OPAALS PROJECT

Contract n° IST-034824

WP9: : Communication and Dissemination

Del. 9.16 – Second Collection of mini-projects

Project funded by the European Community under the "Information Society Technology" Programme

Contract Number: IST-034824

Project Acronym: OPAALS

Deliverable N°: 9.16

Due date: 48

Delivery Date: September 2010

Short Description:

This deliverable presents the final collection of reports from the researchers in exchange among OPAALS partners.

Author: Gabriella Lombardo

Partners contributed: All

Made available to: all the partners

Versioning		
Version	**Date**	**Name, organization**
1	September 10	

Quality check

Internal Reviewer:

Paolo Dini, LSE

Dependences:

Achievements	Objectives of WP9 are: • Establish collaborative research activities and work towards their sustainability and continuation after the end of the funded phase • Support the development of a well-integrated interdisciplinary meta-research field, with the ultimate goal to realise an open and constructive dialogue between the philosophical traditions that relate to associative autopoietic digital ecosystems • Support the process of intellectual and community integration; community building activities will be theoretically framed by social constructivist approaches. So far the researcher exchanges supported all these objectives successfully, but also contributed to the technical developments via the direct migration of human resources together with knowledge acquired over time. We expect that in the last phase the researchers' reports, structured on the basis of key guidelines can delivered reports which will have a significant impact on the final findings of the project.
Work Packages	The deliverable will have an impact on all the Workpackages at different stages of its implementation. The aim of the deliverable is to frame the procedural aspects of the research exchange and to demonstrate how this activity successfully bridged the research across geographical and discipline boundaries
Partners	All partners have benefited already from all the reports in the wider aim to communicate broader topics which link different parts of the project. Also as an activity all partners could apply for their researchers to work at another partner institution and therefore all partners benefit from this OPAALS infrastructure
Domains	All three domains
Targets	The main targets are: 1) To create a flow of researchers who can share and exchange knowledge and skills in order to develop their findings further 2) To enhance the impact of individual research findings across different partners 3) To create a space where knowledge could be exchanged with strict collaboration 4) To increase coordination across different disciplines and specific research areas of the project

	5) To produce collaborative reports and mini-project as spin offs of OPAALS philosophies
Publications	At the present none of the reports produced during the exchanges has been published, although some were at the core of on going writing for future publication and discuss in public workshops. We expect that few of these reports could be submitted for publication.
PhD Students	Few of the researchers in exchange are PhD students. Their reports are integrated in their on-going research as well as in the deliverables of the work packages in which they are working.
Outstanding features	There are two aspects about these exchanges: one internal to the OPAALS project and one outside the project. In the project researchers in exchange actively contribute to building the OPAALS community and to merge findings from different domains and specific aspects of the project which would have less opportunities to exchange ideas and achievements. The integration of the domains is crucial for OPAALS success and researchers face-to-face contact and collaboration supported a significant improvement of the understanding of Open Knowledge. Outside the project the exchange offered an unusual environment within OPAALS where the researchers could travel and contaminate each other finding in an open and fluid interexchange. In a context where higher education institutions tend to maintain some rigid boundaries for researchers exchanges, the OPAALS has created an exceptionally flexible model which has supported no just its own community but in general the concept of scientific cooperation across countries, institutions and above all intellectual areas. This is very unusual and considering the results, a model that could be implemented more regularly in the pattern of scientific collaboration in HE institutions.
Disciplinary domains of authors	Social Sciences

Research Exchange – A reminder

The two overarching aims of OPAALS are to build an interdisciplinary research community in the emerging area of Digital Ecosystems (DE), and to develop an integrated theoretical foundation for Digital Ecosystems research spanning three widely different disciplinary domains: social science, computer science, and natural science. Together, these two aims will result in a global Network of Excellence (NoE) in Digital Ecosystems.

The OPAALS project includes a programme of Research Exchanges in order to support the development of the community through the implementation of common projects executed jointly at partner institutions. This exchange is based on the ability of the consortium to identify contiguous fields of research and institutions that can integrate their research activities. The researchers are travelling to partners' locations in order to ensure that such "contamination process" takes place. The Research Exchange programme aims to create a bigger interaction between partners and higher integration of the different work packages of the project.

So far this activity has supported its main objectives: create a better integration of researchers across the project, particularly among different domains; support an increasing integrations among people working in different work packages and in particular integrate findings from different work packages; finally create a series of reports and short projects available to the whole consortium, which often contribute to the OPAALS research.

The table below shows all the exchanges in the last phase occurred in a chronological order

EXCHANGE	PARTNER	HOST INSTITUTION	DATES
DEBASHIS PATTANAIK	IITK	LSE	15 JUNE- NEANULY 2009
FABIO KONNO	IPTI	SURREY	20 SEPT-14 NOV 2009
GERARD BRISCOE	LSE	IITK	16-29 NOVEMBER 2009
JASON FINNEGAN	WIT	SUAS (AUSTRIA)	18-29 JANUARY 2010
FERNANDO COLUGNATI	IPTI	LSE AND OXFORD	1-28 FEBRUARY 2010
THOMAS KURZ	SUAS	IITK (INDIA)	9-25 FEBRUARY 2010
FABIO KONNO	IPTI	ITA (SPAIN)	6-13 MARCH 2010
CHRIS VAN EGERAT & DECLAN CURRAN	NUIM	SUAS (AUSTRIA)	MAY 2010
SAULO BARRETTO	IPTI	LSE	29 MAY- AYTUNE 2010
GERARD BRISCOE	LSE	IPTI	11 JULY-12 AUGUST 2010
M S RAM	IITK	LSE	23/01/10-06/02/10
RISHI KUMAR	IITK	IPTI	JULY 2009
JAYANTA CHATTERJEE	IITK	UNIKASSEL HELSINKI U OF TECHNOLOGY MAASTRICHT U	1/10/09-21/10/09 21/10/09-26/10/09 26/10/09-5/11/09

Annex1

OPAALS Research Mobility Plan –

2 Formal procedure

Researchers working with the OPAALS project are allowed to spend some time with one of partners. There are two kind of exchanges allowed:

- From one partner institution to another partner
- From a sub-contracted institution to a partner

Operational and financial plan

This document drafts the operational and financial plan for the implementation of the researcher exchanges. The researcher exchange is implemented with a degree of flexibility and it started in Phase I rather than in Phase II.

The exchange is based on a flexible system where researcher can apply for a minimum stay of 1 week and a maximum stay of 8 weeks (or 3 months in exceptional cases). Any exchange below 1 week can be paid by the travel fund available to each partner. Each researcher with the support of their institution can apply for the exchange presenting to the coordinator (LSE) and the domain coordinator the following documentation:

1. Role in the OPAALS project
2. A short work plan with:
    a. A timetable,
    b. rationale for the exchange and reasons to choose the host institution
    c. focus of studies to be developed in the host institution
    d. targeted milestones/deliverables of the visit
3. Letter (or e-mail) of invitation by the host institution
4. Letter (or e-mail) of permission for leave of absence from original institution (in case of a PhD student, a letter/email from the supervisor is also needed)
5. An estimate of the costs of the exchange

If the dossier fits with the project's needs, then the coordinator will authorise the exchange. Refund for the exchange will vary depending on the nature of the exchange:

- Partner to partner: the researcher will be refunded by their own institutions and according to their own financial regulations (documented expenses or per diem allowance). The institution that sent a researcher will then make a simple claim for reimbursement to the coordinator

- If the researcher comes from any other institution or any subcontractor then the host institution would reimburse the researcher according to their own financial regulations. The host institution will then claim the expenses from the coordinator.

It is assumed that host institutions will support the incoming researcher and will provide help and guidance in the choice of accommodation and other needs to settle in a new country.

LSE has established a maximum amount of money that can be refunded per exchange (a table is available to the partners as guidelines. The figures include a fixed amount for travelling (€1,000 within EU and €2,000 from outside EU) and a flexible amount for accommodation and daily subsistence (including transports).

The flexibility will allow at least 40-45 exchanges over the life of the project based on the budget currently allocated to this activity (€200,000). The exchange researchers will create a bigger interaction between partners and higher integration of the different work packages of the project.

The coordinator has the responsibility to monitor the exchanges and report to the management team, so that a high level of fairness and balance of the exchange can be guaranteed.

For any question please contact Gabi Lombardo (g.lombardo@lse.ac.uk) who maintains the guidelines and can provide any clarifications and assistance to any partner

2 Guidance notes

The reports of the OPAALS Researcher Exchange Programme are a contractual deliverable. In order to make them more useful and coherent as a collection of reports with a consistent structure, we ask that you use this template to format your report.

The aim is not to constrain the report, but simply to structure it in a way that is consistent with the other reports. Please keep the section titles the same and add something in each section. Not every item has to be addressed in the notes, and add sub-titles can be added freely, but we need some information to be consistent for example: the researcher in exchange, Purpose of the exchange, reasons to work with the specific institution and who within that institution

Please find below the template designed for the report:

Of course all the texts between angled <brackets> are there just to help to complete the report.

Annex2

Administrative details – Report template

1.1Researcher

<Name, organisation, discipline>

1.2Host

<Organisation name, location, discipline>

1.3Duration

<Dates 'from' and 'to', or number of days and over what period>

1.4Purpose

<Description of objectives in terms of the OPAALS project>

Background

<the need for the exchange>
<why you wanted to make this particular project>
<the detailed aims and objectives>
<who was involved and their comparative expertise and experience>
<plans and preparations that were made>

Conduct

<how well the exchange went>
<any difficulties encountered>
<what went well, what went badly>
<any changes to the original plan>

Outcomes

<what you learned>
<what you achieved>
<what you would do differently>
<how the project will help OPAALS>
<list any specific outputs and who will use them>

2

3

Project description

<Use this section to hold the technical work of the project that you carried out.>

Appendix

<This section is optional in case you have supporting data or other useful items to include, such as a paper you have written>

<INSERT HERE TEMPLATE OF REPORT FOLLOWING REVIEWERS RECCOMENDATIONS>

OPAALS PROJECT

Contract n° IST-034824

Report on Researcher Exchange

<OPAALS Research Exchange>
<Debashis Pattanaik>

Project funded by the European Community under the "Information Society Technology" Programme

Guidance notes

The reports of the OPAALS Researcher Exchange Programme are a contractual deliverable. In order to make them more useful and coherent as a collection of reports with a consistent structure, we ask that you use this template to format your report.

The aim is not to constrain your report, but simply to structure it in a way that is consistent with the other reports. You do not have to address every item in the notes, and can add sub-titles as you wish, but please do keep the section titles the same and put something in each section.

Write in the first person - “I wanted to understand….We worked with…” etc. Include pictures and diagrams if you can.

You can remove this page and all the text between angled <brackets> as they are just notes to help you complete the report.

Administrative details

Researcher

Name – Debashis Pattanaik

Organisation – IIT Kanpur

Discipline – Social science

Host

Organisation name – London School of Economics

Location - The London School of Economics and Political Science,
Houghton Street, London WC2A 2AE, UK;
Tel: +44 (0)20 7405 7686

Discipline – Social science

Duration

Dates – From 5th July 2009 to 29th July
Period – July 2009

Purpose

Description of objectives in terms of the OPAALS project- Collaborative research on D12.10

Background

The need for the exchange - One of the social science agenda in OPAALS's project is to build integrated theoretical frame work for associative autopoietic digital ecosystems. In this direction whereas D1.2 focused on natural science regarding associative autopoietic digital ecosystems, the D12.1 suggested an outline for an integrated theoretical approach to digital ecosystem. In our work for the D12.10 we had further expand the principles of autopoiesis in a socio-technical system such as OPAALS. The research focussed on the social science aspect of the autopoietic principle.

Why you wanted to make this particular project - I was particularly interested in understanding the autopoietic aspect of a DE. My aim was to build a basic theoretical framework for DE based on social science approaches.

The detailed aims and objectives – Our research focused on:

1. Developing a theoretical framework for explaining autopoiesis in a socio-technical system.
2. The role of power and democratic principles in self-organisation of autopoietic systems.
3. The importance of trust and social capital in the understanding autopoiesis in a digital ecosystem

Who was involved and their comparative expertise and experience – Dr. Paolo Dini, expertise – Biology, Computer Science and Social science; Mehita Iqani, expertise – Social science

Conduct

How well the exchange went – Good

Any difficulties encountered - None, The collaboration was beyond my expectation. I am obliged to Paolo, Mehita, Neil and Louise for their help and cooperation during my research exchange at LSE.

What went well, what went badly – The research went perfectly.

Any changes to the original plan – Yes, the travel plans and proposed exchange dates were changed because of visa related issues.

Outcomes

What you learned – I have greatly benefited by this research exchange programme. I personally learned about how biological approaches can be used to build social science theories and explain social phenomena. I have also learned about the emerging complexity approach within social science domain. I am obliged to Paolo for guiding me in this direction.

What you achieved – I am able to produce two research papers through this research exchange. I have also discussed about writing a paper with Neil on autopoieis and digital ecosystem.

What you would do differently – I shall work on biological approaches to social sciences.

How the project will help OPAALS - Our project explores autopoietic principle in a digital ecosystem from a social science perspective. In this way it also highlights principles of sustainability in digital ecosystem, which is applicable to OPAALS framework.

List any specific outputs and who will use them -

D12.10 – Chapter 4 Integrating Biological and Social Science Perspective (pp.34-41).
D11.7 – Paper 2 Dynamism of Organic Assemblage in Digital Ecosystem-Learning and Innovation in DEAL (The paper has been accepted for International Conference on Innovation Management (ICIM 2009), with the publisher of IEEE CS, which will be indexed by EI Compendex and ISTP.)
The outputs will benefit OPAALS partners, academicians, researchers, policy makers and public.

Project description

One of the social science agenda in OPAALS's project is to build integrated theoretical frame work for associative autopoietic digital ecosystems. In this direction whereas D1.2 focused on natural science regarding associative autopoietic digital ecosystems, the D12.1 suggested an outline for an integrated theoretical approach to digital ecosystem.
In our work for the D12.10 we have further expand the principles of autopoiesis in a socio-technical system. The research focuses on the social science aspect of the autopoietic principle.
Our research emphasizes on:

1. Developing a theoretical framework for explaining autopoiesis in a socio-technical system.
2. The role of power and democratic principles in self-organisation of autopoietic systems.
3. The importance of trust and social capital in the understanding autopoiesis in a digital ecosystem.

Autopoiesis the Concept and its Criticisms

Autopoiesis in its most narrow biological sense can be considered an extension mainly of gene expression or, more properly, of the *control* of gene expression. Where gene expression looks at the local mechanisms of biochemical interaction as the implementation of complex cell functional behaviour, autopoiesis looks at the global system structure and behaviour of the cell (OPAALS Del 1.2).
Luhmann has applied the concept of autopoiesis to social systems by depicting societies as divided into different functional social systems as for example law, religion, politics, and science (luhmann 1985, 1987, 1989). All these systems produce functions for the whole society. He applies Maturana's and Varela's autopoiesis concept sociologically, and sees society as a self-referential system with communications as its elements. He suggests that a system can only differentiate itself if it refers to itself and its elements. It generates a description of itself and a difference between system and environment. According to Luhmann all social systems can observe themselves (Luhmann 1982)
Luhmann argues that individuals are (re) produced biologically, not permanently by social systems. If one wants to consider a social system as autopoietic or self-referential, the permanent (re)production of the elements by the system is a necessary condition. Thus to Luhmann not individuals but communications are the elements of a social system. "Social systems use communications as their particular mode of autopoietic reproduction. Their elements are communication which are recursively produced and reproduced by a network of communications and which cannot exist outside such a network" (Luhmann 1988). Luhmann, perceives human beings as sensors in the environment of the system.
Luhmann tries to resolve the sociological problem of how social structures and human actors are related dualistically, but in doing so Luhman brings some inconsistencies in his argument. For example an autopoietic conception of society must show consistently that how society produces its elements itself. In Luhmann's theory, not humans but only social systems act; he describes systems in human terms and but then to certain degree neglects human agency.
Luhmann, identifies modern society as functionally differentiated: Its subsystems are operationally closed networks of communication; each has its own binary code that organizes the communications of the specific subsystem. The social subsystems are structurally coupled, that is, one subsystem can influence or perturb but never determine the other. Autopoiesis as a social process depends on network of processes involved and feed back upon themselves to form a circular concatenation and thereby implicitly demarcate itself from its surroundings. We can see many specific circular feedback loops involved within social processes. Giddens (1984) distinguishes three different types—homeostatic loops via unintended consequences of action, self-regulation through information filtering, and reflexive self-regulation involving conscious

manipulation of social institutions, and uses the poverty cycle as an illustration of all three. Thus when something new emerges in a system it always positive feedback from the actions of actively participating human agents who amplify the system and make the process to accelerate faster and there by brings transformation and built new system.
Human beings are social beings; they enter social relationships, which are mutually dependent actions that make sense for the acting subjects. Individual being is only possible as social being; social being is only possible as a relationship of individual existences. Marx suggest that Man's individual and species-life are not *different*, however much and this is inevitable—the mode of existence of the individual is a more *particular* or more general mode of the life of the species, or the life of the species is a more *particular* or more general individual life (Marx 1955). Man is the subjective existence of society and he exists as a totality of human manifestation of life. Humans rely much more on learned and socialized patterns of behavior. Max Weber (1978) has pointed out that in a social system we always find the production of meaning. He argued that all human action is directed by meanings. Actions have a specific meaning for the actors, which they use for making sense of the world. Social actors have motives; they can identify reasons for their actions and have planned intentions in concrete situations. They can choose between different alternative actions in a situation; they can consciously reflect the state of the world (and its change) and can identify their role and position in the world. Human beings can interpret social situations in different ways; by this, meaning (the definition of situations by actors) is produced.
Thus intended actions, reflection, the identification of reasons for actions, intentions, freedom to choose between different alternative actions, power, trust, social relationships, resources identification of one's own role in the world, and (different) interpretations of the world, are integral parts of associative and/or autopoietic systems. Addressing the "autopietic" elements of systems theory we contribute towards an integrated approach to ICT, human perception, communication, meaning and representation in one single research domain of digital ecosystem.

1. **Research issue:** Self organization, communication, observing system
   Theoretical perspective: Social autopoieis

2. **Research issue:** Socio-technical change
   Theoretical perspective: Action theory, situation of action, normative change, praxis

3. **Research issue:** Democratic processes
   Theoretical perspective: Theories of power, social capital, trust

Appendix

Refer to D12.10 – Chapter 4 Integrating Biological and Social Science Perspective (pp.34-41).
D11.7 – Paper 2 - Dynamism of Organic Assemblage in Digital Ecosystem-Learning and Innovation in DEAL

OPAALS PROJECT

Contract n° IST-034824

Report on Researcher Exchange

Serra, Fábio Konno

Project funded by the European Community under the "Information Society Technology" Programme

Administrative details

Researcher

Serra, Fábio Konno – IPTI

Host

Instituto Tecnologico de Aragon

Duration

From 06/03/2010 to 13/03/2010

Purpose

Work close to the end users (SMEs) in order to improve the flypeer (p2p) infrastructure

Background

There was a need to understand better the points of integration of Flypeer and the other modules from the project, mainly the identity flow. Also, we needed to explain and demonstrate how Flypeer works and how they could use its for their purposes.

The research exchange was a great opportunity to do it and also to share experiences to the others partners from OPAALS and some SMEs.

Conduct

I attended several meetings at ITA and we had opportunity to work together with the other partners to get the things working together, as the integration between Flypeer and the Identity Model. Also, I could explain well to the people from ITA how Flypeer works and had the opportunity to answer some questions and doubts from them.

Outcomes

I could understand very well how the Identity Flow works and how we could integrate its to Flypeer. Also, all people from the project that were there, could discuss the points of integration and where and how Flypeer would be useful.

I had the opportunity, with Paulo Siqueira, to present the Flypeer to some Small and Medium Enterprises that showed their interest in try Flypeer out.

Project description

In the Research Exchange, we had the opportunity to improve and to understand more the points of integration between Flypeer and the systems from the partners. Also, we could explain and demonstrate Flypeer to the people that were there, including some

SME's from Spain.

The points of integration that were discussed there were related to the Identity Module. We had doubts about how to generate and pass through the Flypeer network the credential from a peer to another one, but Mark McLaughlin helped us to find a way to serialize the credential and deserialize it. With this, Flypeer is now able to send the credential of an initiator peer to all services of a transaction. In other words, the Identity is working on Flypeer.

We had also the opportunity to explain to people from ITA how to create services, model and run transaction using Flypeer. Now, they have enough knowledge to start using Flypeer and to help the SME's from Spain. During that week, they also helped us a lot finding bugs and points of improvement in Flypeer.

OPAALS PROJECT

Contract n° IST-034824

Report on Researcher Exchange

Serra, Fábio Konno

Project funded by the European Community under the "Information Society Technology" Programme

Administrative details

Researcher

Serra, Fábio Konno - IPTI

Host

Surrey University

Duration

From 20/09/2009 to 14/11/2009

Purpose

Work close to the Surrey team in the implementation process of the p2p infrastructure

Background

The main goal of this research exchange was to figure the lock model out. It was a great opportunity to be near of the people responsible for the creation of this model. As one of the main developers of Flypeer, everything that were explained to me could be absorbed and shared with the team. With that, many doubts could be clarified.

Conduct

There were many meetings and talks where the lock model could be explained in details and scenarios could be built. Then, through these scenarios, I figured out that before starting the development of the lock, I would have to do some infrastructure modifications on Flypeer.

I started to implement these modifications already in Surrey and it went very well with the help from Amir Razavi. He helped a lot building scenarios and finding solutions to the problems that come during the development.

Outcomes

I learned a lot about the transaction and lock model and could understand more how they work and what we could do better in the Flypeer's implementation.

Regarding the work that I did there, I could start modelling the lock model implementation, the infrastructure modifications in Flypeer, the integration between Identity Flow and Flypeer and did some improvements in the collaborative tool, that was presented at the review. As result of the meetings that I participated there, I could finish with some doubts in the transaction and lock model.

Finally, I could present to the people of Surrey University how to use Flypeer and how it works and they gave me a lot of feedbacks of how to improve Flypeer.

Project description

A new transaction context schema was created by SURREY to allow mapping the data dependencies between the services composited. It helped to make easier the parameters feature of Flypeer.

As mentioned, some of this work has been done during the research exchange, but another part had to be finished later. So, we couldn't finish the lock model implementation during the research exchange.

Besides that, an implementation workshop about Flypeer services was done to present to SURREY people how to create, deploy and composite services using the infrastructure provided by Flypeer. Because of that, many feedbacks were given and they were very helpful.

The participants of this workshop thought that was painful to create and describe a service as it was. They advised that if we used some standards, as WSDL, would facilitate the whole process because using them would enable the developers to do what they already know. Because of these feedbacks we decided to support WSDL as the way to describe services on Flypeer and it really facilitated the process.

Some effort was made to fix and to finish the collaborative tool which was presented at the last review. During this work, a bug when running Flypeer peer was fixed. This bug was related to not be able to start up two peers and also to not be able to restart the same peer on the same instance of a browser.

After that, the integration between the Identity Model and Flypeer was started but not concluded during the research exchange.

The next steps are to finish the work on the infrastructure of flypeer to provide the base to start the lock model implementation and to finish the integration between the Identity Model and Flypeer.

OPAALS PROJECT

Contract n° IST-034824

Report on Researcher Exchange

Sustainability

Saulo Faria Almeida Barretto

Project funded by the European Community under the "Information Society Technology" Programme

Administrative details

Researcher

Saulo Faria Almeida Barretto, IPTI

Host

London School of Economics and Political Science

Duration

From May 29th to June 6th 2010

Purpose

Sustainability

Description

The exchange was necessary as part of the consolidation process that IPTI is doing to establish a long term sustainability around research and scientific cooperation between Brazil and Europe on the use of digital ecosystems for social and economical development.

Since 2009 IPTI has being working for the Brazilian Ministry of Science and Technology MCT) to establish a bilateral scientific cooperation between Brazil and European Commission and this activity is a consequence of the long articulation process developed by IPTI with MCT around the OPAALS project and how such a network of excellence could contribute to some Brazilian issues related to the use of ICT as a manner to improve socio-economic development.

This period in Europe was mainly dedicated to sharing ideas about OPAALS sustainability with Dr. Paolo Dini, in London, and to make a short visit to Brussels, to participate in the Future Internet Enterprise Systems (FinES) cluster, as this cluster and its Project Officer, Ms. Cristina Martinez, have a strong connection with this cooperation perspective as well as the implementation of some OPAALS outcomes in Brazilian case studies and new experiences.

The discussions with Dr. Paolo Dini, at London School of Economics, were centred in 2 main issues. First about the model of sustainability OPAALS consortium is planning to propose and implement. As IPTI is a private, not for profit, self sustainable research institution our experience on raising funds from different sources can be useful for the OPAALS model. We believe that through OPAALS NoE we can start to work with some countries and/or regions to help them to implement programs for ICT adoption based on the digital ecosystems principles, amplifying the possibility of success of those program.

This bring us to the second issue of our discussions at LSE. IPTI is working with the Brazilian government (MCT) as well as with SEBRAE, which is the biggest organization that works with SMEs in Brazil, to raise funds and develop research projects on the use of an Open Knowledge Space, one of the main OPAALS outcomes, to support the adoption of ICT for socio-economic improvement. Mainly the project for SEBRAE can become an interesting case study so that OPAALS consortium can use it as a "knowledge" product to offer for other countries and/or regions. Both projects are planned to start still in 2010 and the negotiations are very well advanced.

Finally, the visit to Brussels and the participation in the FinES cluster have the aim to maintain our close relationship with this new DG-INFSO cluster, because it is the one who has the strongest synergies between what IPTI is proposing to do in terms of the use of OKS as a virtual environment to support new business and management models for SMEs within a perspective of b2b driven by knowledge. This is the project IPTI is negotiating with SEBRAE and our approach with FinES is in the sense that around this case study we can establish a win-win partnership with some OPAALS members participation.

OPAALS PROJECT

Contract n° IST-034824

Report on Researcher Exchange

LSE to IITK
Gerard Briscoe

Project funded by the European Community under the "Information Society Technology" Programme

Administrative details

Researcher

Gerard Briscoe, LSE, Computer Science

Host

IITK, India, Computer Science

Duration

16/11/2009 - 29/11/2009

Purpose

Continue collaboration on WP1 activities.

Background

The need for the exchange was to continue our efforts into the natural computing approach to the autopoietic computing of WP1, which had previously been started with a visit to London by Professor T V Prabhakar. We wished to pursue an autopoietic inspired form of computing based upon extending the concept of autonomic computing to include certain autopoietic behaviour. So, my primary collaborator in visiting IITK was Professor T V Prabhakar, who is an expert in Software Architecture, Knowledge Engineering and Web 2.0.

Conduct

The exchange went well, with no significant difficulties encountered. We established the groundwork for our intended approach, although we do not progress as quickly as we had hoped in drafting the outline for the paper we intended to write.

Outcomes

We learnt about autonomic computing, the autonomic nervous system upon which it is based, the autopoietic immune system, and what differentiates them. We established a framework for a natural computing approach to autopoietic computing, based on extended autonomic computing with properties of the autopoietic immune system. This effort was in aid of WP1, and formed a chapter in D1.5.

Project description

We pursued an autopoietic inspired form of computing based upon extending the concept of autonomic computing to include certain autopoietic behaviour, specifically that of autopoietic replication. Autonomic computing started with a seminal paper that defined a vision for it, and so we similarly propose a vision for this form of autopoietic computing. Given the differences between the autonomic nervous system and the autopoietic immune system, we extended the self-CHOP (Configuring, Healing, Optimising, Protecting)

properties of autonomic computing to include the self-R (Replicating) property. Creating CHOPR for our (natural computing based) autopoietic computing.

Autonomic Nervous System

The autonomic nervous system is the part of the peripheral nervous system that acts as a control system functioning largely below the level of consciousness, and controls visceral functions. These are affects heart rate, digestion, respiration rate, salivation, perspiration, diameter of the pupils, micturition (urination), and sexual arousal. Whereas most of its actions are involuntary, some, such as breathing, work in tandem with the conscious mind. It is classically divided into two subsystems: the parasympathetic nervous system and sympathetic nervous system. Relatively recently, a third subsystem of neurons that have been named non-adrenergic and non-cholinergic neurons (because they use nitric oxide as a neurotransmitter) have been described and found to be integral in autonomic function, particularly in the gut and the lungs.

A brief introduction serves to explain the fundamentals of the autonomic nervous system, and is still far greater consideration than it received in the creation of autonomic computing. This is because autonomic computing was quite rightly based on the high-level abstract principles of the autonomic nervous system. However, we suspect that the lack of greater consideration of the autonomic nervous system was such that it was not fully appreciated, especially its uniqueness when compared to other systems of the vertebrate anatomy. Specifically, the lack of cellular replication as a core functionality. Equally, as biologically-inspired computing often originates from fulfilling an engineering need or problem, the scope of the form of computing envisaged did not necessitate any other additional properties than those found within the autonomic nervous system. Whether the later or the former, or a combination of the two, be the reason, we now believe that an opportunity exists for a more inclusive inspiration of anatomical systems in defining computing paradigms in the context of current computational engineering challenges. However, we will first have to consider the current state-of-the-art of autonomic computing and the autopoietic immune system.

Autonomic Computing

Autonomic computing refers to the self-managing characteristics of distributed computing resources, adapting to unpredictable changes whilst hiding intrinsic complexity to operators and users. An autonomic system makes decisions on its own, using high-level policies; it will constantly check and optimise its status and automatically adapt itself to changing conditions. The ultimate aim being to develop computer systems capable of self-management. So, overcoming the rapidly growing complexity of computing systems management, and reducing the barrier that complexity poses to further growth.

The Autonomic Computing Initiative (ACI) aims at providing the foundation for autonomic systems. It is inspired by the autonomic nervous system of the human body. This nervous system controls important bodily functions (e.g. respiration, heart rate, and blood pressure) without any conscious intervention. In a self-managing Autonomic System, the human operator takes on a new role: He does not control the system directly. Instead, he defines general policies and rules that serve as an input for the self-management process. For this process, IBM has defined the following four functional areas:

- Self-Configuration: Automatic configuration of components
- Self-Healing: Automatic discovery, and correction of faults
- Self-Optimisation: Automatic monitoring and control to optimise resource provisioning
- Self-Protection: Proactive identification and protection from arbitrary attacks

These self-CHOP properties, as they are called, in which each property takes up a quarter of the circle showing their equal importance.

Autopoietic Immune System

An immune system is a system of biological structures and processes within an organism that protects against disease by identifying and killing pathogens and tumor cells. It detects a wide variety of agents, from viruses to parasitic worms, and needs to distinguish them from the organism's own healthy cells and tissues in order to function properly.

Autopoietic theory describes a model of self-organisation in which a system's organisation is defined by its structure (its components(nodes) and their relations (links)) and the processes that this structure performs, which continuously regenerate the structure that produces them. So, in the context of autopoietic theory, the immune system that extends the idiotypic network theory. The immune system is no longer considered to be antigen driven. Rather the immune system is an organisationally closed network that reacts autonomously in order to define and preserve the organism's identity,in what is called self-assertion. The autopoietic view of the immune systems stresses self-reactiveness and in contrast to others. The immune system produces different responses depending on the external stimulus and its current state. As the immune system changes over time (e.g. during development) the same stimulus can trigger different responses.

So, while the autonomic nervous systems is primarily made of non-replicating components, some of which are never replaced should they fail (e.g. nerve cells of the spine), the autopoietic immune system is primarily made of components which undergo constant replacement, partly to achieve the necessary diversity required in immune system response, but also to support the dynamic resource provisioning required for the immune response. It is this ability, made possible by the self-replication principles of autopoiesis, which we can make use of in extending autonomic computing to define autopoietic computing.

Autopoietic Computing

Considering autonomic computing relative to the autonomic nervous system, and autopoietic computing relative to the autopoietic immune system, then we must consider the differences of the autopoietic immune system relative to the autonomic nervous system. We observe that the autopoietic immune system demonstrates all of the same controlling behaviour of the autonomic nervous system, plus the ability of the self-replication of its components (e.g. B-cells). Therefore, we can postulate that while autopoietic systems demonstrate the behaviour of an autonomic systems, they also demonstrate the behaviour of self-replication, and so we can consider autonomic systems a sub-class of autopoietic systems. So, we would expect autopoietic computing would include the self-CHOP (Configuring, Healing, Optimising, Protecting) properties of autonomic computing, plus a self-Replication property, creating CHOPR.

The vision of autopoietic computing proposed is one of dynamic resource scaling, which has many potential applications. One obvious one is the provisioning of resources in Cloud Computing, where there is an inherent necessity for the dynamic scaling of resource provisioning. This would include our Community Clouds, which is a realisation of Digital Ecosystems in the context of Cloud Computing, with a key differentiator being the distribution of control.

OPAALS PROJECT

Contract n° IST-034824

Report on Researcher Exchange

LSE to IITK
Gerard Briscoe

Project funded by the European Community under the "Information Society Technology" Programme

Administrative details

Researcher

Gerard Briscoe, LSE, Computer Science

Host

IPTI, Brazil, Computer Science

Duration

11/07/2010 - 12/08/2010

Purpose

Continue collaboration on WP10 and WP12 activities.

Background

The need for the exchange was to continue collaborating on two efforts socially-aware networking and art-based scale-free user interface paradigms, which had previously been started with visits to London by Fernando Colugnati and Renata Piazzalunga respectively. For the first we wished to pursue properties of social networks that would be useful in defining socially-aware networking protocols, and for which my primary collaborator in visiting IPTI was Fernando Colugnati, whose expertise includes statistical analysis and modelling. In the second we wished to pursue approaches for context awareness through scale-free artistic interpretations (user interfaces), and for which my primary collaborator in visiting IPTI was Renata Piazzalunga, whose expertise includes architectural and artistic context awareness

Conduct

The exchange went well, with no significant difficulties encountered. We established the groundwork for our intended approaches, although we do not progress as quickly as we had hoped in drafting the outline for the papers we intended to write.

Outcomes

In the first collaboration we learnt about social media, social networking, the small-world phenomenon, including their integration and other unique properties they can therefore posses. We established possible collaborations with Lancaster University and University College London, which hold the potential for access to the the usage data of social networking platforms for statistic analysis. We also outlined an approach to the statistical analysis and a draft paper to combine our potential quantitative results, with current state-of-art qualitative understanding. This first effort was in aid of WP10.

In the second collaboration we learnt about zoomable user interfaces, scale free and fractal usage paradigms, and their potential integration into what we called fractal user interfaces, or more generically recursive user interfaces. We also learnt about context awareness, ubiquitous computing, phenomenology, including context in artistic and architectural spaces. We established a framework for context aware artwork, and a

possible demo, for which the implementation was started. We chose to focus on the second part of this collaboration as it held more potential, being less developed than the first part. The effort was in aid of WP12.

Project description

We managed the following two collaborations in parallel.

Social Networking Analysis

We introduce the structure and properties of small-world networks, including the tendency towards caves, small well connected communities with a few connections between. We then discuss the small-world nature of social networks, considering well-known examples, and including the significance of these caves in distilling general principles that apply to all. We then consider an example social networking platform, performing statistical analysis to elucidate any small-world properties that may be present. Finally, we discuss the implications and consequences of this small-world nature, including the management of its growth and the supporting of its distribution.

Many social networks are typically small-world networks, having many strongly connected clusters (communities), called sub-networks (quasi-complete graphs), with a few connections between these clusters (communities). Graphs with this topology have a very high clustering coefficient and small characteristic path lengths. So, most nodes are not neighbours of one another, but most nodes can be reached from every other by a small number of hops or steps. A small world network, where nodes represent people and edges connect people that know each other, captures the small world phenomenon of strangers being linked by a mutual acquaintance.

Context Aware Artwork

Here we discuss the theoretical basis for context aware artwork, considering context awareness from both phenomenological, and the computational (ubiquitous/pervasive computing) perspectives. We the provide an abstract generic framework for the realisation context aware artwork, providing a methodology and approach to define contexts and artwork such that they can be linked within the framework to form dynamic artwork that is reactive to chosen contexts. We then consider an example in which the context of social networking in linked to a dynamic interpretation of a simple 2D image in our framework, to create a live piece of artwork, which is potentially not only enriching to the soul, but informative of one's online social network. Finally, we assess and discuss the benefits and limitations of our approach, and other potential applications.

From phenomenology we are acquainted with the wide perspective of the theory of experience and examining the basis and foundations of knowledge. That is, subject and reality seen in a manifold perspective (plurality of categorical possibilities and scientific forms of experience) e.g., consciousness, the object, the human body itself, meaning, methods applied to the structure of things. Consciousness and intentionality as the source of things and experience and both the objects of experience and science described phenomenologically. Some names here are Martin Heidegger, Maurice Merleau-Ponty, Huber Dreyfus, Michael Polanyi and Don Ihde, for example. Some arguments arising from this view are: a) the argument that thinking and reasoning can not be totally formalized or explicited, because behind our ability of judgment and reasoning there are tacit and pre-

reflexive domains. And this tacit knowledge structures our perception when consciousness is at work, directed to something; b) embodiment, here meaning that the body is part of our orientation to the world and objects, not accordingly to a mechanicist view, not considering the body as a mechanical apparatus and the mind as a substance/entity of a different nature. Our dispositions organize our experience; c) consciousness as a private feature, in that its contents can only be properly known from the inside, what provides a gap between the mind's "self-knowledge" and its "other-knowledge" (knowledge of all other things) where epistemology springs.

Report on OPAALS Research Exchange NUI Maynooth – FH Salzburg (2010)

Partners and Actors

The research exchange involved two OPAALS partners: NIRSA, NUI Maynooth and FH Salzburg. NUIM was represented by Dr. Chris van Egeraat and Dr. Declan Curran. The Fachhochschule Salzburg was represented by Professor Thomas Heistracher, DI. Thomas Kurz, DI. Raimund Eder and DI. Christoph Reucker

Date

The actual face to face exchange took place between 26 and 28 may 2010 but the exchange has continued on a non-face-to-face basis since.

Location

Fachhochschule Salzburg, Puch-Uhrstein, Salzburg, Austria

Aim

The overall aim was to exchange knowledge on the visualisation of social network analysis data. The detailed aims and anticipated outputs of the research exchange were refined during the first meeting (see below)

Research Exchange Process

The exchange commenced with a discussion of the datasets on social networks in the Irish biotechnology developed by the NUIM team. Based on the new understanding of the datasets and the functionality of the EVESIM application, the partners decided on the activities and anticipated outcomes of the exchange. The anticipated outcomes were formulated as follows:

1) Visualisation of the data on cross-directorship in the Irish biotech Industry using EVESIM. The resulting visualisation process has a number of benefits for the OPAALS Phase III Task 11.6. Firstly, it will function as an example of an Irish biotech DE application. As such the results will be integrated in Deliverable 11.11. In addition, the tool can play a role in the analysis of the spatial characteristics of the social networks in the Irish biotech industry. Again the results will be reported in Deliverable 11.11.
2) Visualisation of the data on co-inventors in the Irish biotech Industry using EVESIM, with anticipated benefits similar to those emerging from outcome 1
3) Visualisation of the spin-off processes in the Irish biotech industry using EVESIM, with anticipated benefits similar to those emerging from outcome 1
4) Instruction of the NUIM partners regarding the use of the EVESIM Application

5) Testing the usability of the EVESIM application in a new context, exploring possible extensions of its functionality. The results will have direct relevance to the OPAALS research activities in relation to EveSim.

The project required a number of different activities which were conducted on a shoulder-to-shoulder basis.

1) Geo-coding of the actors in the various datasets in order to add a spatial dimension to the network data. The NUIM partners employed an existing geo-coding tool developed by NUIM.
2) Translate the data from Irish National Grid Projection to the specific format recognised by the EVESIM application. This involved a substantial amount of data preparation.
3) Writing of programming syntax to facilitate the data being imported into the EVESIM software. This activity involved a substantial amount of coding by the Salzburg partners. By the end of the research exchange meeting two datasets had been coded. The third dataset was geo-coded after the meeting and provided to the Maynooth partners. The specific actions will be documented in D10.20 (Emulation and testing of OPAALS P2P infrastructure by utilization of EvESim)
4) Adding additional functionality to the software to fully exploit the facets of the Irish Biotech datasets. The project involved many feed-back loops between the various activities. NUIM partners interpreted the outcomes which led to recoding efforts by the Salzburg partners. At the end of the exchange, most requested functionality was added. Some elements were added by the Salzburg partners after the face-to-face exchange and the Maynooth partners have received a new version of the Simulator. The specific actions will be documented in D10.20 (Emulation and testing of OPAALS P2P infrastructure by utilization of EvESim)
5) Instruct NUIM partners regarding the use of the EVESIM application. The Maynooth partners received face-to-face instruction regarding the functionality of the EVESIM application. In a step y step fashion they were explained how to import data, manipulate data, add attributes and produce output. The Maynooth partners were then offered the opportunity to master all activities using one of the datasets. They were also provided with literature about the underlying programme. The Maynooth Partners received the EVESIM software which allows them to use it for OPAALS and other research projects.
6) Provide the Salzburg team with feedback on further possible refinements of the EVESIM application. On return the Maynooth partners produced further research output using the EVESIM application. Their experience with the Simulator in a new research context provides valuable insights into the usability of the application. The NUIM Partners have communicated their ideas regarding user friendliness, possible changes and possible extensions of its use.

Output

The exchange was fruitful and all the aims were achieved. The NUIM team has the software and knowledge to produce visualisations of three biotech datasets and, with some further study, new datasets. Figures 1 and 2 provide screenshots of the possible output. The visualisation output presents the geography of different biotech networks in a very flexible way. It shows the connections of different actors in the biotech industry and their spatiality.

1) The output can function as a showcase for possible DE applications. It can be presented as supporting a biotech forum for the exchange of know-who type information. For this it would be great if the application could be developed in a way that members can upload their own network information. The tool can play a role in the analysis of the spatial characteristics of the social networks in the Irish biotech industry. For, example the visualisation greatly facilitates the identification of the geography of spin off processes and information flows. These findings will be integrated in the OPAALS Deliverable 11.11. The NUIM experience with the Simulator in a new research context has provided valuable insights into the usability of the application. These have been communicated to the Salzburg team and will be integrated in OPAALS Deliverable D10.20 (Emulation and testing of OPAALS P2P infrastructure by utilization of EvESim) .

Finally the great atmosphere of the research exchange has further cemented the relationship between the two research institutions and the OPAALS consortium in general. This relationship will undoubtedly continue beyond the end of the OPAALS research project.

Maynooth/Salzburg, 1 June 2010

Dr. Chris van Egeraat and DI Thomas Kurz

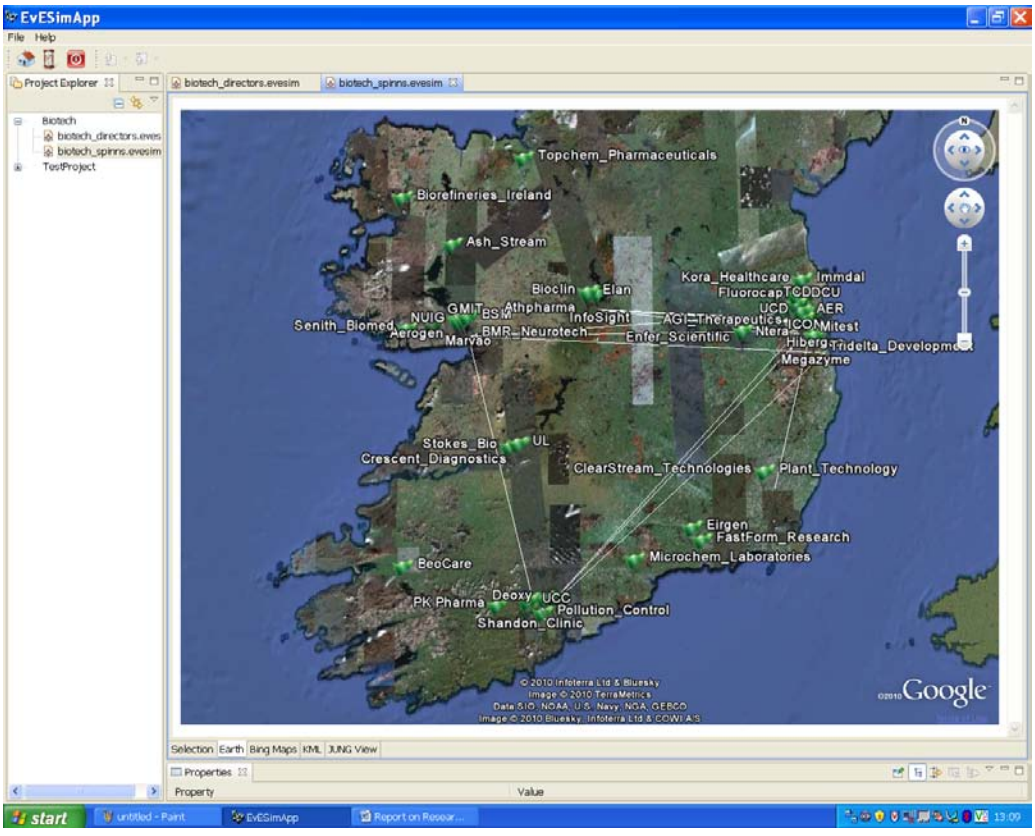

Figure 1: Screenshot visualisation network of spin-offs

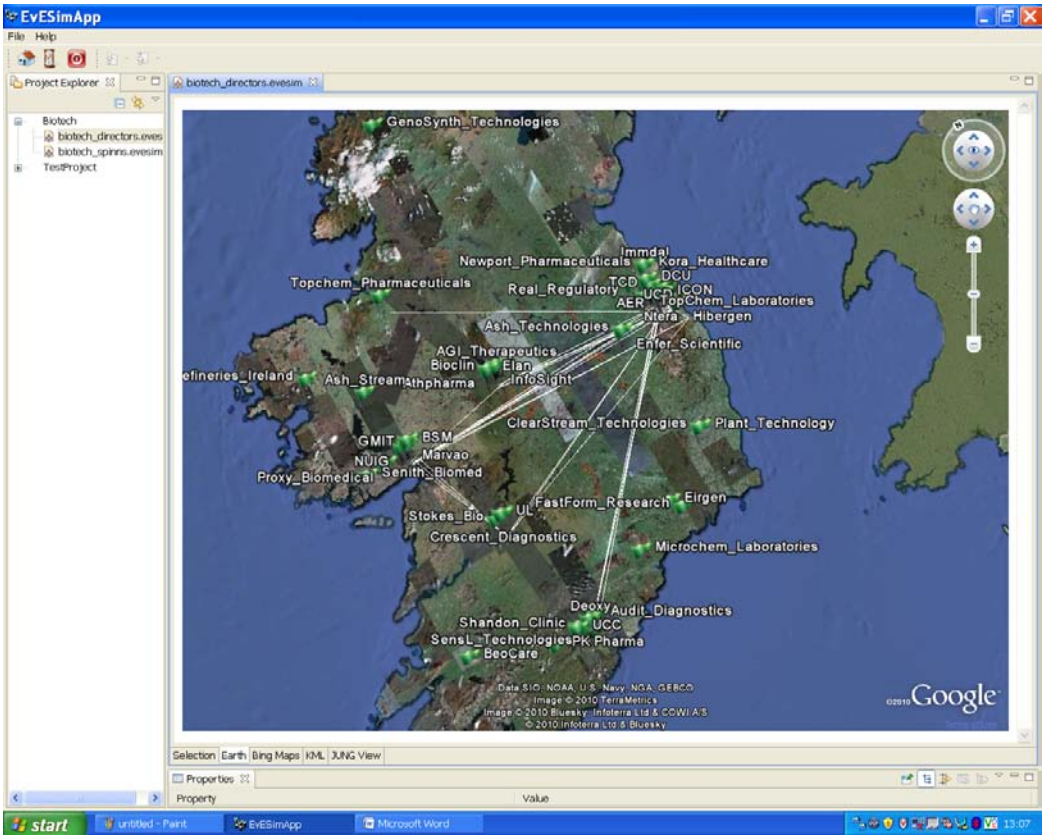

Figure 2: Screenshot visualisation network of directors

OPAALS PROJECT

Contract n° IST-034824

Report on Researcher Exchange

Salzburg Jan 2010
Jason Finnegan

Project funded by the European Community under the "Information Society Technology" Programme

Administrative details

Researcher

Jason Finnegan (Waterford Institute of Technology)
OPAALS Technical Integration Coordinator

Host

SUAS Austria
Fachhochschule Salzburg University of Applied Sciences

Duration

18-1-10 to 29-1-10

Purpose

The aim of this exchange was coordinate the integration of SUAS's computing work on OPAALS with that of other partners including WIT and IPTI.

A secondary aim was to work on the sustainability plan for OPAALS to be discussed at the Sustainability and Governance Workshop on the 21st and 22nd of January

Background

At the OPAALS technical Meeting in London (15-12-09) an updated functional architecture for all computing components was decided on. This new architecture required several new service interfaces and components be rapidly developed and tested, so that they could be built upon by other partners. One new component was the Service Browser/service search component for which SUAS was responsible. There were many technical issues that needed to be resolved and it was suggested that a short exchange could help accelerate the integration process.

Another reason for the specific timing of the exchange was due to the Sustainability and Governance Workshop at SUAS on the 22nd Of January, at which I could present the progress of the computing Integration to the non-computing partners.

From SUAS I worked primarily with Thomas Kurz, Raimund Eder and Christoph Ruecker. I also had occasional meetings with Prof. Thomas Heistracher, the leader of the Dept Informatics and Software Engineering at SUAS.

Preparation for the exchange was primarily in communicating with all the Computing partners regarding the status of their components and progress towards the agreed goals. Preparations were made with Thomas and Raimund regarding which issues we would be working on during my stay.

I also prepared a presentation of my own work for the Sustainability meeting, along with a summary of that provided by the other computing partners

Conduct

The exchange went well with myself and the SUAS team making progress on a number of known problems, such as the Service Search and Browsing, and the EveSim Integration. Some new features were also developed during the period, including the ability to monitor Flypeer Nodes remotely using a modified EveSim tool.
An additional benefit of the exchange was the transfer of knowledge that the SUAS researchers had collected from their own experiences during previous exchanges.

At the sustainability meeting I presented the progress integrating the components from other partners and also described the Prototype for the Distributed File System. Here feedback was given which had a major effect on the further development of the DFS. The specific feedback to the presentation highlighted the importance of guaranteed file availability over decentralisation.

Outcomes

During my time at SUAS I learned about the work they have done there over the past 2 years, and also what they learned when they visited other partners. This included not only the technical functioning of components but also the higher goals of individual partners, the overall aim of their work across multiple projects.

Achievements: Improvements to the Flypeer search feature
Specification and design of a Flypeer Monitoring service, using elements and methodology from the EveSim platform
Improvements to the Distributed File System service, based on feedback from multiple partners

The results of this exchange have been contributed to the Code Base of SUAS and WIT, and to the Deliverables D10.20 and D3.15

OPAALS PROJECT

Contract n° IST-034824

Report on Researcher Exchange

Dynamic Social Network Models

Fernando A.B. Colugnati

Project funded by the European Community under the "Information Society Technology" Programme

Administrative details

Researcher

Fernando Antonio Basile Colugnati, Research Institute for Technology and Innovation (IPTI), Statistician, Social Network Analyst

Host

London School of Economics and Political Science (LSE) and Nuffield College at Oxford

Duration

From February the 1st to February the 28th

Purpose

To contact Dr. Tom Snijders from Nuffield College, specialist in Dynamic Models for Social Network Analysis. He is the main reference in the type of models used in some deliverables (D 10.8, D 3.7, D 10.20) and papers written by this researcher.

Background

The dynamic models for social network analyis is a brand new branch in statistical science, having Dr. Tom Snijders, from Nuffield College, whose have produced the seminal papers in this area.

Attending the 5th UK Social Network Conference, held in London in July/2009, I have met Dr Snijders in a tutorial about the theme, and there we talked about the opportunity to work together in some analysis that I was already carrying out in my OPAALS tasks. The main objective was to improve my knowledge about this modeling approach, to learn modeling strategies (since it involves several parameters and types of effects that can be included in the model), and to spread my research network aiming to find new collaborators and researchers that share same type of problems to solve.

Conduct

Dr Snijders had no room in the college facilities to receive a researcher not formaly registered as Oxford student, so after talking to OPAALS coordination about the possibility of this good contact, LSE could receive me havin the Dygital Ecosystems Laboratory, from OPAALS, as an office. This was even better since Dr Snijders was present in Oxford only every other week, so the weeks he was unable to receive me I could spend in LSE having all structure and facilities available.

I had regular meetings with Dr Snijders and have participated in an informal seminar group leaded by him at Nuffield College (stats.ox.ac.uk/~snijders/stat_net_mod.htm). There I had the opportunity to participate in the following seminars:

- Week 4: Tuesday February 9, 2.30-4.00 pm. Nuffield College, Meeting Room L5. Paulina Preciado Lopez: Distance matters: exploratory analysis of the distance dependency of adolescent friendship dynamics.
- Week 6: Tuesday February 23, 2.30-4.00 pm. Nuffield College, Meeting Room L5. Krista Gile: *Inference for Hidden Populations Based on Network Sampling*

Also, I paticipated in the the formal regular seminars about SNA (nuffield.ox.ac.uk/nnnr/seminars.htm), attending the following seminars:

- Week 4 (Feb. 8) Tamas Nepeusz "Large scale network analysis with the iGraph platform"
- Week 5 (Feb.15) Mark Tranmer "The role of individuals, households, geographical groups and social networks in social statistics."
- Week 6 (Feb.22) Filip Agneessens "Macro-structural conditions on micro-processes: towards a Network Contingency Theory"

Outcomes

The exchange have happened as planned, having as result a better understanding of dynamic modeling for Social Network Analysis. Some of the ideas were incorporated in the *Evesim* framework for network simulation (D 10.20, evesim.org), and a paper presented in the 3rd OPAALS Conference was the main result. An extended version for a regular periodic is under development.

Related to the SUPERA dataset, cited in the original plan, I had the opportunity to know a new approach for dyadic events, like happens in a discussion forum, the Event Model. This dataser is under analysis, and an article is planned to publish the results. This modeling have great potential to study questions regarding network infrastructure, mainly P2P problems.

Project description

This project and their technical aspects are well described in the paper presented in the 2nd OPAALS conference, in Tampere, attached herein. This served as the introcuction of my interests to Dr Snijders.

Dynamic social network modeling and perspectives in OPAALS frameworks

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Abstract. Social Networks Analysis (SNA) plays an important role in OPAALS, since it is subject in many WPs and their tasks, in a way that results and conclusions from a specific research problem are interchangeable among different research frameworks. This paper intends to present a suggestion for SNA over panel data, based on a statistical and dynamic perspective, rather than purely static and mathematical. The difference is in the fact that probabilistic components are included in the model allowing quantification of some parameters that can have direct or indirect influence over the network behavior. Knowledge about those parameters could give important information on how networks behaves and evolve, based on the influence of covariates (variables), and then how we could simulate more realistic scenarios. Some purposes about the utilization in OPAALS tasks are discussed.

Keywords: Social Network Analysis, Dynamic Models, Simulation

1 Introduction

The study of Social Networks (SN) plays an important role in OPAALS, since it is subject in many WPs and their tasks, in a way that results and conclusions from a specific research problem are interchangeable among different research frameworks.

The great majority of studies carried out by the social network research community employs relatively static notions of networks. Sometimes research on Social Network Analisys (SNA) can drive to an idea that it is just “connect dots” an then isolate the “key actors” who are often defined in terms of their “centrality” in the network (Carley 2003). However this view is quite limited if one think in terms of an enviroment where:

1. the content of information is vast and the relationships amongst all actors can be represented in different ways, and
2. its influenced by time, i.e., the network structure is modified according to the “history” behind the actors, and this “tale” has many important things to tell us about the different structures that the ongoing network has been configured. In other words, we need to understand the basic proccess by which the network evolves.

The first point is about the abstraction of the network. For example cognitive networks are networks based on a recorded series of events, like e-mails, citations, chats, etc..., and those, when aggregated, provide a behavioral network. We can be interested in the analysis of the data per-see (like e-mail exchange) or in the interepratation of something that those data represent, e.g. e-mail exchange as a representation of some construct like “leadership” in a company. More complexity is introduced when we take more than one indicator to represent this network, chat and forum participation further to e-mail exchange.

The second point is concerned on how to represent the “history”. To pick up network data in two or three different snapshots separated by a pre-defined time interval is the most applied approach, the called panel design. In this case, researchers can only assess the micro-dynamics, once the history of each relationship is not complete, and its never directly observed. To tell the whole history, one have to keep in mind how and at which rate, data should be collected, and how to display this dynamic minimising distortions and yelding interpretable visualizations.

The Dynamic Network Analysis is a new framework that arrised due to the demanded application of SNA to other areas, the development of new methods for data collection and the growing of computational power for simulations and graphical display. It consists of a tool-kit comprised by statistical modeling and visualization

techniques, that used together can improve the undertanding and knowledge about the network process, providing information that can help in actions and decisions when this network structure should be "fostered", as in the case of a collaboration network.

This paper intends to present a suggestion for SNA over panel data, based on a statistical and dynamic perspective, rather than purely static and mathematical. The difference is in the fact that probabilistic components are included in the model allowing quantification of some parameters that can have direct or indirect influence over the network behavior. Knowledge about those parameters could give important information on how networks behaves and evolve, based on the influence of covariates (variables), and then how we could simulate more realistic scenarios. Some purposes about the utilization in OPAALS tasks are discussed.

2 Importance of dynamic in network modeling

A key feature for social network analysis is the study and interpretation of the interdependence among members from a social group, a recurring theme in theory of formation. The concept of cohesion among those group members as indicator of compliance with group norms, is also well-known (Homans, 1974).

In statistical science this interdependence is called *network autocorrelation,* such that ties in the network occur more frequently among similars in terms of specific attributes, like geographical localization, economic status or musical preference. Some measures from the traditional SNA methods, that lead with an instant picture of the network, give some clues about clusters or modules (Wasserman 1994, Newman & Girvan 2004), but the complete understanding about how these clusters were formed depends on the assessment of the network in a follow up fashion. This necessity turns more clear when two principles are defined, that are the most prominent explanations for the autocorrelation.

The first principle is called *homophily* (McPerson,et al. 2001), a selection mechanism where actors seek relationship with similars over the time. In this case, network ties are formed according to similarity on some actor attribute, and network autocorrelation emerges as consequence of social selection over the time. Another explanation may be the *assimilation principle,* where actors adapt their own attributes to match the group average attribute profile (Friedckin, 1998). In this process, again over time, autocorrelation emerges by a social influence mechanism. From these two principles, it is clear that the right understanding of the autocorrelation phenomena requires the social network to be dynamic, in its topology (selection over time) and in its endogenous attributes (influence changing behavior). In a real social network data, it is likely that both principles can occur, and then the interest is study how they influence the network evolution, and if one of them better explain this dynamic.

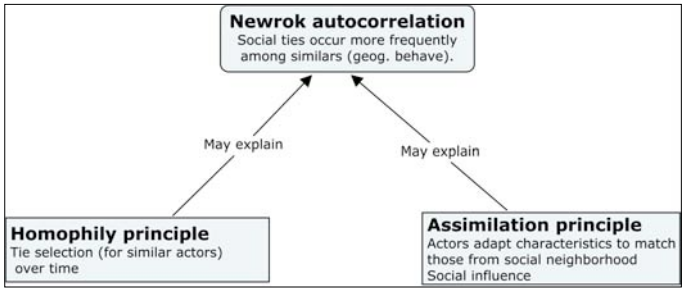

Fig.1- Principles that may explain network autocorrelation concept

It is clear that follow up data is needed to understand autocorrelation mechanism, and in social science this kind of data come from the called panel design. The group is observed in different time points, making possible only observations of what is happening in that point. This discretization of time observations introduces an analytical complication, once that reasonably the processes of selection and influence will occur in-between consecutive panels, in a continuous time spam that is not possible to be observed. Another complication is related to the *completeness* of the network, that can be understood as a clear definition of the network set of actors boundaries. In general, the dynamic process is hardly limited, once that actors can entry or leave the network.

Because of this methodological constraints, many approaches have failed to respond to the statistical challenge in separate and explain both principles. *Contingency table* approach (Kandel, 1978), *ad-hoc social network analysis* (Cohen 1977, Kirke 2004) and *structural equation modeling* (Krohn et al. 1996) are the most known. The main reason on the non-success for these approaches, further to the above mentioned, relies on the fact that all of them have the independence observations assumption, a common feature in classical statistical modeling.

Next section introduces the *Actor-oriented models*, firstly presented and developed by Snijders (1996) and them the inclusion of the behavior component. This modeling approach intends to understand the co-evolution of network topology and behavioral scenario applying concepts from the stochastic process theory, mainly Markov process.

3. Proposed approach

To introduce the complete co-evolution model, we need first to understand the actor-oriented approach, and after that how to include the behavioral aspect. In terms of the methodological development, this was the chronological sequence of models presented by the main research group.

3.1 Actor-oriented model

Snijders introduced stochastic actor-oriented models (Snijders 1996, 2001, 2005) firstly modeling just the evolution of the network. Actor orientation means that, for each change in network, the perspective is taken of the actor whose tie is changing, such that this actor (let´s call *i* actor) controls the whole set of tie variables included in the *i-th* row of the adjacency matrix that defines the network. This is called a *micro-step*, so that the analysis of the dynamic has a bottom-up perspective, from micro changes (actor tie selection) to macro changes (change in network topology).

To overcome the methodological frailties already exposed, the idea is to consider a time continuous stochastic process where the state space is formed by all network configurations of directed graphs given a set of actors. The observed network is modeled by means of a parametric model for the transition probabilities between these states. In network panel data, each panel will present a configuration that pertains to the whole large set of the state space. So that, the explanation of dynamics is formulated by means of the transition probabilities, having the first observation conditioned upon. In other words, the first observation is the starting value of the stochastic process. As can be seen, this state space grows squared exponentially, and a simple binary network with 10 actors will present approximately $2^{(10(10-1))} = 1{,}23\text{x}10^{25}$ possible states. So that, three basic assumptions are made to reduce the complexity (Snjiders 2006):

1. the transitions between panel measurements are manifestations of an underlying process that takes place in continuous time;
2. actors do not coordinate their actions, but act conditionally independent from each other, given the current state of the network;
3. actors change at most one tie at a time, that is, create one new link or dissolve one existing link in one microstep.

So that, the modeling task is reduced to:

a. Modeling the change in the microstep
b. Modeling the occurrence of this microstep, over time

The first task is solved by means of a multinomial logistic model that will be used to a maximization of a stochastic utility function, here called the **Objective function.** Task b) consists of a specification of a probability model for the actors´ individual waiting time (usually the Exponential model), called the **Rate function**. By this approach, the time dependence of the evolution process is implicitly modeled as an emergent consequence of model dependence on time. Both model components include dependences on previous network state (topology), time and actor, but not for the whole history of the process (Markov assumption).

At this point some notation should be introduced. Let $\mathbf{X}(t) = \{X_1, X_2, ..., X_n\}'$ be the adjacency matrix that defines the network topology at time *t*, where X_i is a *1 x n* vector. So that, we define the model components.

3.1.1 Rate function

The rate function $\lambda i(\mathbf{x})$ for actor *i* is the rate at which changes occur in this actor ties, X_i. Formally, it can be defined as:

$$\lambda_i(x) = \lim_{dt \to 0} \frac{1}{dt} P(X_{ij}(t + dt) \neq X_{ij}(t) \text{ for some } j \in \{1, \ldots, n\} \mid \mathbf{X}(t) = x)$$

The simplest way to model it, is to consider this rate, constant among all actors, or $\lambda_i = \lambda$ for *i = 1, ..., n*. Based on (1) and the constant λ assumption, we have that waiting times *D* between successive mini-steps will follow the Exponential probability distribution, with density function $\lambda e^{-\lambda d}$, for $d > 0$. Consequently, the expected number of total changes in the whole network, between two consecutive time points t_a and t_b is $n\lambda(t_b - t_a)$.

The constant assumption can be relaxed, and this can be a function of attribute variables, so that we have $\lambda(\eta,$

W), where η is the effect parameter vector for the attribute *W*. Also, it can be modeled depending on the network structure. More details can be found in Snijders 2004.

3.1.2 Objective function

The meaning of this function is not easy as the rate function, mainly for no-practitioners, once that it involves some network concepts like transitivity and balance among others. In the previous sections, it was presented as the functions that will govern the mechanism of network evolution, so it is related to the topology of the network.

The objective function can be understood as a representation of the preference distribution of the actor *i* the set of all possible networks. When actor *i* makes a change (a microstep) he/she will change the configuration of his/her network neighborhood. Let $X_{i+} = \sum_j X_{ij}$ be the number of all ties actor *i* has and $n - 1 - X_{i+}$ the number of actors whose he/she is not tied. Denoting $\boldsymbol{x} = \mathbf{X}(t)$ as the state of the network ant time *t,* the new network formed after a tie is changed by the actor is denoted $\boldsymbol{x}(i, j)$. The choice for this change is modeled as follows:

Let $U(j)$ be a random latent variable that represents the unexplained part of the preference for *i* to *j,* or a latent preference. This variable is assumed to have a symmetric distribution around 0 (a white noise) and independently generated by each micro-step. The idea is that actor *i* will change the digraph in a way that maximizes

$$f(\boldsymbol{x}(i, j)) + U(j)$$

A convenient traditional distribution for *U(.)* is the Gumbel distribution, with mean 0 and scale parameter 1. Under this assumption, the probability that *i* chooses to change the digraph x_{ij} is given by the logistic function:

$$p_{ij}(\boldsymbol{x}) = \frac{e^{f(\boldsymbol{x}(i, j))}}{\sum_{X_i} e^{f(\boldsymbol{x}(i, j))}} \qquad i \neq j$$

Here, *f(.)* is the function that is a weighted sum on a parameter vector $\beta = (\beta_1, \beta_2, \ldots, \beta_L)$ such that

$$f_i(\beta, \boldsymbol{x}) = \sum_{k=1}^{L} \beta_k s_{ik}(\boldsymbol{x})$$

Functions $s_{ik}(\boldsymbol{x})$ are well known metrics in SNA, like:

1. Density effect (out-degree)

$$s_{i1}(\boldsymbol{x}) = x_{i+} = \sum_j x_{ij}$$

2. Reciprocity effect

$$s_{i2}(\boldsymbol{x}) = x_{i(r)} = \sum_j x_{ij} x_{ji}$$

3. Transitivity effect

$$s_{i3}(\boldsymbol{x}) = \sum_j \sum_h x_{ij} x_{ih} x_{jh}$$

among others like Balance, Number of geodesic distances 2, Popularity and Activity effect. □

So, the parameters β give the importance of the effect in the actors´ choice in changing ties. It´s possible to estimate uncertainty for these parameters and even perform hypotheses tests to assess the statistical relevance of each of the *s(.)* effects estimated. The choice of which and how many effects should be included in the models depends on a previous exploratory analysis and, of course, in the size of the network, since we have to have enough degrees of freedom for estimation. Reminding also that the difficult to interpret and computational time cost increase as number of parameters do.

3.2 Behavior component

So far, all the definitions about the dynamic modeling stated only about the network evolution, a process emerged from the actors choices. The addition of the behavior component is done straightforward, in the following way.

For each behavioral variable, that must be a discrete outcome, a separated behavioral state space is handled consisting of all possible individual scores of the variable, and so observed transition on each behavioral dimension is modeled in an analogue way of micro-steps, decomposing all changes and using parametric model for the probability transitions. These *behavioral microsteps* again are modeled as multinomial logistic distribution based on random utility objective function and their changes following an Exponential distribution based on a rate function.

The integration of this component to the network evolution is done by:

1. specifying a Cartesian product of the separate state spaces as a joint state space;
2. assuming conditional independence of the occurrence of the different types of micro-steps;
3. extending the separate objective and rate functions to allow for dependence on the respective dimension of the state space

In step 3 the interdependence between network and behavior dynamics is introduced in the model. The Markov property is inherited from the separate components the forms the complete model and actor-driven nature is reflected in the locus of occurrence of any micro-step. It is the actor who decides the changes he/she has under control, the outgoing ties and the behavior, having the velocity of these changes modeled by the rate function and the evaluations of consequences once a decision change is made modeled by the respective objective function.

3.3 Data specification and estimation methods

Data for this kind of modeling should be observations made over a closed social group ate least in two panels. For closed group, we understand that all actors involved in the panels must be included in all $\mathbf{X}(t)$ adjacency matrix. Even if the actor just entered in the group in the second panel and left before the third panel, he/she must be represented in the first and in all subsequent matrices, having zeros in the respective line *Xi*. This specification tries to cover the problem of completeness of the network, where the boundaries will be naturally defined by all actors the have had at least one participation in the follow up data. The same specification should be followed for the vectors of covariates (fixed or time dependent) and for the behavioral variables.

Due to the complexity of the model, that collapses state spaces, dealing with high dimensional problem evolving as function of time, it is easy to imagine that closed forms are not defined, so that well-known methods for estimation based on maximization, like Maximum Likelihood, are note possible. Neither the assessment of the equilibrium distribution, a consequence from the Markov property. But simulations of model-specific evolution process are possible, so that approximation should be applied, and simulation-based estimates for the parameters can be obtained.

The software SIENA (Snijiders 2003) use the simulation-based method of moments. This is the only implementation of this kind of modeling available for general use for analysis. It is a freeware software, that runs under the STOCNET free software, developed by the same group. However it does not have open source code.

4. Relevance to OPAALS NoE

Network is a key concept for OPAALS, as a self understanding mechanism for evolution and sustainability and as research framework, since it is intrinsically present in all domains of the NoE that supports the Digital Business Ecosystem research: Natural, Computing and Social Sciences.

The right understanding of how the two main components of network evolution and behavior changing can bring new insights for mechanisms of incentive due SMEs, P2P architecture and scientific collaboration. Follows some ideas about the use of this approach in the context of the project.

Three use cases for simulations are outlined bellow, having always OPAALS scientific and technical concerns as basis.

4.1 An extension to the use case in DBE

In the “D27.5 – Territorial Social Capital and User SMEs” a SNA approach is given to define main Social Variables, providing 7 variables represented as blue boxes in figure 2. The SNA applied performs the dynamic including new actors and interpreting changes in the network topologies in terms of number of arcs and density degree. This was already an Actor Oriented approach, however done manually. What this new approach suggests is an automatization of such procedure, including and excluding actors and estimating the effects in the network as well, but having further properties studied, beyond network degree or density.

Defining an arc as any of the 7 relationship typologies between two SMEs, described in the D27.5, it’s possible to construct the network. From the Social Variables defined, some of them could be modeled as behavior, once they are likely to change according to the market, or according to the enterprise growing, etc... . As suggestion, the following variables could be modeled as behavior:

- Business strategy: an SME can start in the network as "Aggressive", and after some time turn to "Quality-oriented", for example, as long as more business transactions are made (more out-degree arcs, in SNA "idiom"). Strategies change following different market situations, i.e., as function of out and/or in-degrees;
- ICT usage: usually it tends to increase, as time goes by and technology turns a powerful tool;
- Attitude in DBE: Offer or demand, and its intensity, are naturally variable.

The other variables can be included in the models as covariates, following the effects diagram showed in the figure 2. For example:

- SME dimension "may affect" Business Strategy. How much?
- Is the SME typology effect bigger than Business strategy for Attitude in DBE?
  - Will an SME make more business (ties) if ICT usage change? About the topology, will the network become centralized?
  - Will the business strategy change too?

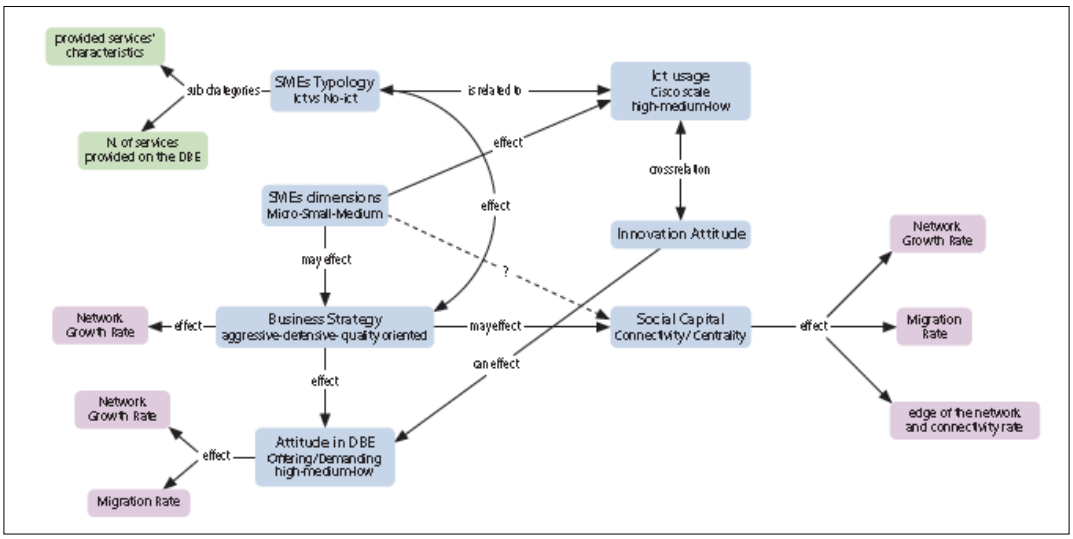

Figure 2- Hypothetical causal relations among social variables. Source: CENSIS, 2006

Having SMEs as agents exchanging services, simulations using different rate functions for behaviors change can provide different scenarios on how SMEs will join or compete for market share. Those questions can be answered, therefore, by means of quantification from real data, where estimations include uncertainty permitting even hypotheses testing.

4.2 Use case of network-behavior co-evolution in OPAALS

A survey over all OPAALS participants, from all institutions, is being carried by UniKassel, assessing mainly how collaborations are happening, among many others attributes, like concentration area and communication media. Also, questions about communication and collaboration tools used for research, deliverables development and decisions. With the ongoing implementation of the OKS, it is expected some changes in this dynamics.

Data collected can represent two levels of agents, the institutional upper level formed by the NoE stakeholders and their researchers in the lower level. This multilevel characteristic provides even further possibilities to explore the emergence in a bottom-up way, since the tie set of a researcher will define his/her institution set.

Any kind of sharing or collaboration can be understood as a service, in the Evesim "world", that will provide the network links, and usage of tools can be modeled as potential changing behavior, since the NoE expect to stimulate the utilization of collaboration tools in the integrated platform of OKS.

This data can serve as basis for simulation on this kind of network, providing results for a virtual longterm running of the collaboration network.

4.3 P2P architecture

OPAALS aims to implement a P2P architecture, having OKS/Guigoh and Evesim as use cases. The most promising and

in development option is the concept of Dynamic Virtual Super-Peer (DVSP) (Razavi et al. 2007), where nodes from a network form, by means of a choice/selection algorithm, a super-peer that can provide information/services demanded from the whole network. This choice is made by a stability function, that tries to translate to a metric, multidimensional concept of stability and service provider.

Simulations have been done, but this approach can allow for more complex simulation models, since the rate functions here could make the behavior of nodes change according to more complex combinations of features.

5. Concluding remarks

Dynamic models for network analysis show to be a promising methodology in the context of Digital Ecosystem as a new research framework. From the concept of natural science of ecosystem, dynamic behavior of actors that compound it should be well understood.

SNA techniques so far used in many different areas, use static analysis or repeated static analysis over panel observations where the dynamic component is missed due to model assumptions and data collection. The possibility to separate Selection from Influence can help a lot in comprehension of many network phenomena, further to social ones.

The implementation of this approach in Evesim will make available for the scientific community, a powerful tool for network analysis, indeed outside OPAALS NoE.

Acknowledgments

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OPAALS PROJECT

Contract n° IST-034824

Report on Researcher Exchange

Integration Exchange SUAS-IITK

Thomas Kurz, Raimund Eder

Project funded by the European Community under the "Information Society Technology" Programme

Administrative details

Researcher

Thomas Kurz, Raimund Eder
Fachhochschule Salzburg GmbH - Salzburg University of Applied Sciences
Information Technology & System-Management (ITS)
AUSTRIA

Host

Indian Institute of Technology Kanpur
Computer Science and Engineering Department
INDIA

Duration

Feb 9th, 2010 – Feb 25th, 2010

Purpose

- Integration of the semantic search service with Flypeer
- Synchronization and support on SBVR activities
- Cooperation with the Agropedia project group as regards SNA and SN visualisation
- Work on D3.14 – Simulation and test of Semantic Search in a DE infrastructure

Background

SUAS helped IPTI in testing the Flypeer P2P infrastructure and gained considerable knowledge on the integration and application of this infrastructure with other frameworks, e.g. EvESim. Further, SUAS motivated a small task in the DoW of Phase III in order to test and integrate the semantic search components of partner IITK with the OPAALS P2P infrastructure. Consequently, the need of a face-to-face support was essential especially because at this point in time almost no documentation of Flypeer was available. Additionally, the data from Agropedia was an interesting collaboration point as regards EvESim. The OPAALS conference in March enabled us to synchronise with the SNA working group at IITK and promote the knowledge to IPTI.

IITK and the heterogeneous research groups there were an ideal field also for a long-term cooperation of IITK and SUAS. The opportunity of having act technology and computer science together with social networks like Agropedia give a perfect match for the EvESim activities. The related objectives are given in the purposes section.

From IITK mainly Professor T.V. Prabhakar was involved in the exchange. Beside him and his students and colleagues in the field of computer science, Runa Sarkar, who was involved in OPAALS Phase II with Agropedia was travelling from Calcutta to meet with the SUAS researchers and the Agropedia project group at IITK. This group has long-lasting experience in software engineering and social networks.

The planned main output of the exchange was i) the integration of semantic search with Flypeer and drafting of deliverable D3.14, ii) synchronisation of activities from IITK with the other partners of the OPAALS project, and iii) exchange of data with the Agropedia group.

Conduct

The exchange went very well. Although the integration of Flypeer could not be finished within the allocated exchange time, the meetings with different researchers at IITK turned out to be fruitful for current OPAALS activities and also for future cooperation. The constantly changing Flypeer versions at this time and the administrative effort to open ports on the IITK servers caused some delay in the integration, which could finally be solved in the subsequent weeks. These additional activities also resulted in a delay of D3.14, which was accepted by the authors in order to have practical results in the deliverable.

The cooperation with the Agropedia group was even more successful than expected. The group offered an export interface for Agropedia Data in the Network Description format of EvESim which enables exporting of current and past network data (see Figure 1). This feature was also helpful in cooperations with other OPAALS partners, e.g. TUT, because the EvESim network description format was used also for related visualisations (see for example D10.19).

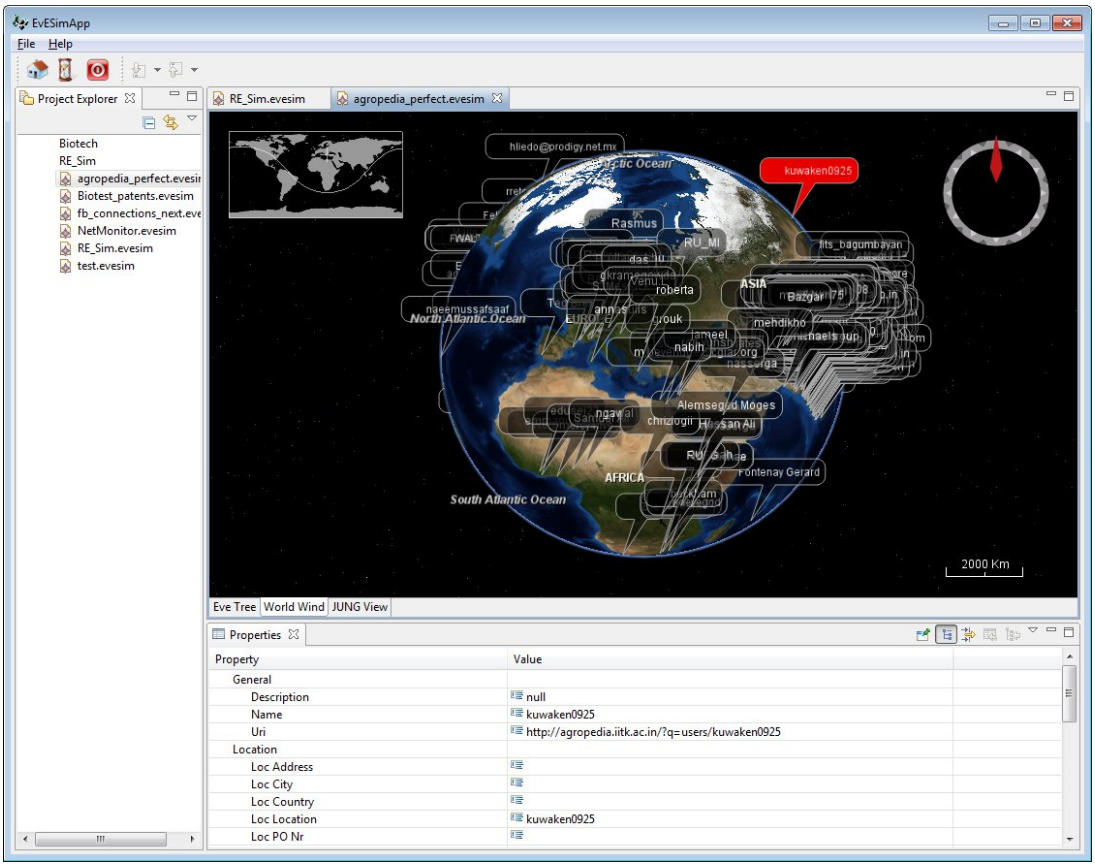


Figure 1: Visualisation of Agropedia in EvESim

Additionally, researchers of Professor T.V. Prabhakars group met with us and we supported their work in SBVR and web-based technologies.

Outcomes

The semantic search service was successfully integrated with Flypeer. Further a test was performed and documented in deliverable D3.14. Also the other outcomes of the semantic search and Flypeer activities of SUAS and IITK are documented in this deliverable.

The interfaces to Agropedia data were promoted to other partners and included as an usecase for EvESim visualisations. The detailed outcomes are documented in D10.19 and D10.20.

Additionally to the OPAALS-related achievements we had the chance to learn a lot about the culture of a very interesting country with wonderful people.

Project description

All technical descriptions of the tasks performed during the exchange were documented in deliverables D3.14 and D10.20 as well as partially in D10.19.

OPAALS PROJECT

Contract n° IST-034824

Report on Researcher Exchange

IITK-LSE Researcher Exchange
M S Ram, IITK

Project funded by the European Community under the "Information Society Technology" Programme

Administrative details

Researcher
M S Ram, IIT-K, Computer Science & Engineering.

Host
LSE, London, Media Labs

Duration
23/01/2010 to 06/02/2010

Purpose
Exchange of ideas on autopoietic computing with Gerard Briscoe and Paolo Dini.

Background

As my PhD problem is in a related area, I thought I could do something for OPAALS and take some technical inputs from other members of OPAALS. Paolo Dini and Gerard Briscoe of LSE were the people involved in the exchange; Paolo helped me with some biology and algebra related notes and Gerard helped me with architectural details.

Conduct

Technical discussions went well, and they helped me understand the things with OPAALS.
Stay and food availability was a little problematic, otherwise everything was fine.

Outcomes

I learnt Biology and Algebra related stuff needed for autopoietic computing from Paolo. Discussed IBM model of autonomic computing with Gerard, and we tried extending the original model with an extra attribute.

Project description

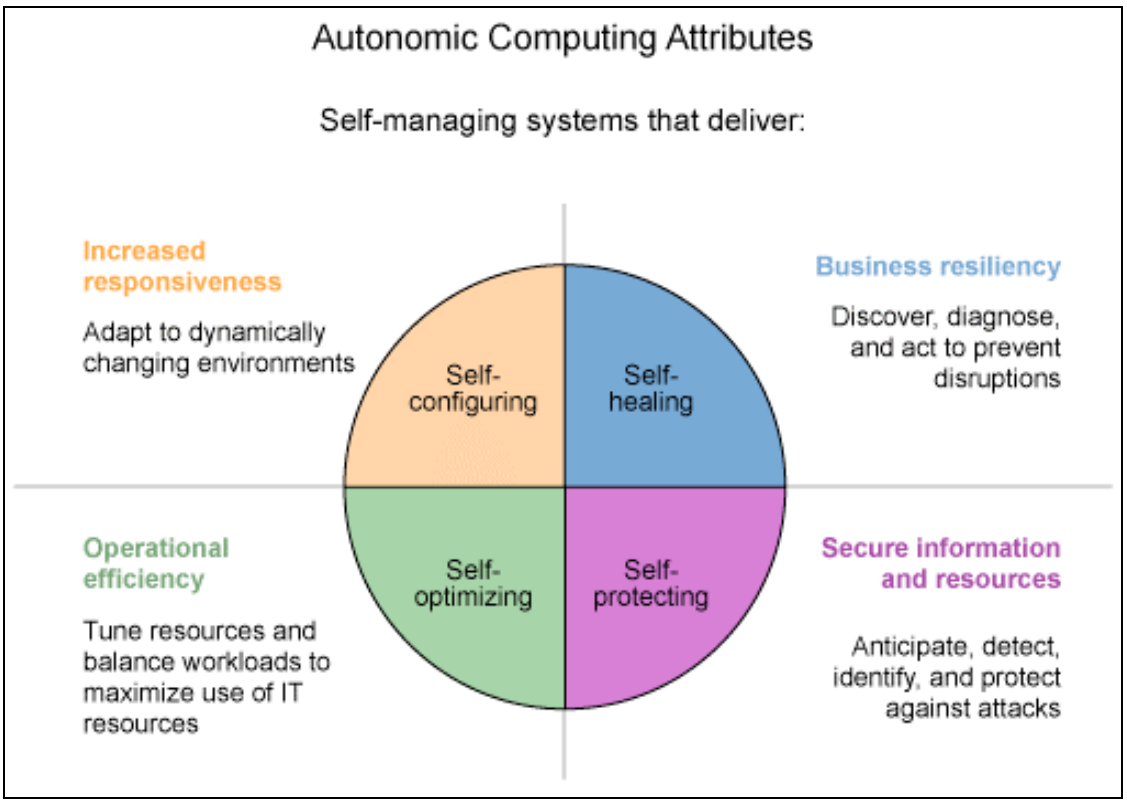
In an effort to study the possibilities of autopoietic behaviour in software systems, several things including the following were considered:

1. Extending IBM's model of Autonomic Computing with *self-replication*
2. Algebraic modelling of the structure of a biological cell
3. Autopoiesis as a quality attribute

Extending IBM's model of Autonomic Computing with *self-replication*

Autonomic computing refers to the self-managing capabilities of distributed computing resources so that they can adapt to unpredictable changes, while hiding the intrinsic complexity from the end users. It is inspired by the autonomic nervous system which controls many of the organs of the human body. The autonomic nervous system functions in such a way that we won't have to worry about what goes on behind the scenes. Moreover, it always keeps working. Inspired by these characteristics, autonomic computing strives to achieve high availability and involuntary and reflexive ways of functioning so that the end users will not have to worry about how the system functions.

The self-manageability of autonomic computing systems is a collection of four attributes: self-configuration, self-healing, self-optimization and self-protection. These four attributes together are referred to as self-CHOP and are shown in the figure below.



Courtesy: *The autonomic computing edge: Can you CHOP up autonomic computing?* by Brent Miller;

Self-configuration refers to the ability of the system to adapt to new environments automatically by deploying new components and removing existing components as needed. Self-configuration presumes a set of policies provided by the IT professionals. Self-healing refers to the ability to detect the malfunctions of the system and initiate the respective corrective actions. Self-optimization is the ability to automatically monitor and tune the resources and reallocate them in response to dynamically changing workloads so as to maximize resource utilization. Finally, self-protection is the ability to anticipate, detect, identify external attacks on the systems and protect itself from such attacks. These external threats could arise from sources such as unauthorised access and virus infection.

In addition to these four attributes, a fifth attribute namely *self-replication* was proposed. Self-replication is the ability of the system to replicate parts or whole of itself as per necessity. The system may have to replicate itself when it detects a potential virus threat on it so that when one copy is known to be attacked by a virus, the other copy could kill the first one and resume the operations.

This is a work done together with Gerard Briscoe.

Algebraic modelling of the structure of a biological cell

In order to understand how a biological cell works, I had some discussions with Paolo Dini on cellular biology, abstract algebra and the connections between them. During these discussions, Paolo explained me some group theory, ring theory, some basic cell biology and some of the works he did with other members of OPAALS.

Autopoiesis as a quality attribute

From a software-architectural perspective, autopoiesis can be seen as a quality attribute just like performance, security, availability, scalability etc. With this perspective, we had discussions on whether autopoiesis is an intrinsic property (that is, a property innate to a particular component of the system) or an emergent property (that is, a property that emerges as a result of combining certain components in a certain manner). During these discussions, examples from human immunology were considered to see how the human immune system as a whole achieves autopoietic behaviour.

OPAALS

RESEARCH EXCHANGE REPORT

July 17, 2009- Aug 16, 2009

IPTI

Administrative details

Researcher

Rishi Kumar, IIT-K, Computer Science & Engineering.

Host

IPTI, Sao Paulo, Brazil

Duration

01/07/2009 to 20/07/2009

1. Objective:

To integrate automatic tagging tool, developed at IITK into RTS, a knowledge community, developed at IPTI.

2. Background:

2.1 Automatic Tagging Tool:

The basic task of the tagging tool is to extract keywords from a set of documents automatically. This task is achieved in four ways keeping in mind the various use case scenario available in the knowledge communities:

Approach	Available	Unavailable	Advantage(s)	Disadvantage(s)
1	• Training Set • Thesaurus	NA	• Best accuracy • Highest Precision	• Processing time is huge. • Getting documents manually tagged is quite expensive.

				• Also constructing thesaurus is difficult
2	Thesaurus	Training Set	• The expense of manual tagging is done away with. • Processing time is reduced as no training phase is there. • Tags are from controlled Vocabulary	• Less Precision • Constructing thesaurus is difficult.
Approach	**Available**	**Unavailable**	**Advantage(s)**	**Disadvantage(s)**
3	Training Set	Thesaurus	• Good Precision • Free Tags • The expense of constructing thesaurus is got rid of.	• Getting documents manually tagged is expensive. • Processing time is huge.
4	NA	• Training Set • Thesaurus	• No training set required. • No thesaurus required. • No training phase	• Worst Accuracy

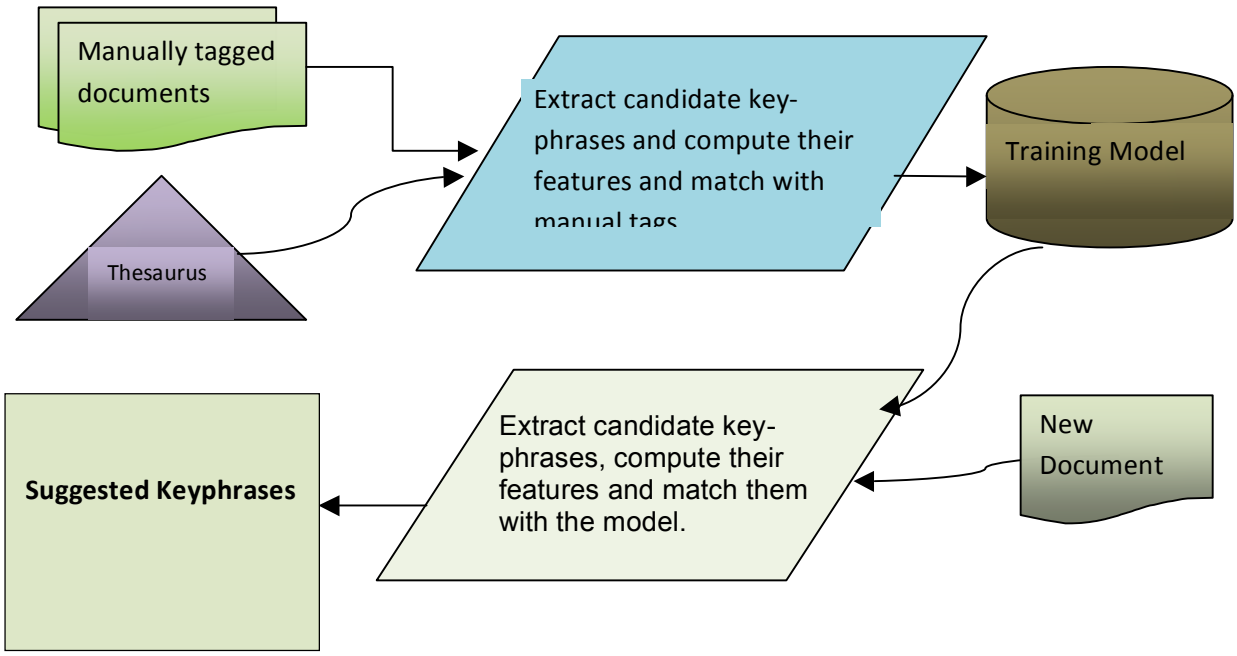
2.2 RTS

RTS is a knowledge community aiming to foster share of solutions created by ordinary people to solve social problems. For instance, a guy who developed a solution to keep rain water in a dry region can share his technology through a multimedia file and other people who face similar problem can find this file and apply the technology in their contexts. The system also aims to be enriched by those re-applications so people are also asked to describe their experience in applying the technologies.RTS works with 20 themes (water, energy, etc.).

This is the project under development at IPTI, Brazil. More by Saulo FA Barretto on this.

3. Tools Developed and Tested

We have developed the automatic tagging tool using open source KEA (http://nzdl.org/kea) and tested it on documents related to agriculture in different languages like English, French and Spanish. In each of these languages, the knowledge model is required, in the form of thesaurus in SKOS RDF format. Apart from this, a set of (say 100 documents) manually tagged documents is needed for training purpose. Also some linguistic knowledge is required like stop words and stemming rules of the language. The process of automatic extraction of keywords is depicted below:

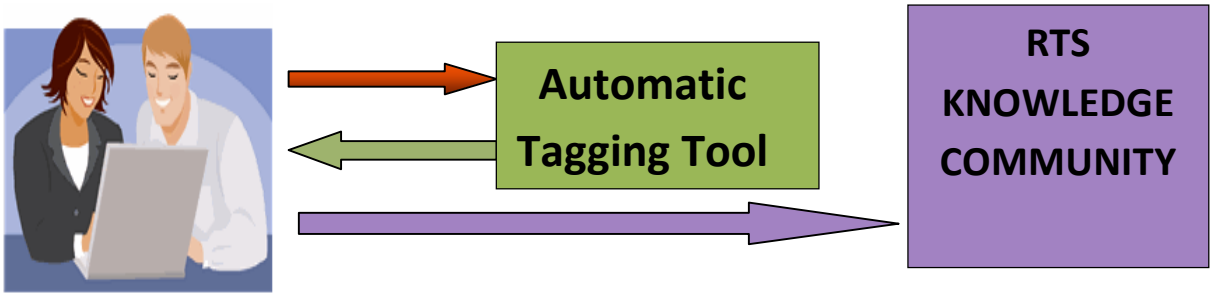


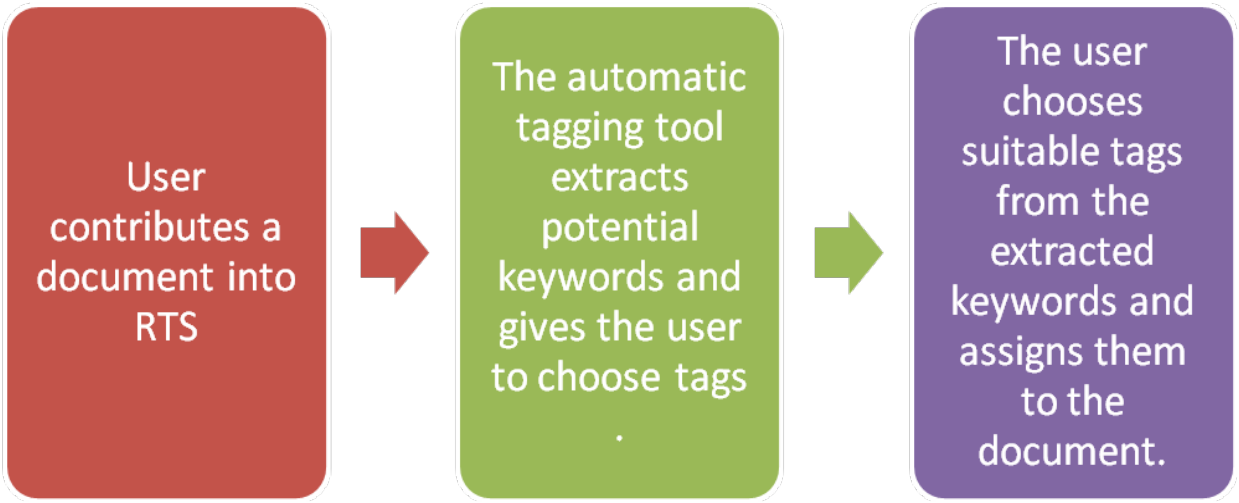
4. Research Exchange Proposal

As described in 2.1 the tagging tool requires the following 3 items for its best output:

1) Knowledge model of the domain.
2) Some 100 manually tagged documents.
3) Linguistic knowledge especially stop words and stemming rules.

Thus to integrate the tagging tool into RTS we need to adapt the tagger for Portuguese and this requires the building of the above three items for Portuguese. The idea is to demonstrate the tagging tool in RTS for at least one theme and one experience. The keywords extracted by the tool will be given to the publisher to choose tags from. Thus the tool will assist the members of RTS to assign tags to their documents, particularly text documents.





5. Research Exchange Accomplished

A. Internationalization of Tagger

a. Guessing the language of the document given the text encoding.
b. Tagging process adapted for Portuguese language(apart from English, French and Spanish)
   - Making iteratively the stopwords list for Portuguese.
   - Stemming rules for portuguese implemented.
c. Tagger tested on one use case of RTS. Results are quite satisfactory.

B. Integration with RTS

a. Ran a separate servlet that calls the automatic tagger.
b. RTS calls the URL of the servlet and fetches the tags**. (not yet uploaded on RTS)**

C. Ontology Building

a. Hands on demonstration of protégé tool given to domain experts of RTS.
b. After the creation of ontology, specifically thesaurus, the extracted tags will be a subset of thesaurus.

OPAALS PROJECT

Contract n° IST-034824

Report on Researcher Exchange

IIT Kanpur to Univerisities of Kassel, Ilmenau (Germany), Maastricht (Netherlands) & Helsinki University of Technology (Finland)

Jayanta Chatterjee
IIT Kanpur

Project funded by the European Community under the "Information Society Technology" Programme

Administrative details

Researcher

Jayanta Chatterjee
Indian Institute of Technology, Kanpur
Social Science

Host & Duration

1. Technical University of Ilmenau & University of Kassel, Germany (1 October to 21 October, 2009)
2. Helsinki University of Technology, Sober IT Lab, Innopoli, Finland (21 October to 26 October, 2009)
3. Maastricht University, Netherlands (26th October to 05 November, 2009)

Purpose

To expand the domain of collaborative research on Digital Ecosystem for Knowledge (DEK) initiated at IITK under OPAALS to other application areas like Service Ecosystem, Participative Media & University Research – Entrepreneurship Ecosystem.

Background

These Research Exchange visits were aimed at reaching out to other research communities in Europe and share with them the DEK research frameworks developed at IITK under the OPAALS Project. The key objective was to initiate new research possibilities in the subject areas generated through multi-disciplinary interactions between the target research communities and IITK Social Science Group.

Key researchers involved at :

1. TU, Ilmenau were Dr.Frauke Zeller, Marco Brauer, Ingmar Steinicke, Prof.Jens Wolling & Prof.Wimmer.
2. The collaborators at Maastricht Univetsioty were Prof, Jos Lemmink (Dean) and his research students. Subsequetly new areas have come up with Dr.Sanjay Sharma, Prof.W.Gijselares.
3. The research partners at Helsinki University of Technology were Prof.Matti Hamalainen, Prof,Kalevi Ekman, Prof,Timo Itala, Mika Helenius and research scholar Kimmo Karhu.

Conduct

All three research exchange trips were useful and fruitful as depicted by the output Publications and Workshops.

Outcomes

1. Out of the interactions with TU-Ilmneau and University of Kassel group, two research papers were generated. Both have been presented at International Conferences.
   a) The diffusion of Social Media and Impact on Knowledge Management- towards Integrative Typologies By Frauke Zeller, Jayanta Chatterjee, Ingmar Steincke and other – OPAALS Conference March 2010, Brazil and published as Springer Lecture Note Series on Computers & Communication
   b) Knowledge Diffusion over Social Media-Integrative Processes – Produsage & Prosumption by Ingmar Steinicke, Frauke Zeller, Marco Brauer and Jayanta Chatterjee - German Media Innovation Conference, DGPUK 2010.De, 12 to 14 May, 2010.

2. The Maastricht collaboration led to a major chapter in the book titled 'Science of Service Systems' edited by Dr.Haluk Demirkan & Dr.James C.Spohrer which was co-authored by Prof.Jos Lemmink of Maastricht Univerisity and Prof.Jayanta Chatterjee of IIT Kanpur. This research work is based on the problem of developing 'Interdisciplinary Pedagogy'.

3. The Workshop held at Helsinki University of Technology, Software Business Research Laboratory on 22 October, 2009, has led to several new research initiatives on 'Service Eco=system' and 'Co-Creation Phenomena' that aims at

establishing a Living Laboratory on Rural Digital Services in and around IIT Kanpur with joint funding from Finland and India

Appendix

The following three papers were produced as a result of this researcher exchange(please read in conjunction with the preceding section):

Lemmink, J G A M and Chatterjee, J (2010). "Service Science Learning: Exploring the Challenge of Cross Disciplinary and Academia-Company Collaboration", in *Science of Service Systems*, H Demirkan and J C Spohrer, Editors, Springer.

Zeller, F, Chatterjee, J, Bräuer, M, Steinicke, I, and Lapteva, O (2010). "The diffusion of social media and knowledge management – towards an integrative typology, Proceedings of the 3rd International OPAALS Conference, Sergipe, Brazil, March 2010, pp 62-75.

Hämäläinen, M, Itkonen, M and Chatterjee, J (2009). From Idea to Business – Finnish Model for Creating a University-Based Innovation, 9th International Entrepreneurship Forum, Istanbul, Turkey, 16-18 September.