Enterprise 2.0
- Research Challenges and Opportunities -

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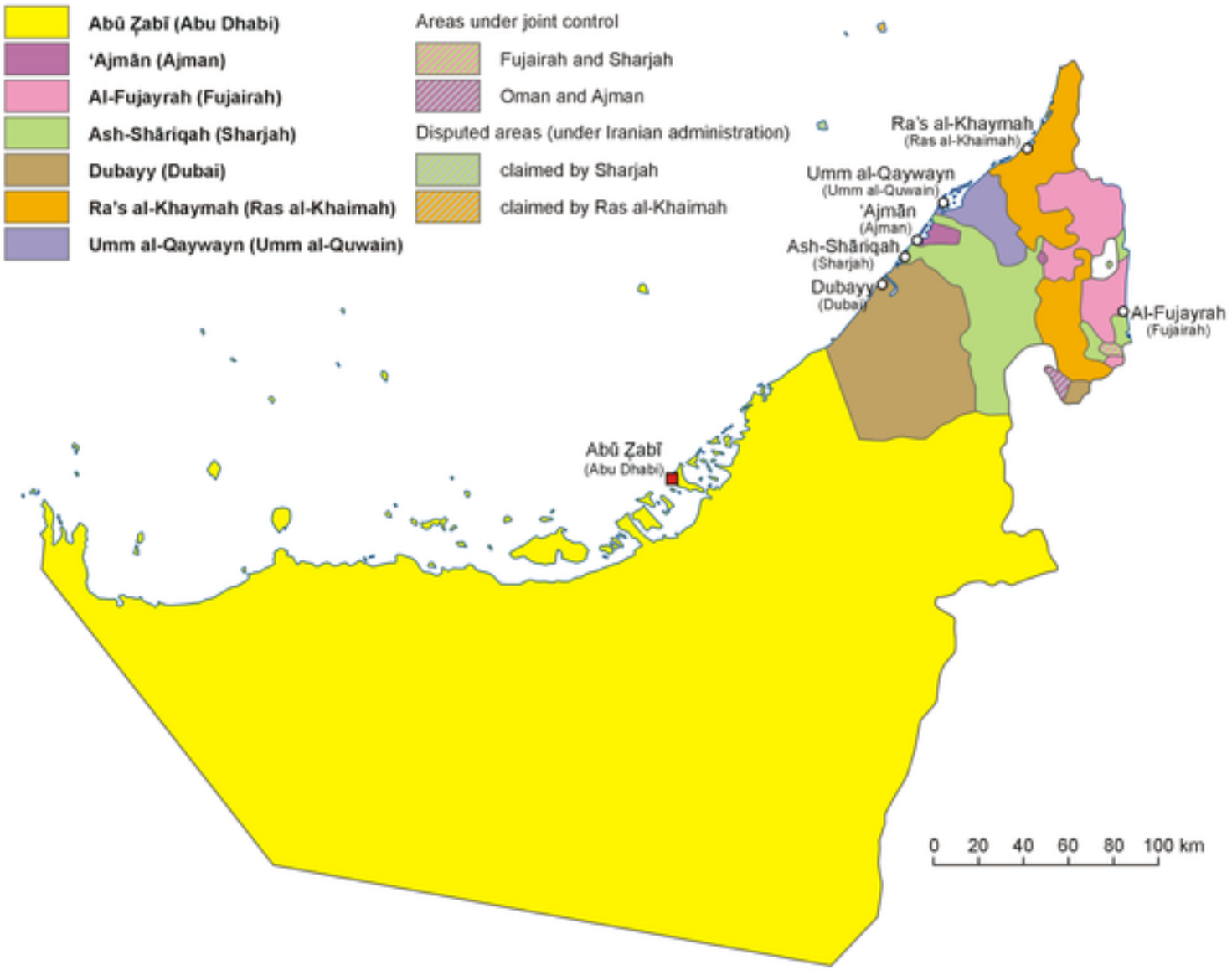
Agenda

- Brief overview of UAE and ZU
- Keynote presentation
  - Some preliminaries
  - The social fever
  - Our research initiatives (existing and ongoing)
  - Conclusion

United Arab Emirates


Abū Ẓabī (Abu Dhabi)
'Ajmān (Ajman)
Al-Fujayrah (Fujairah)
Ash-Shāriqah (Sharjah)
Dubayy (Dubai)
Ra's al-Khaymah (Ras al-Khaimah)
Umm al-Qaywayn (Umm al-Quwain)
Areas under joint control
Fujairah and Sharjah
Oman and Ajman
Disputed areas (under Iranian administration)
claimed by Sharjah
claimed by Ras al-Khaimah
Ra's al-Khaymah
(Ras al-Khaimah)
Umm al-Qaywayn
(Umm al-Quwain)
'Ajmān
(Ajman)
Ash-Shāriqah
(Sharjah)
Dubayy
(Dubai)
Al-Fujayrah
(Fujairah)
Abū Ẓabī
(Abu Dhabi)
0 20 40 60 80 100 km

Some Dubai's landmarks
Burj Khalifa, Dubai - 828 meters

Some Dubai's landmarks - Ski Dubai

Zayed University

- Established in 1998 with 2 campuses in Abu Dhabi and Dubai
- Enrollment of about 10,000 Emirati students, only
- 6 colleges (undergraduate and graduate programs):
  1. Arts and Creative Enterprises
  2. Business Sciences
  3. Communication and Media Sciences
  4. Sustainability Sciences and Humanities
  5. Education
  6. Technological Innovation (ex IT)

ZU – Dubai Campus

inside court

Keynote presentation

Enterprise 2.0 definition

- McAfee was the first to introduce the term Enterprise 2.0 as the use of emergent social software platforms within or between companies and their partners or customers, A. P. McAfee, Enterprise 2.0: The Dawn of Emergent Collaboration, MIT Sloan Management Review. Vol. 47, 3 (2006)

Towards a social world…

- Where is the social dimension in software engineering?

  Z. Maamar, "Commerce, E-Commerce, and M-Commerce: What Comes Next?", CACM, 46(12), **2003**

- Paving the way for the m-commerce post-era by combining social aspects and technology: social commerce (s-commerce)

Social computing

- It is about collective action, content sharing, and information dissemination at large
- User ability and willingness to interact, share, collaborate, and recommend content, people, applications, etc.
- Users are now referred to as prosumers, i.e., providers and consumers at the same time

Preliminaries

- Structured *vs.* Unstructured Business Processes (BPs *aka* know-how)
  - Informal taking over formal:
    - New work practices emerge raising concerns over "who does what", "how and when it was done", etc.
  - Informal becomes omnipresent when
    - The formal is inefficient
    - Unusual/unforeseen situations require immediate attention

- Today's enterprises have to juggle with
  - Globalization challenges (local *vs.* global competition)
  - Market volatility (new regulations)
  - Stakeholder diversity (customers, suppliers, etc.)
  - Etc.

- Could enterprises tap into the informal world?
  - Develop new business models
  - Understand market trends
  - Open up new communication channels to reach out to stakeholders

The social fever (Big-Data era)

- Average number of tweets per day: 58 million, http://www.statisticbrain.com/twitter-statistics

- 55 million photos uploaded every day through Instagram, http://jennstrends.com/wp-content/uploads/2014/02/2014-IG-Stats-Engagement-Levels.jpg

- "*Facebook says it now has 1.11 billion people using the site each month, slightly more than the 1.06 billion reported three months earlier*", http://news.yahoo.com/number-active-users-facebook-over-230449748.html

- Web 2.0 technologies are helping set the stage for the Enterprise 2.0 (or Social Enterprise)
  - Top-down command flow and bottom-up feedback flow in traditional enterprises
  - These flows in Enterprise 2.0 cross all levels and in all directions
    - Bringing people together for the development of creative and innovative products and services.

However…

- *"…Many large companies are embracing internal social networks, but for the most part they're not getting much from them"* How to Analyze Your Sales Processes on Efficiency versus Effectiveness, Gartner report, 2012

- *A survey of 1,160 business and IT professionals shows that while 46% of the organizations increased their investments in social technologies in 2012, only 22% believed that managers are prepared to incorporate social tools and approaches into their processes"* M. Vizard. IBM: Business Processes Need to Get Social in 2013, ITBusinessEdge, December 2012

- Gartner reports that some 80% of social business software projects will not achieve intended benefits through 2015 (http://www.computerworld.com/s/article/9236323)

Social software

- Erol et al. note that "…*impressive results are created without a central plan or organization. Instead, social software uses a self-organization and bottom-up approach where interaction is coordinated by the 'collective intelligence' of the individuals; the latter do not necessarily know each other and are a priori not organized in a hierarchy*", Erol et al. Combining BPM and Social Software Contradiction or Chance, *Journal of Software Maintenance and Evolution: Research and Practice*, 22(6-7), pp. 449-476, October-November 2010

- Social software's four properties: weak ties, social production, egalitarianism, and mutual service provisioning, Bruno et al. Key Challenges for Enabling Agile BPM with Social Software, *Journal of Software Maintenance and Evolution: Research and Practice*, 23(4), 2011

- For Liptchinsky et al., social software "*fosters collaboration of individuals who work across time, space, cultural, and organizational boundaries*", Liptchinsky et al., A Novel Approach to Modeling Context-Aware and Social Collaboration Processes, in *Proceedings of the 24th International Conference on Advanced Information Systems Engineering (CAiSE'2012)*, Gdańsk, Poland, 2012

- Social software does not work like an ERP application
  - Procedures are defined and employees are told to comply with them
  - Employees' commitments (willingness) to using social software are a critical factor to success, i.e., employees must opt-in rather than forced

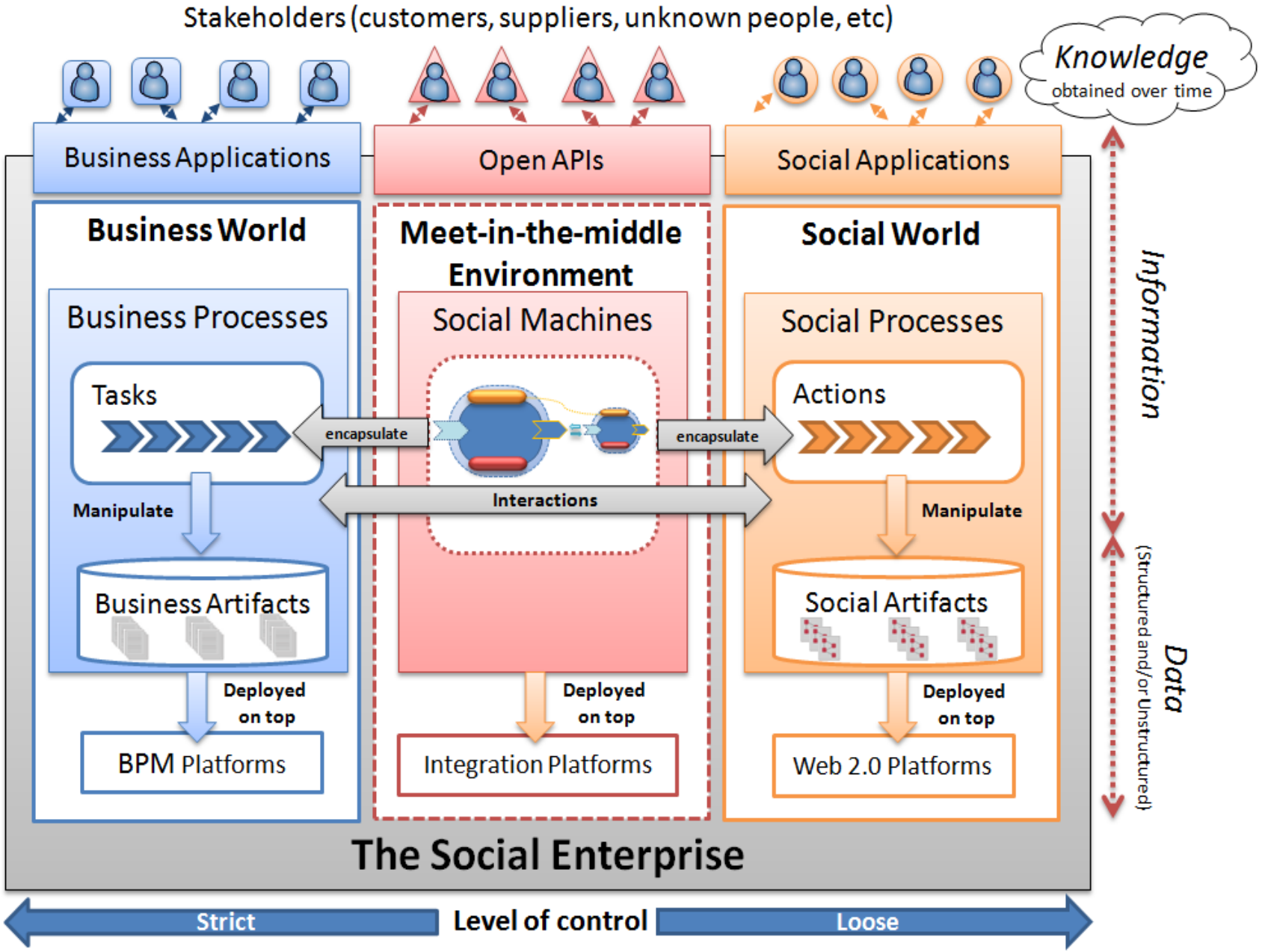
Social coordination

- Coordination success is dependent on selecting a proper coordination strategy (P. P. A. Storms and T. J. Grant. Agent Coordination Mechanisms for Multi-National Network Enabled Capabilities, in Proceedings of the 11th Coalition Command and Control in the Networked Era, Cambridge, UK, 2006):
  - Implicit *versus* explicit
  - Dynamic *versus* static
  - Cooperation *versus* competition
  - Centralized *versus* decentralized

- How about a fifth strategy built upon social relations?
  - Implicit strategy relies on supervision relation between supervisors and supervisees to identify who delegates to whom and what to delegate
  - Competition strategy relies on trustworthiness relation to ensure that a community's inhabitants are ready and willing to share valid details
  - Decentralized strategy relies on friendship relationship to guarantee proper dissemination of any necessary detail among a community's inhabitants

What can be done?

- The enterprise 2.0 needs a new business model
  - The technology perspective identifies the future Web 2.0 applications that seem relevant for sustaining the enterprise growth and fall into its mission
  - The organization perspective puts in place the necessary procedures that permit an efficient use of the Web 2.0 applications
  - The management perspective identifies the relevant metrics (or key performance indicators) that permit to evaluate this efficient use


Stakeholders (customers, suppliers, unknown people, etc)
Knowledge
obtained over time
Business Applications
Open APIs
Social Applications
Business World
Meet-in-the-middle Environment
Social World
Business Processes
Social Machines
Social Processes
Tasks
encapsulate
encapsulate
Actions
Interactions
Manipulate
Manipulate
Business Artifacts
Social Artifacts
Deployed on top
Deployed on top
Deployed on top
BPM Platforms
Integration Platforms
Web 2.0 Platforms
The Social Enterprise
Information
Data
(Structured and/or Unstructured)
Strict
Level of control
Loose

Our ongoing research work

- *"... Currently, most social networks connect people or groups who expose similar interests or features. In the near future, we expect that such networks will connect other entities, such as software components, Web-based services, data resources, and workflows. More importantly, the interactions among people and nonhuman artifacts have significantly enhanced data scientists' productivity"*

  Tan et al., Social-Network-Sourced Big Data Analytics, IEEE Internet Computing, 17(5), September/October 2013

What is a business process?

- A BP dictates why, how, when, and where to do things in response to internal and external events
- Some process performance is strictly confined into the borders of a single organization unit (e.g., finance department), the performance of others spans several, sometimes disparate, organization units
  - Security, privacy, heterogeneity, and monitoring concerns among process engineers and end-users

BPs social design

- Some obstacles
  - Lack of design approaches that help illustrate how BPs could/should connect to Web 2.0 applications
    - Limited use of Web 2.0 applications
    - BPs ignoring Web 2.0 applications' offered opportunities
  - Web 2.0 applications are open, loosely controlled, dynamic, etc.
  - As long as appropriate social relations are not identified, the role of social software in enterprises is mitigated

- 3-stage proposed solution
  1. Develop specialized social relations that permit to connect tasks together, persons together, and machines together in a BP
  2. Build networks upon the social relations that reflect how tasks, persons, and machines engage in completing BPs
  3. Assess the value-added of these networks to the enterprise operation

Stage 1 – Relation identification

- Between tasks
  - Execution relations: prerequisite, parallel prerequisite, and parallel
  - Social relations: Interchange and coupling
- Between persons
  - Execution relations: enablement and inhibition
  - Social relations: substitution, delegation, and peering
- Between machines
  - Execution relations: enablement and inhibition
  - Social relations: backup, cooperation, and partnership

Entities involved	Social relation types	Pre-conditions	Conditions	Post-Conditions
t_i, t_j	Coupling	t_i and t_j participated in joint business processes	review of business process design or concern over coupling level	business-process design completion or coupling level satisfaction
	Interchange	t_i and t_j producing similar output in receipt of similar input	t_i lacking of executor who satisfies its requirements	executor found for t_j
m_i, m_j	Backup	m_i and m_j having similar capacities	m_i unexpected failure or concern over m_i reliability	backup/replacement machine found for m_i
	Cooperation	m_i and m_j having similar capacities	concern over machine collective-performance	collective- performance level satisfaction
	Partnership	m_i and m_j having complementary capacities	concern over machine collective-performance	collective- performance level satisfaction
p_i, p_j	Substitution	p_i and p_j having similar capacities	p_i expected unavailability (e.g., annual leave and sick leave) or concern over p_i availability	substitute found for p_i
	Delegation	p_i and p_j having similar capacities	p_i unexpected unavailability (e.g., call in-sick, urgent task to complete, and risk of overload)	delegate found for p_i
	Peering	p_i and p_j having similar or complementary capacities	concern over peering appropriateness	peer found for either p_i or p_j

Stage 2 – Network development

- Configuration network of tasks
  - Node and edge correspond to task and relation between tasks, respectively

- Support network of machines
  - Node and edge correspond to machine and relation between tasks, respectively

$$w^{S}_{delegation_{(p_i,p_j)}} = \frac{\left|delegateSuc_{T^{del}_{p_i},(p_i,p_j)}\right|}{\left|T^{del}_{p_i}\right|}$$

- Social networks of persons
  - Node and edge correspond to task and person between tasks, respectively

- Grim-Yefsah et al. reveal the existence of informal networks that people at work rely on to conduct their business. These networks co-exist perfectly with regular networks where formal relations like supervision are reported. They discuss how the "official" executor of a task seeks informally help from other persons in the organization known as contributors
  - The help takes different forms like asking for advices or confirming a technical detail
  - The contributors are contacted because of their tacit knowledge that cannot be shared nor transmitted easily
  - The informal networks are here to back the work of regular networks

Grim-Yefsah et al. Using Information of an Informal Network to Evaluate Business Process Robustness. In Proceedings of the International Conference on Knowledge Management and Information Sharing (KMIS'2011), Paris, France, 2011.

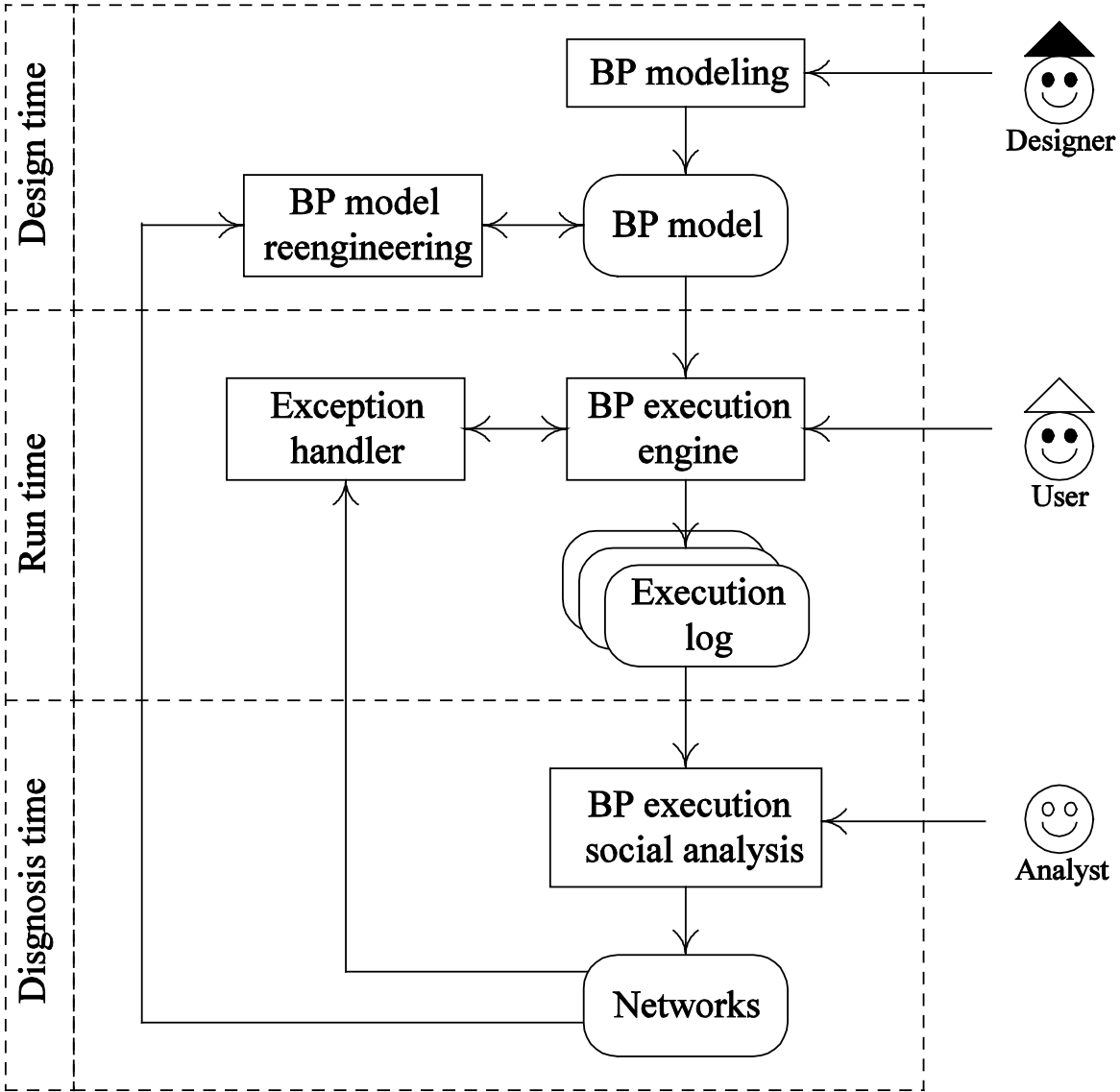
Stage 3 – Value-added of networks

- Configuration network of tasks
  - An interchange network is used when a task's requirements cannot be satisfied at run time due to lack of executors
    - Another similar task with different requirements is considered using the interchange weight as a selection criterion
    - The combined weight of all the interchange edges compared to a certain threshold (Tinterchange) indicates the satisfaction level of a task's requirements with respect to the available capacities of executors

- Support network of machines.
  - A backup network is used when either a machine breaks down unexpectedly or there is a concern over the reliability of a machine
    - In either case another machine is considered through this network to ensure task execution
    - The combined weight of all the backup edges compared to a certain threshold (Tbackup) indicates the reliability level of a machine and how straightforward it is to replace with respect to the available capacities of machines. This level could avoid assigning less reliable machines to critical tasks

- Social network of persons.
  - A substitution network is used when either there is a concern over a person availability or a person unavailability is planned due to annual leave, for example. In either case another person with similar capacities is considered using the substitution weight as a selection criterion
    - The combined weight of all the substitution edges compared to a certain threshold (Tsubstitution) indicates the engagement level of a person in helping peers execute their tasks

Social-based bUsiness Process managEment fRamework (SUPER)



BPs social coordination

- Some obstacles
  - Resource (e.g., data, power, and CPU time) consumption/use might raise conflicts
    - Some do not last forever, some are limited, and some are not shareable
  - Limited use of details collected out of networks of tasks, networks of persons, and networks of machines

- 4-stage proposed solution
  1. Categorize resources that BPs require for their completion
  2. Define how tasks/machines/persons in a BP bind to resources to achieve this completion
  3. Categorize conflicts on resources that arise between tasks, between machines, and between persons
  4. Analyze the appropriateness of certain networks of tasks/persons/machines for addressing these conflicts

Stage 1 - Resource categorization

- Logical resources (i.e., their use/consumption does not lead into a decrease in their reliability/availability level)
- Physical resources (i.e., their use/consumption does lead into a decrease in their reliability/availability level), which necessitates their replacement (this can be the result of degradation) or replenishment at a certain stage

- Resource properties: Unlimited, limited, limited but renewable, shareable, and non-shareable
- Resource's consumption cycle:
  - E.g., unlimited property: $r(cc_{ul})$:

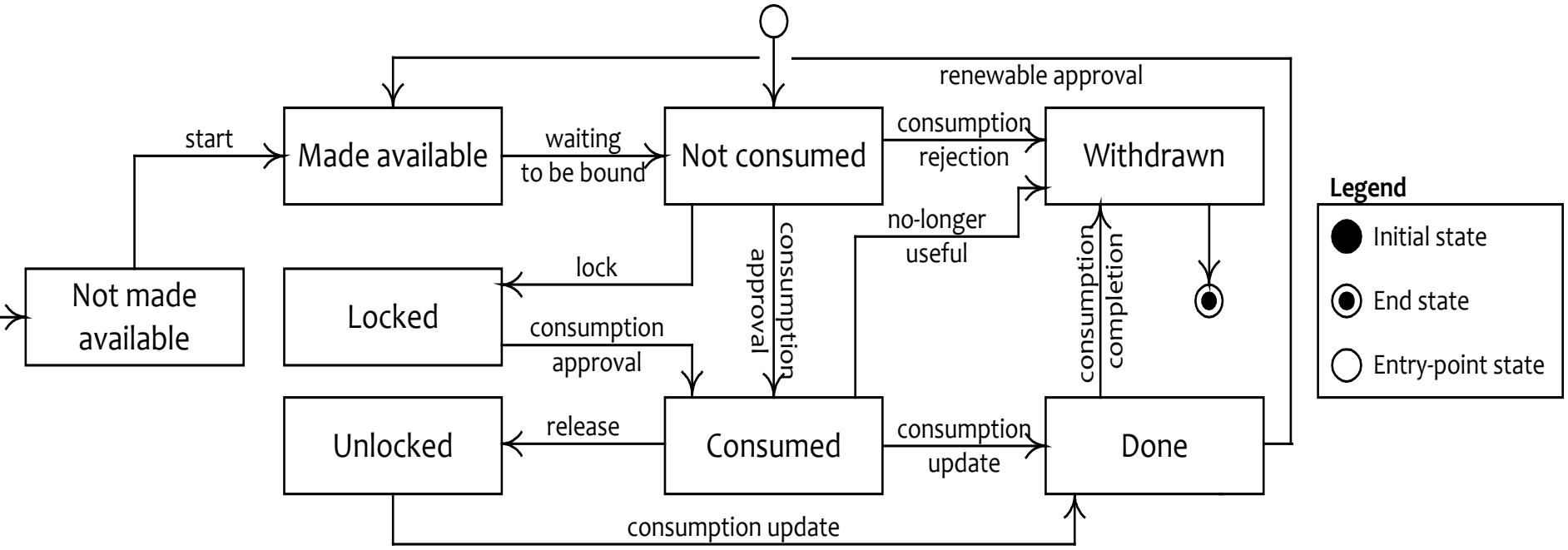
$$\text{not-made-available} \xrightarrow{start} \text{made available} \xrightarrow{\substack{waiting\ to \\ be\ bound}} \text{not}$$

$$\text{consumed} \xrightarrow[approval]{consumption} \text{consumed} \xrightarrow[useful]{no\ longer} \text{withdrawn}$$

The resource remains available for continuous consumption until the transition from consumed to withdrawn is satisfied

Examples of logical resources with respect to their properties

Properties of logical resource	Examples
Unlimited	Data (read mode), software (no cap on number of licenses, no expiry date)
Limited	Thread
Limited but renewable	File access right (valid for a certain time with possible extension), password (valid for a certain time with possible extension)
Shareable	Web server, database management system
Non-shareable	Data (update mode)



State transition diagram of a resource

Stage 2 – Resource binding

- **consume**(t_i,r_i): the performance of t_i requires consuming r_i
  - Independently of the success or failure of this performance, its impact on r_i differs such as for *logical*: (*ul*: no-impact), (*l*: resource withdrawal) (*lr*: no-impact), (*s*: no-impact), and (*ns*: no-impact).

- **use**(p_j,r_j,**consume**(t_i,r_i)): the performance of t_i by p_j requires that p_j uses r_j
  - This performance, whether successful or failure, leads also into consuming r_i as well. Similar impact as stated above

- **use**(m_k,r_k,**consume**(t_i,r_i)): similar to **use**(p_j,r_j,**consume**(t_i,r_i))

Stage 3 - Conflict categorization

- Conflicts over resources exist between tasks, between machines, and between persons

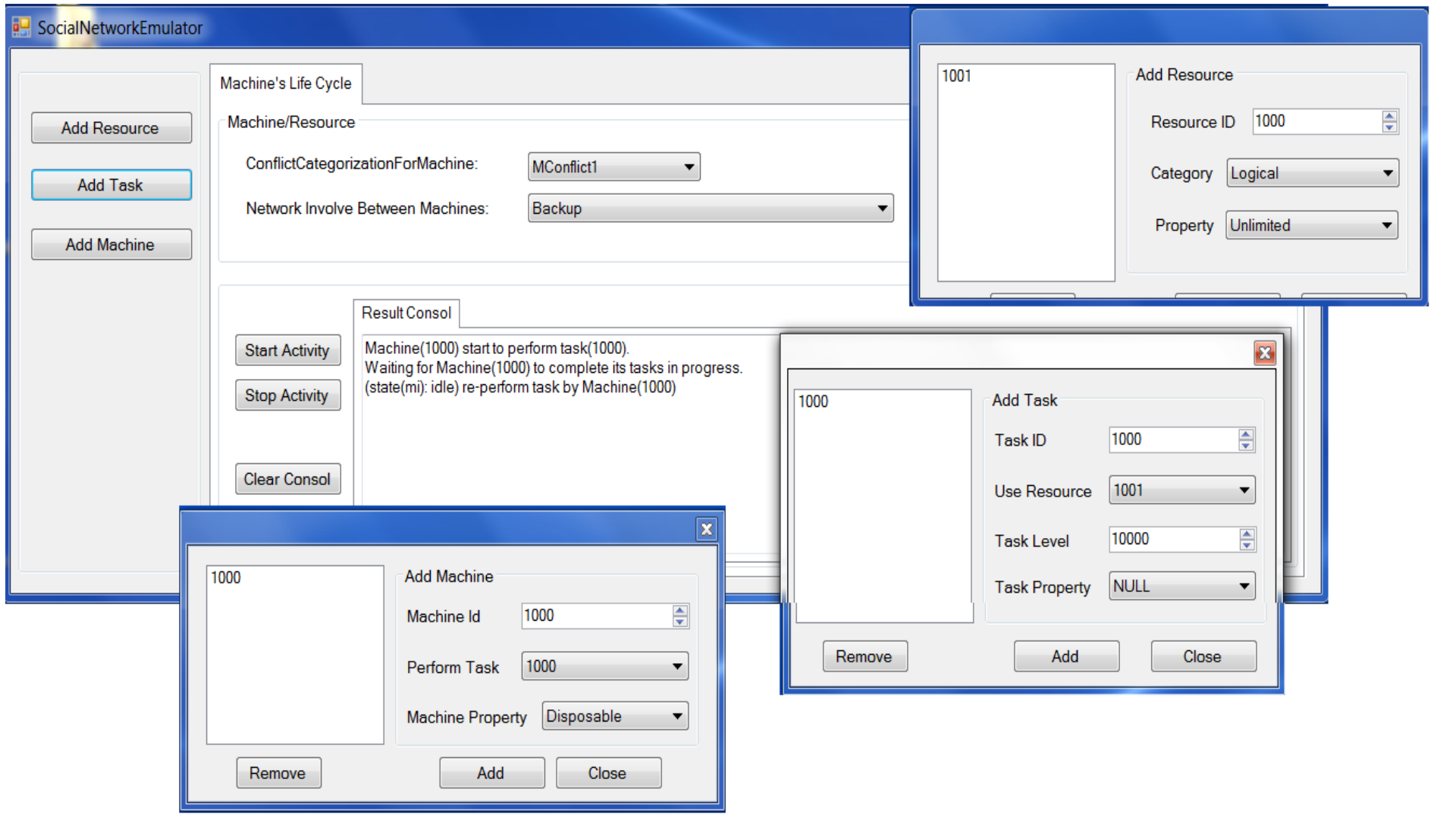
- Examples of conflicts between tasks
  - T-Conflict$_1$ arises when a prerequisite relation between t_i and t_j exists, **consume**$(t_i,r_i) \rightarrow$ produce$(t_i,r_{i,j})$ and t_j needs $r_{i,j}$ (i.e., $\neg(t_j \rightarrow r_j)$)
  - limited: two cases result out of the **prerequisite** relation between $t_{\{k,\ldots\}}$ and t_j on top of the same relation between t_i and t_j:
    - (a) $r_{i,j}$ ceases to exist before the performance of t_j begins; t_j waits for $t_{\{k,\ldots\}}$ to produce $r_{\{k,\ldots\},j}$; (at least one) $t_{\{k,\ldots\}}$ either is still under performance or failed
    - Only one consumption cycle of $r_{i,j}$ is permitted (per type of property) but it turns out that several consumption cycles are required to complete the performance of t_j and finish the consumption of $r_{\{k,\ldots\},j}$ that $t_{\{k,\ldots\}}$ produce.

Stage 4 – Conflict resolution

- Aspects that are taken into account
  - Tasks' transactional properties: pivot, retriable, and compensatable
  - Resources' properties: limited, unlimited, etc.

Possible coordination actions for T-Conflict$_1$

Transactional property		Coordination actions	Network involved
t_i	t_k		
Null	Null	- re-perform t_i to re-produce $r_{i,j}$ - re-perform t_k to produce $r_{k,j}$	N/A
	Pivot	Deadlock	N/A
	Compensatable	Deadlock	N/A
	Retriable	- re-perform t_i to re-produce $r_{i,j}$ - replace t_k with $t_{k'}$ then perform $t_{k'}$ to produce $r_{k',j}$	Interchange(t_k, $t_{k'}$)
Compensatable	Null	- compensate t_i; either re-perform t_i to re-produce $r_{i,j}$ or replace t_i with $t_{i'}$ then perform $t_{i'}$ to produce $r_{i',j}$ - either re-perform t_k to produce $r_{k,j}$ or replace t_k with tk' then perform $t_{k'}$ to produce $r_{k',j}$	Interchange(t_i, $t_{i'}$)
	Pivot	Deadlock	N/A
	Compensatable	- compensate t_i; either re-perform t_i to re-produce $r_{i,j}$ or replace t_i with t_i then perform $t_{i'}$ to produce $r_{i',j}$ - replace t_k with $t_{k'}$ then perform $t_{k'}$ to produce $r_{k',j}$	Interchange(t_i, $t_{i'}$) Interchange(t_k, $t_{k'}$)
	Retriable	- compensate t_i; either re-perform t_i to re-produce $r_{i,j}$ or replace t_i with $t_{i'}$ then perform $t_{i'}$ to produce $r_{i',j}$ - re-perform t_k to produce $r_{k,j}$	Interchange(t_i, $t_{i'}$)


SocialNetworkEmulator
Add Resource
Add Task
Add Machine
Machine's Life Cycle
Machine/Resource
ConflictCategorizationForMachine:
MConflict1
Network Involve Between Machines:
Backup
Result Consol
Start Activity
Stop Activity
Clear Consol
Machine(1000) start to perform task(1000).
Waiting for Machine(1000) to complete its tasks in progress.
(state(mi): idle) re-perform task by Machine(1000)
1001
Add Resource
Resource ID
1000
Category
Logical
Property
Unlimited
1000
Add Task
Task ID
1000
Use Resource
1001
Task Level
10000
Task Property
NULL
Remove
Add
Close
1000
Add Machine
Machine Id
1000
Perform Task
1000
Machine Property
Disposable
Remove
Add
Close

BPs social monitoring

- Some obstacles
  - Effectiveness (i.e., are we doing the right things?) and efficiency (i.e., are we doing things right?)
  - Limited monitoring of BPs progress by excluding social aspects such as who interacts with whom, when, where, etc.

- 4-stage proposed solution
  1. Identify additional flows on top of communication and control
  2. Study the operationalization and interconnections of these flows
  3. Drill into these flows to establish execution patterns
  4. Identify some emergent work practices from these execution patterns

Ongoing research projects

1. Tagging BPs
   - Building networks of tags based on task dependencies
2. Behaviors of BPs' components
   - Assigning social qualities to persons and machines, how about tasks?
3. Restrictions on social actions
   - Mitigating the risks of social actions execution

Conclusion

- Today's economic and political contexts pose new challenges to those who make decisions by relying on personal contacts and unstructured information sources such as social networks.

- Enterprise executives' reliance on social networks raises concerns over drawing the line between professional life and social life

Tips to become an Enterprise 2.0

- Technology perspective analyses the available Web 2.0 technologies in the market that could be in line with the mission of the enterprise:
  - Understand the different types of Web 2.0 technologies in terms of pros and cons
  - Set the necessary functional and non-functional criteria that will allow selecting the appropriate Web 2.0 technologies depending on the enterprise's goals
  - Define the technical specifications of the computing resources upon which the Web 2.0 applications will operate
  - Develop a risk analysis (e.g., what-if) of the impact of Web 2.0 applications on the enterprise operation.

- Management perspective establishes the value-added of Web 2.0 applications to the enterprise:
  - Evaluate how the social enterprise can leverage Web 2.0 applications through tangible benefits (or key performance indicators)
  - Monitor the activity level of the Web 2.0 applications (e.g., number of active members and number of posted messages)
  - Assess the Web 2.0 applications' return-on-investment (e.g., number of new customers and increase in sales volume).
  - Harness the available content on Web 2.0 applications into a content that is suitable for decision making

Without tangible benefits, accurate performance indicators, and proper unstructured content for use, it will be challenging for any enterprise to back its Web 2.0 investment

- Organization perspective establishes the necessary procedures that regulate the use of Web 2.0 applications in accordance with the enterprise's policies:
  - Indicate how, when, and where employees can engage in Web 2.0 operations.
  - Define the nature of content that can be discussed over Web 2.0 applications.
  - Set policies for reaching out to Web 2.0 applications' respondents.

Without proper awareness and guidance, ``I did not know'' could become the default response to actions taken over Web 2.0 applications

Thank you for your patience

Q&A