A Theoretical Basis for the Management of Human-Driven Processes

Workshop on Petri nets and pi-calculus for business processes

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Are all processes grey in the dark?

- *Mechanistic* processes are different from *human-driven* processes
- What characterizes the 2 sorts of process?
- How should we model them?

The 2 types of process

- Mechanistic
  - Routinized
  - Human involvement limited to key points
  - Semi- or fully-automated
- Human-driven
  - Involve innovation
  - Depend on interaction
  - Dynamically shaped by the participants

Example processes of the 2 types

MECHANISTIC

- Compliance testing
- Facilities construction
- New product release
- Component sourcing
- Assembly line
- Logistics
- Invoicing
- Settlement
- Returns
- Stock level maintenance
- Purchase order approval
- Payroll
- Stock trading

HUMAN-DRIVEN

- Research
- Product design
- Marketing
- Merging companies
- Auditing
- Treating a patient
- Controlling an epidemic
- Implementing a government policy
- Dealing with a natural disaster
- Running an election campaign
- Solving a crime
- Military action
- Restoring an old building

Mechanistic processes

- *Software support* is becoming standardized
  - BPEL
  - XPDL
  - etc
- *Theoretical foundations* are strong, for example:
  - Petri nets for high-level depiction
  - Pi-calculus for low-level description
- Practice and principles not yet harmonized
  - Hence this workshop

Human-driven processes

- *Software support* is poor
  - BPEL, for instance, provides no place at all for human involvement
- *Theoretical foundations* are missing
  - Is a process a program?
- Human Interaction Management (HIM)
  - Complete theory of human collaborative work
  - Draws from various disciplines

Human Interaction Management

- Complete theory of HIM beyond scope of this presentation
- We will outline some aspects of human-driven processes
- Then focus on Petri and pi
  - How they are used in conjunction
  - To model *process management*

What makes human-driven processes different?

- Intentionality
- Data
- Mental work
- People are not automata
- Process dynamism

Intentionality

- Intention of each process participant is important
- We can break this down:
  - Goals
    - Endpoint(s) for process participant
  - Responsibilities
    - May prevent certain actions being taken

Data

- Typically maintained privately
  - Although may be synchronized centrally
- May be expressed informally
  - Minimal structure
  - Ambiguous semantics
- May have metadata attached
  - Also informal

Mental work

- Activities that are:
  - Investigative
  - Analytic
  - Decisive
- May not move the process on in a visible way
  - Indirect effect on process deliverables

People are not automata

- Do not operate like a conventional program
  - Not by procedural control flow
  - More according to declarative rules
    - Although analogy requires care, since the actions people take are indeterminate, based on a combination of circumstances and inclination
- Can model activities as controlled by pre- and post-conditions
  - Any number may be true at once
  - Hence, if there are states in a human-driven process, they are formed by the combination of all such conditions
  - Treating them individually not a convenient approach to modelling
- *Beyond the scope of this presentation, but we use the Z notation to:*
  - *Describe when activities can take place and their effect*
  - *Leave humans with just the right amount of control*
  - *Visualize this via Role Activity Diagrams (RADs)*
    - *Using new and more powerful semantics for the notation*

Process dynamism

- Much of the process is about definition of what is to happen next
  - Agreement on the rest of the process
- Implications for process management:
  - How agreement is gained
  - How agreement is described
  - How agreement is shared
- *This is where Petri and pi come in …*

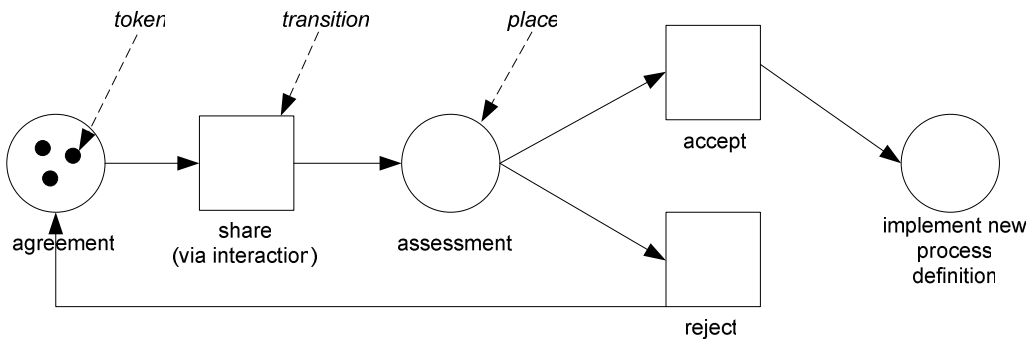
Separation of control

- Management control
  - The day-to-day facilitation of human activity
    - Resourcing
    - Monitoring
    - Process re-design
  - Part of operating the process
  - Comes from within
- Executive control
  - Determining the framework of a process
  - Primary Roles, interactions and deliverables
  - Comes from above
- Strategic control
  - Yet higher level of management activity
  - Concerned with the general direction of the organization
  - Expressed as:
    - Vision
    - Mission statement
    - Policies
    - Roadmaps
    - etc

Management control (1 of 2)

- Need to understand how the process will evolve
- Can use a Petri net to track and control this evolution
  - *Place* represents a stable process definition
  - *Transition* depicts the distribution for approval or implementation of an agreement made by process participants on future process change
    - Potentially moves the running process from one definition to another
    - Either to refine it or alter it

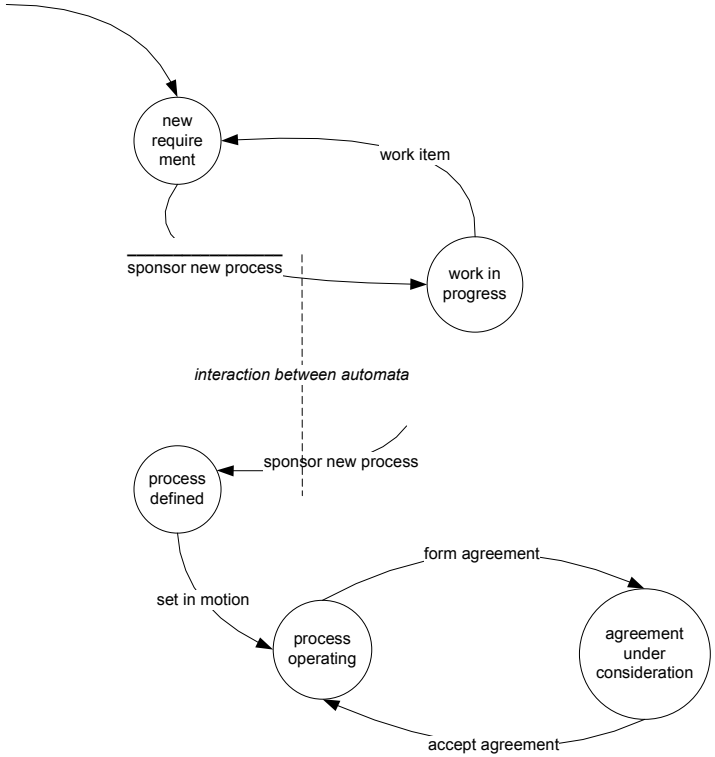
Management control (2 of 2)



Executive control (1 of 2)

- Need to understand how the process is controlled
  - A higher-level view of process change, abstracted away from the individual agreements made
- Can use pi-calculus to model authority and delegation
  - Automaton represents a self-contained process network
    - A group of Roles, co-operating via interactions, and responsible both for management control and for the work itself
  - Actions equate to process changes
    - In a sense, a pi-calculus action summarizes the impact of the individual Petri net transitions described above (distribution, approval, and implementation of an agreement on change)
  - Ports show the fundamental mechanisms of executive control
    - How communication is effected between the executive sponsor who initiated a process and the lead Role of the process itself
    - Mobility equates to the implementation of executive control, and its transfer from one Role to another
      - For instance, when authority over a process is granted or delegated

Executive control (2 of 2)



Strategic Control

- Need to understand why we have certain processes and not others
- Relation to work processes is indirect
- Not yet covered by HIM

Summary

- Human-driven processes are unlike mechanistic processes
  - Involve innovation
  - Depend on interaction
  - Dynamically shaped by the participants
- Need to understand how the process will evolve
  - Can use a Petri net to track and control this evolution
- Need to understand how the process is controlled
  - Can use pi-calculus to model authority and delegation

Further reading

- "Human Interactions: The Heart and Soul of Business Process Management"
  - Harrison-Broninski, Meghan-Kiffer Press, 2005
  - http://www.mkpress.com/hi
- Articles on Human Interaction Management (HIM) and the Human Interaction Management System (HIMS):
  - The Philosophy Of Human Interaction Management (bpm.com)
  - What is going on in your Organization? (bpmg.org)
  - Human Interaction: The Missing Link in BPM (Part I) (ebizq.net)
  - Human Interaction: The Missing Link in BPM (Part II) (ebizq.net)
  - Managing Process Change? Easy as Pi (and Petri) (bptrends.com)
  - Building Your SOA for the Human Race (ebizq.net)
- http://www.rolemodellers.com/abstracts
  - A Role-Based Approach To Business Process Management
  - Role-Based Transaction Management In Collaborative Systems
  - Modelling Human-Driven Processes
  - RADs and the UML