis
 - Sharing of explicit knowledge



https://fedoraproject.org/wiki/Main_Page

Blogs

- Content organized in posts presented in inverse chronological order
- Communication according to roles
- Extra features
 - Permalinks, RSS feeds, trackbacks
- Project blogs
 - promote sharing of tacit knowledge by narratively recording projects' events



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Microblogs

- Brief text messages (~140 chars) as a response to a basic question:
 - *What are you doing?*
- Submitted via web, IM, email, SMS
- Viewed from the web, email, RSS reader
- Project microblogs
 - Promote sharing of status updates among coworkers



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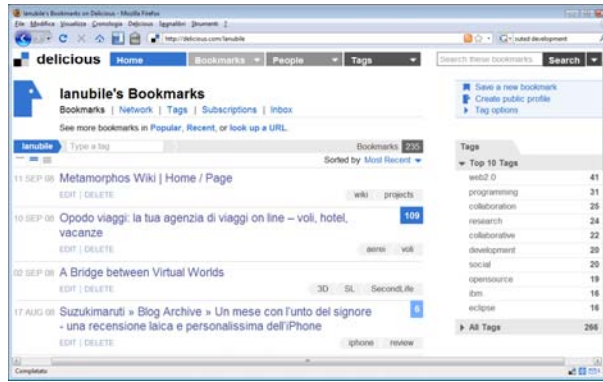
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Collaborative tagging systems



- Tags as user-generated metadata
 - Tag = keyword added to digital items
 - can be bookmarks, docs, biblio refs, ...
 - You can tag your own items or items owned by others
- Also known as folksonomies = folk + taxonomies
- Project folksonomies
 - Bottom-up classification of artifacts



<http://delicious.com/lanubile>

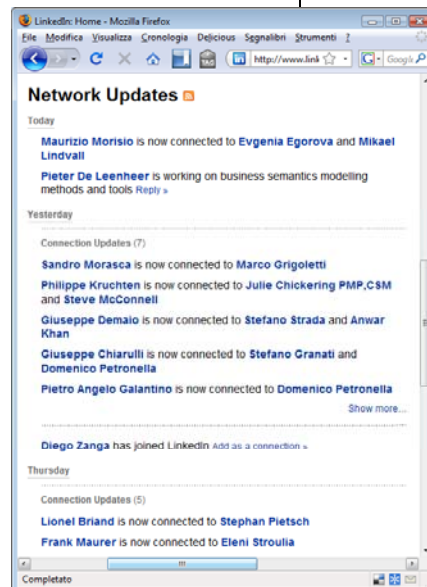
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Social Network Sites

- Web-based services that allow users to
 - create a public or semi-public profile
 - invite other users to be "friends"
 - Friends become linked
 - leave messages on their friends' profiles
- Enable users to make visible their social networks
 - Users can view and traverse their list of links and those made by friends



<http://www.linkedin.com/home>

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Mashups



- Web apps that combines data from more than one source into a single access point
- How data can be mixed?
 - APIs, RSS feeds, screen scraping
- Can be useful for sw project dashboards

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Collaborative Development Environments (CDE)



- Integrate SE task-specific tools and generic communication tools
- Initially born to manage OSS projects
- Nowadays have become a critical infrastructure for DSD in general
- More and more include Web 2.0 apps

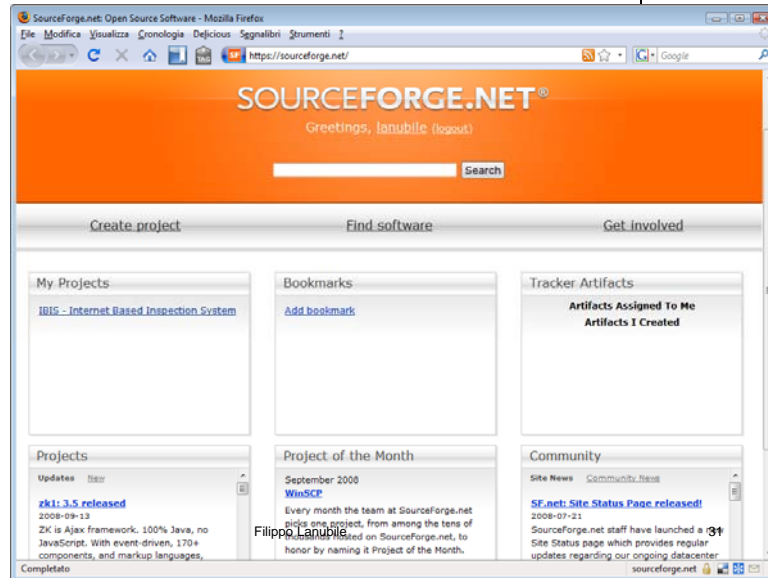
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SourceForge

<https://sourceforge.net/>



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GForge-based CDE

<http://cde.di.uniba.it/>



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Google Code

<http://code.google.com/>



The screenshot shows the Google Code page for the 'openmeetings' project. The page title is 'openmeetings' and the subtitle is 'Multi-Language Cross-Platform Customizable Video-Conferencing and Collaboration'. The page includes a search bar, navigation tabs for 'Project Home', 'Downloads', 'Wiki', 'Issues', and 'Source', and a 'Demo-Portal' section with links to demo portals and a 'News' section dated March 2009. A 'Code License' section indicates 'GNU Lesser General Public License'. A 'Featured Downloads' section lists three zip files: 'openmeetings051.zip', 'openmeetings_moodle_plugin_v02.zip', and 'openmeetingsaudience_moodle_plugin_v1.zip'. The 'Labels' section lists various technologies like 'Red5', 'OpenLaszlo', 'VideoConference', etc.

Trac: wiki

<http://econf.di.uniba.it/econference-over-ecf/>



The screenshot shows the Trac wiki page for the 'eConference over ECF' project. The page features a search bar, navigation tabs for 'Wiki', 'Timeline', 'Roadmap', 'Browse Source', 'View Tickets', and 'Search'. The main content area includes a description of the project as a porting of the old 'eConference 3' project to a new architecture based on the 'Eclipse Communication Framework (ECF)'. It also contains sections for 'Content' and 'Contacts', providing information about software requirements, user roles, and how to get in touch with the project administrator.

Trac: issue tracking system

<http://econf.di.uniba.it/econference-over-ecf/report>



{1} Active Tickets (31 matches)

- List all active tickets by priority.
- Color each row based on priority.

Ticket	Summary	Component	Version	Milestone	Type	Owner	Status	Created
#6	A participant can be given or removed the rights to speak	core	1.0	M4	user-story	pasquale_fersini	assigned	12/25/07
#9	A caller may grant speech rights as he wishes	core	1.0	M4	user-story	pasquale_fersini	assigned	12/25/07
#12	A caller may remove speech rights as he wishes	core	1.0	M4	user-story	pasquale_fersini	assigned	12/25/07
#15	A caller choose the scribe	whiteboard	1.0	M4	user-story	pasquale_fersini	assigned	12/25/07
#16	The scribe updates the whiteboard	whiteboard	1.0	M4	user-story	pasquale_fersini	new	12/25/07
#94	Port eConference to Penelope Framework	framework	1.0	M5	enhancement	mario_scalas	new	09/04/08
#89	Application state is left dirty when leaving the conference	core	1.0	M3	defect	alessio_angelini	new	06/04/08
#62	Implement automatic updating	core	1.0	M4	enhancement	mario_scalas	new	04/18/08
#70	Implement the UserManager	core	1.0	M4	task	pasquale_fersini	new	04/23/08
#95	Rework "injection	framework	1.0	M5	defect	mario_scalas	new	09/04/08

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Trac: interface to SCM

<http://econf.di.uniba.it/econference-over-ecf/browser>



root / trunk / it.uniba.di.cdg.econference.handraising / src / it / uniba / di / cdg / econference / handraising

Name	Size	Rev	Age	Last Change
actions		618	4 months	dkmorb: Modified public API names in HandRaiseManager?
event		562	5 months	mario_scalas: Add SWT synchronization
internal		671	3 months	dkmorb: Hand Raise view now shows the real container ID.
views		671	3 months	dkmorb: Hand Raise view now shows the real container ID.
HandRaise.java	3.0 kB	671	3 months	dkmorb: Hand Raise view now shows the real container ID.
IHandRaise.java	0.7 kB	671	3 months	dkmorb: Hand Raise view now shows the real container ID.
IHandRaisingManager.java	0.6 kB	618	4 months	dkmorb: Modified public API names in HandRaiseManager?
IHandRaisingModel.java	1.1 kB	570	4 months	dkmorb: Add @replicate signature to Add and Remove meth
IHandRaisingModelEventListener.java	0.7 kB	478	5 months	mario_scalas: Reworked the HandRaising? plugin to comply
IHandRaisingView.java	0.8 kB	562	5 months	mario_scalas: Add SWT synchronization

Note: See [TracBrowser](#) for help on using the browser.

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Jazz

<http://jazz.net>



- Collaboration platform for integrating work across the phases of the development lifecycle
- Characteristics
 - Extensible (plugin)
 - Scalable (team of teams)
 - Interoperable (API)
- Built upon Eclipse and the experience of the Eclipse development team
 - Built-in development process: Eclipse Way
 - Definition of custom processes

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Jazz: Eclipse-based client

demo



Work Items - Ugres Migration - Rational Team Concert

File Edit Navigate Search Project Run Window Help

Team Team My Wo UI for M2 [1.0 M2] 23: Tuning dei plugin Gravatar e Post Star Rating del Blog

My Open ...k Items By Priority 00.37

Event Log Events (16 unread)

- [9] Current iteration changed: eclip
- [5] Process customization changed:
- [14] TagsPlugin installation (30) Last
- [4] Upgrade Jazz 1.0 (33) 25/ago/0
- [4] OpenFire installation (29) 25/ago/0
- [2] Encoded url abilitati in Tomcat C
- [2] Tuning dei plugin Gravatar e Post Sta
- [2] Tag mancanti nel Blog (22) 25/ago/0
- [2] Link a login nella sidebar errato (21)
- [2] RSS error (20) 25/ago/08 18:16
- [2] problems with search function (
- [2] Share code with Jazz Source Co
- [2] Define a new build (14) 25/ago/08
- [2] Define an iteration plan (13) 25/ago
- [2] Define categories and releases for
- [2] Domenico Gendarmi added compo
- [2] Domenico Gendarmi created streu

Defect 23

Summary: Tuning dei plugin Gravatar e Post Star Rating del Blog

Details

Type: Defect

Severity: Normal

Found In: Unassigned

Created: 20/08/08 11:23

Created By: Fabio Calcato

Team Area: Ugres Migration Team / Ugres Migration

Filed Against: Ugres Migration

Tags: wordpress, blog, collablog, avatar

Owned By: Vincenzo Tondino

Priority: Medium

Planned For: Collablog

Description

Il plugin gravatar mostra gli avatar dei commenti duplicati nella vista del singolo post. esempio <http://whitecube.di.uniba.it/blog/index.php/archives/2008/05/02/aggiornamento-log/2/comments>

inoltre il plugin post star rating è in spagnolo e quindi compare la scritta "7 votos" credo basti editare il codice php nella relativa cartella dei due plugin.

Discussion (3 commenti: 1 new)

1. **Filippo Lanubile**, 2-Lug-2008, 19.15
Ma questo è stato veramente risolto? Mi sarei aspettato un commento
2. **Filippo Lanubile**, 2-Lug-2008, 19.31
L'ha verificato Fabio
3. **Vincenzo Tondino**, 25-Ago-2008, 18.27
Adesso vengono visualizzati i gravatars originali, utilizzando il corretto plugin GRAVATARS

Work Items Tag Cloud Problems Progress Team Advisor Chat

No work items found - Plan Items

Id	Status	Summary	Owned By

<No Current Work>

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Jazz: web client

<https://jazz.net/development/development.jsp>
<https://whiteduke.di.uniba.it:9443/jazz>
<https://ugres.di.uniba.it:9443/jazz/>



The screenshot displays the Rational Team Concert web client interface. The main content area shows a table of 'New unassigned' work items. The table has columns for Type, Id, Summary, Owned By, Status, Priority, Severity, and Modified Date. The items listed are:

Type	Id	Summary	Owned By	Status	Priority	Severity	Modified Date
	48799	Label badly aligned when browsing the web ui as guest	Unassigned	Triaged			1 minute ago
	52825	getOrderedPageIDs tries to parse an array as JSON	Unassigned	Triaged			1 minute ago
	52844	SideNavigationLayout should allow to set plain text title	Unassigned	Triaged			1 minute ago
	48703	ifProcessRestService is being called even when the process component is not loaded	Unassigned	Triaged			2 minutes ago
	59436	[Reusable widget] Error/warning/info box	Unassigned	Triaged			3 minutes ago
	49102	Difficult to debug client-side javascript viewlet code	Unassigned	Triaged			4 minutes ago
	56371	Unfriendly message when server goes down in the middle of loading	Unassigned	Triaged			5 minutes ago
	56981	URL switcher fails on IE when server not responding	Unassigned	Triaged			6 minutes ago
	54871	Jazz net - Filippo Lanubile	Unassigned	Triaged			6 minutes ago

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Wrap up

- Software development is an intense collaborative process
- More challenging when team members are distant
- Great range of applications available for collaboration
- Need to understand how to communicate effectively over media to properly select or design a tool infrastructure
- Now we have an initial empirical evidence in the software engineering field, specifically distributed requirements engineering
- Need for young researchers wishing to invest their effort into this challenging and interdisciplinary topic
 - e.g., Distributed Agile Development

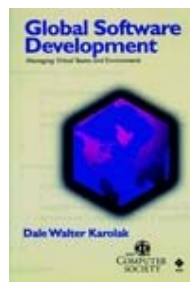
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Books

- Karolak D.W.
Global Software Development: Managing Virtual Teams and Environments, 1998
- Carmel E.
Global Software Teams: Collaborating Across Borders and Time Zones, 1999
- Sangwan R., Bass M., Mullick N.
Global Software Development Handbook, 2006



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Journal special issues



- *IEEE Software*, 18(2), March/April 2001, special issue on Global Software Development (eds. Herbsleb & Moitra)
- *Journal of Software Process: Improvement and Practice*, October/December 2003, special issue on Global Software Development, 8(4) (eds. Damian)
- *ACM Queue*, 1(9), December/January 2003-2004, special section: Distributed Development
- *IEEE Software*, 23(5), September/October 2006, special issue on Global Software Development (eds. Damian & Moitra)
- *Information and Software Technology*, 48(9), September 2006, special issue section: Distributed Software Development (eds. Komi-Sirviö, Abrahamsson, Huomo)
- *Communications of the ACM*, 49(10), October 2006, special issue: Flexible and distributed software processes (eds. Ågerfalk & Fitzgerald)
- *Journal of Software Process: Improvement and Practice*, 13(6), Nov./Dec. 2008 special issue on Global Software Development (eds. Damian, Lanubile & Sengupta)

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Conference and workshop series



- Workshops on Software Engineering over the Internet
 - at ICSE 1998-2001
- Workshops on Cooperative Supports for Distributed Software Engineering Processes
 - at COMPSAC'02, CSMR'03, ASE'04
- Workshops on Global Software Development
 - at ICSE 2002-2004
- Workshop on Distributed Software Development
 - at RE 2005
- Workshop on Global Software Development for the Practitioner
 - at ICSE 2006
- Workshop on Social Software Engineering and Applications
 - at ASE 2008
- International Conference on Global Software Engineering
 - ICGSE-06 (Brazil), ICGSE-07 (Germany), ICGSE-08 (India), ICGSE-09 (Ireland)
www.icgse.org

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Further reading: Distributed software development (1)



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Further reading: Collaboration tools and environments (2)



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Filippo Lanubile

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