Data Encapsulating Services: A New Paradigm for Developing Enterprise Systems

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500 workflow models
300,000 cases/year
**Permit for Selling an Unbuilt Appartment**

- **Obtaining a Permit** (商品房预售申请)

- Application 申请
- preliminary review 初审
- secondary review 复审
- Approval 审批

- Delivary 递交
- Certificate 制证
- lic. fee payment 缴费
A Typical Housing Management System

- Ad hoc design, developed over time, patches, multiple technologies, ... a typical legacy system

- Problems:
  - Embedded business logic, hard to learn
  - hard to maintain, costly to add new functionality
  - hard to change/evolve
OpenAPI approach towards
- Business Process as a Service (BPaaS)
- Enterprise may run virtual IT systems

Good idea but need to manage enterprise data
Current Practice

- Data and services are separately modeled, designed, managed
  - Adds difficulties in design, execution, maintenance, and making changes
- Furthermore, many issues can’t be addressed
  - Workflow transaction remains an art
  - Data consistency is a concern of DBMS even though violations are caused by service execution
  - Business analytics is an after thought
  - Long tail phenomenon is a “holy grail”
  - Big data
Big Data—A Gowing Torrent

- Mckinsey Global Institute, June 2011: **Big data: The next frontier for innovation, competition, and productivity**

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

$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
**Big Data + Biz Processes ➔ Big Potential**

**US health care**
- $300 billion value per year
- ~0.7 percent annual productivity growth

**Manufacturing**
- Up to 50 percent decrease in product development, assembly costs
- Up to 7 percent reduction in working capital

**US retail**
- 60+% increase in net margin possible
- 0.5–1.0 percent annual productivity growth

**Europe public sector administration**
- €250 billion value per year
- ~0.5 percent annual productivity growth

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**Two observations**

- **A significant portion of big data generated by biz processes**
- **Productivity growth only obtainable via more efficient/effective biz processes**

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**Global personal location data**
- $100 billion+ revenue for service providers
- Up to $700 billion value to end users

**Source:** MGI Analysis
Virtual ES’s: Data Management Problem

OpenAPI approach towards
- Business Process as a Service (BPaaS)
- Enterprise may run virtual IT systems
An Open Market Model

- No major players
- Enterprise makes its own data management plan
- Bring Your Own Data (BYOD)

Enterprise system

BPaaS with OpenAPI

Data needed for services + services states
Business Artifacts (业务流程工单)

- 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
- Update Cash Balance
- Open GCs
- GC
- Prepare Receipt
- Pending Receipts
- Recalculate Receipt
- Disagreed Receipts
- Payment
- Payed Receipts
- Arch ve G Cs
- Closed GCs
- Archived Receipts
- Archived GCs
- Arch ve K Os
- Cash Balance
- CB

Example: Restaurant Processes
- Restaurant Processes
- 2012/11/16
SeGA: A Service Wrapper/Mediator

- SeGA separates data from execution engine
- Serves as a mediator

SeGA

- Fetch correlated instances of the event
- Send the event, the process instances, & their schemas to the engine
- Dispatcher retrieves the updated instances & stores into the repository
- Outgoing event

Incoming event to SeGA

SeGA receives incoming events

1. Dispatcher fetches the correlate BP instance according to the type of the incoming event
2. Dispatcher sends the incoming event, the BP instances, and their schemas to the corresponding engine
3. The engine then processes the incoming event, updates the BP instances, and sends outgoing events
4. Dispatcher retrieves the updated BP instances from the engine and stores them back to the repository

SeGA: A Service Wrapper/Mediator [Sun-Xu-S.-Yang CoopIS 12]
Data Encapsulating Services

- Data package between SeGA & services:
  - Business data, enactment data, resource data, correlation data

- Data encapsulating services: Stateful services but the engine need not maintain state

- Independence of data and service management

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Enterprise system  SeGA
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2012/11/16
浙江大学
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Research Challenges

- **Design**: What are appropriate service designs? Choreography vs orchestration (Part II)? Design aid (analysis/model checking tool), interoperation

- **Runtime**: Enforcement of process/data constraints, KPI/monitoring techniques, resource planning and management

- **Transactions**: What is the notion of workflow transaction?

- **Change/evolution**: Process vs instance changes, long lasting vs temporary, longtail

- **Big data**: monitoring to analytics to change
Potential Applications

- Traditional and new service sectors and businesses
  - Housing management (房管)
  - Social security (社保)
  - Retail
  - Auditing (审计)
  - ...

- May spawn new types of service businesses such as
  - cloud platforms for BPaaS providers
  - consulting businesses to analyze and improve business processes (big data)
Conclusions

- Inclusion of persistent data is critical to capture business logics into services
- Data encapsulating services enable separation of data and service management and support
  - Independence of data and service management
- Many research challenges