Business Artifacts:

A Data-Centric Approach to Business Process Modeling & Management

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Outline

- Data: Critical to Business Processes
- Current BP Development & Management Practice
  - Challenges
    - Activity centric (e.g., Visio diagrams), data left to lower level design
- Business Artifacts:
  - Blending data with business processes
  - Business processes as lifecycles of business artifacts
- Overview of Research Focuses
- Conclusions
Business (Biz) Processes

- A **business process** is an **assembly** of one or more related **activities** (automated or manual) that collectively realizes a **business objective** or policy goal, normally within the context of an **organizational structure** defining functional roles and relationships.

- **Example:** *Obtaining a Permit* (Hangzhou HMB)

  - application
  - preliminary review
  - secondary review
  - approval
  - delivery
  - certificate
  - lic. fee payment
BP Management Systems (BPMSs)

Software systems to manage, support, and control:
- biz process models
- data \((documents, files, \ldots)\)
- enactments
- resources \((including human)\)
- others \((e.g. support for auditing)\)

BP “=” workflow in the wider sense

Traditional concept of workflow in 80’s to early 90’s restricted to mostly task sequencing
Mckinsey Global Institute, June 2011: **Big data: The next frontier for innovation, competition, and productivity**

- **Availability of “big data” brings opportunities for improving productivity**

Data Quality Solutions Summit 2012

$600 to buy a disk drive that can store all of the world’s music

5 billion mobile phones in use in 2010

30 billion pieces of content shared on Facebook every month

40% projected growth in global data generated per year vs. 5% growth in global IT spending

235 terabytes data collected by the US Library of Congress by April 2011

15 out of 17 sectors in the United States have more data stored per company than the US Library of Congress
Two observations

- A significant portion of big data generated from biz processes
- Productivity growth only obtainable via more efficient/effective biz processes
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Vanda Group

- Developing workflow systems for regional banks, credit unions, provident funds, ... (in China)

- Est. 60% of the market excluding national banks

Key obstacles:

- Training (engineer liquidity)

- Repetition of work, labor intensive (could make more $$ or ¥¥ and be more competitive)

- High maintenance cost

*developed* workflow application domains
Hangzhou Housing Management Bureau

- City population: 8.7 millions
- One division (~400 SMEs) deals with all real estate licenses, permits, titles, etc.
- 300,000 cases each year:
  - ~500 biz process models, 35% 1 day, 30% 7-9 days
- Contractor/in-house development of workflow systems (¥¥ millions for in-house only)

Challenges:
- Manage changes (policy, environment, ...)
- Serious lack of automation for design-development-maintenance
Hospitals: RuiJin & SB Cottage

- Health care delivery: much of the $300 billion could be gained [MGI’11]
- Treatment workflows can fundamentally improve health care quality

Falling far behind:
- No workflows, conflicting “workflows”
- “Shaky” IT infrastructures

- RuiJin has the largest IT team (40+ FTEs) among all hospitals in Shanghai

new IT divide?
BPM Application Challenges

- Lack of clear ways to combine various factors of biz processes
- Lack of workflow technology to support a variety of essential functions
  - Analysis, modifications, interoperation, ...
  - Needs holistic approach to BPM
- Long tail phenomenon is a “holy grail”
- Application domains work in isolation

Origin of the difficulties:
  ill-suited modeling methodology
Typical Biz Process Modeling

- A bookseller example: Traditional control-centric models
Typical Biz Process Modeling

- A bookseller example: Traditional control-centric models
- Multiple steps needed for each activity

In practice, 100s to 1000s of nodes

Hard to reason, find useful views: missing data
Business Analytics (Biz Intelligence)

- Extract-Transform-Load

Diagram:
- Transactions → inventory
- Transactions → catalog
- Transactions → Data Warehouse
- Data Warehouse → Analysis
- cust_db
- Missing Biz Processes

Activities:
- Extract
- Transform
- Load
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Four Kinds of Data in Biz Processes

- **Business data** essential for business logic
  - Examples: *items, shipping addresses*

- **Enactment status**: the current execution snapshot
  - Examples: *order sent, shipping request made*

- **Resource usage and state** needed for BP execution
  - Examples: *cargo space reserved, truck schedule to be determined*

- **Correlation** between processes instances
  - Example: *3 warehouse fulfillment process instances for Jane’s order*

- **Traditional biz process models** barely capture data
Business Artifacts

- **A business artifact** is a key conceptual business entity that is used in guiding the operation of the business
  - *fedex package delivery*, *patient visit*, *application form*, *insurance claim*, *order*, *financial deal*, *registration*, ...
  - both "information carrier" and "road-maps"

- Technically, it includes two parts:
  - **Information model:**
    - data needed to move through workflow
  - **Lifecycle:**
    - possible ways to evolve

✔ Very natural to business managers and BP modelers
Example: Restaurant Processes

Artifacts
- Guest Check
- Kitchen Order
- Receipt
- Cash Balance

Activity
- Add Item
- Pending KOs
- Prepare & Test Quality
- Ready KOs
- Deliver

Create Guest Check

Open GCs

Update Cash Balance

Payment

Add Item

KO

RC

Recalculate Receipt

Disagreed Receipts

Update Cash Balance

 archival

Ready KOs

Create

Guest Check

Closed GCs

Update Cash Balance

Archived GCs

Archived Receipts

Paid Receipts

Pending Receipts

Pending KOs

Prepare & Test Quality

Example: Restaurant Processes

Restaurant Processes

Data Quality Solutions Summit 2012

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Artifact-Centric Biz Process Models

- Informal model [Nigam-Caswell IBM Sys J 03]
- Systems: BELA (IBM 2005), Siena (IBM 2007), EZ-Flow (ArtiFlow) (Fudan-UCSB 2010), Barcelona (IBM 2010)
- Formal models
  - State machines [Bhattacharya-Gerede-S. SOCA 07][Gerede-S. ICSOC 07]
BP Models: Data Abstraction to Artifacts

Four classes of Biz process models:

- **Data abstraction models**: data mostly absent
  - WF (Petri) nets, BPMN, UML Activity Diagrams, …

- **Data-aware models**: data present (as variables), but storage and management hidden
  - BPEL, YAWL, …

- **Storage-aware models**: schemas for persistent stores, mappings to/from data in BPs defined and managed manually
  - jBPM, …

- **Artifact-centric models**: logical modeling for biz data, automated modeling other 3 types, data-storage mapping
  - GSM, EZ-Flow
Case Study: IBM Global Financing

- Finance HW, SW & services for global clients
  - $38B asset base, financing >$40B/year, 125K clients

- Business challenges
  - Country “silos” inhibited integration & annoyed clients
  - Failed to produce end-to-end “tangible model”
  - Efficiency/cost control need global performance metrics
  - Need a globally standard process w/ local variations

- No results after 2 year efforts with traditional approach

- A preliminary artifact design after a 3-day workshop with 15 business SMEs from IGF

- 6 weeks of design refinements lead to final design
  - Also, a blueprint for transformation of IGF operations
Case: Hangzhou Housing Management

- **Problem:** Cannot handle ad hoc changes effectively
  - Regulation and policy changes (some temporary)
  - Temporary changes in response to, e.g., disaster
- **Example:** A *green* channel for projects of flood victim resettlement omits reviewing tasks

HHMB’s Workflow System:

- **Application**
- **Preliminary review**
- **Secondary review**
- **Approval**

- **Delivery**
- **Certificate**
- **Lic. fee payment**
Artifact-Centric BPs are Easier to Change

- Biz process = biz artifacts = state machine lifecycle + BP change rules
- BP change rules conservatively extend workflow
  - Could be temporary, non-schematic
- Rules allow biz processes to respond to situations with many more options
- Estimated labor savings:
  - 9% for Hangzhou HMB (preliminary study) or 38 out of 400 FTEs

[Xu-S.-Yan-Yang-Zhang  CoopIS 2011]
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Artifact-Centric BPMS & Current Research

Biz process modelers, administrators

Runtime Monitoring Engine

Artifact Manager

Execution Engine

Worklist Manager

Resource Manager

BP Change Manager

Biz Process Optimizer

human performers, ...

verification
dominance
runtime monitoring
interoperation

automated construction
preserve data ICs
exec. res. calculation
dynamic modification

Functional Component
Research Challenges

- Unifying holistic conceptual models
- Design tools (analysis, verification, optimization)
- Runtime support, manage changes
- Reasoning, business analytics (informatics), process mining
- Interoperation
Conclusions

- Biz process modeling: a foundation for BP management
  - Many challenges: old and new
  - Data are essential and play prominent roles for BPs
- Biz artifact centric approach promising
- Two alternatives:
  - As a BPM design methodology/tool, e.g., accompanying jBPM
  - Full-fledged BPMS, one possible aim: install and use as easy as mySQL
- Biz artifacts: a very active research topic
Thank you!