16. Design Patterns for Information Systems

22 October 2008

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Plan for ISSD Lecture #16

Introducing Patterns

Design Patterns for "Information-Intensive" Business Models

The Supply Chain Pattern and "Information Supply Chains"

Transaction patterns

The Midterm on Monday 27 October

Patterns

A PATTERN is a model that is sufficiently general, adaptable, and worthy of imitation that it can be reused

It must be GENERAL so that it can apply to a meaningfully large set of possible instances or contexts

It must be ADAPTABLE because the instances or contexts to which it might apply will differ in details

It must be WORTHY because the instances or contexts to which it might apply are supposed to benefit by following the pattern rather than being impaired

Why "Businesses" Follow Patterns

At the most abstract level all businesses (or "enterprises," so that we can include governmental, educational, military, and non-profit "businesses") follow the same pattern

Businesses share common EXTERNAL influences, especially those in the same industry

They also share common INTERNAL influences and goals

Some resistance to using patterns arises from the need for a business to differentiate itself from competitors, but few companies have the market dominance or true innovations to divert from patterns in significant ways

Patterns and Reuse

In addition to improving designs (by replacing an ad hoc approach with a successful one) - patterns promote reuse

Reuse has the immediate benefit of reduced implementation and maintenance costs

Reuse has the longer term benefit of encouraging and reinforcing consistency and standardization

Once patterns are identified they assist in analysis by simplifying structures and processes as they replace low-level specific descriptions with more abstract ones

Reuse at more abstract levels enables interoperability between systems that follow patterns that differ at more concrete levels

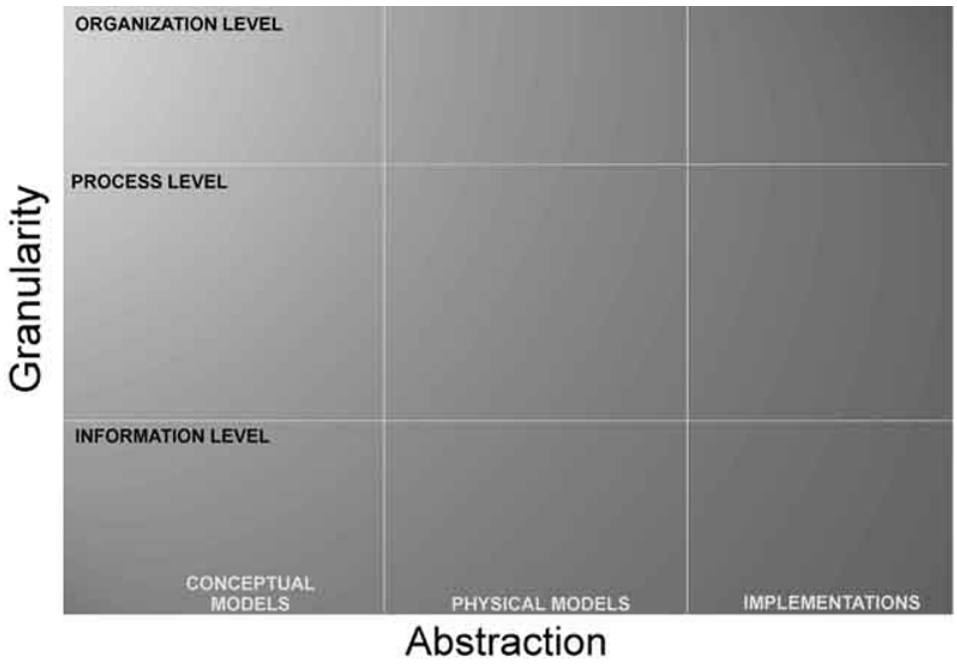
Model and Pattern Abstraction and Granularity

Recurring patterns in structures or processes are visible in abstract models but invisible in the concrete, real-world objects and functions that the model describes

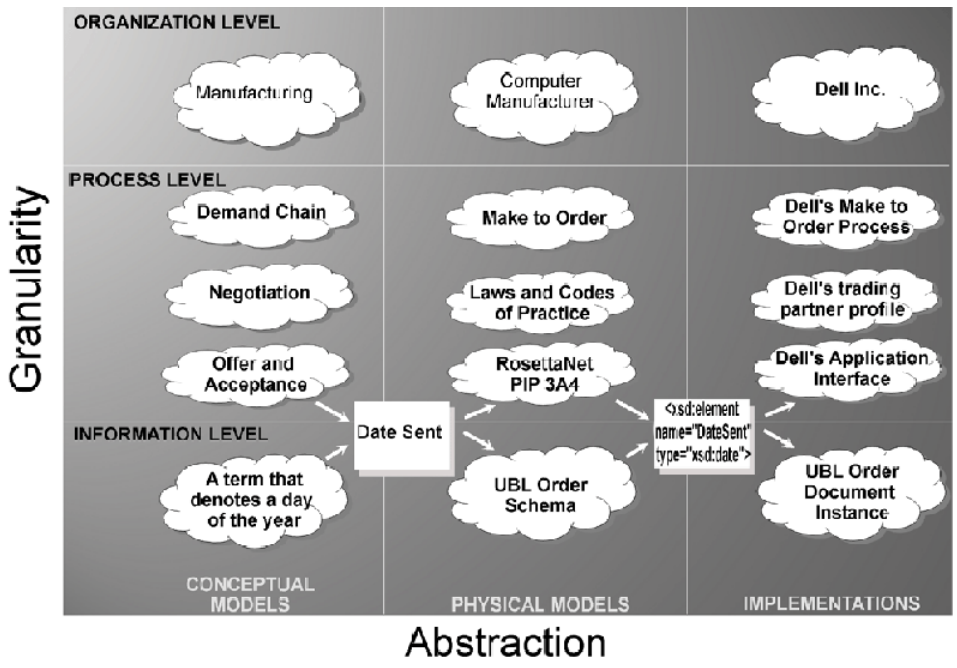
Models can also be expressed at different levels of granularity

- *Business model or organizational*
  patterns: marketplace, auction, supply chain, build to order, drop shipment, vendor managed inventory, etc.
- *Business process* patterns: procurement, payment, shipment, reconciliation, etc.
- *Business information*
  patterns: catalog, purchase order, invoice, etc. and the components they contain for party, time, location, measurement, etc.

The Model Matrix, or the "Pattern Stack"



The Model Matrix: Examples



Design Patterns for "Information-Intensive" Businesses

There have been many efforts to devise abstract frameworks or patterns that describe business models, or "families" of related business models

Many of these are centered around the increasing role of information and communication technologies in enabling new patterns of business architecture

(We'll briefly discuss two of them today, and later in the semester when we talk about "component and composite services" we'll see some more)

Betancourt and Gautschi - Patterns of Economic Activity

Production, Distribution, and Consumption are the three economic activities

What are their spatial relationships? What are their temporal relationships? 25 possibilities

Time	{P, D, C}	D | {P, C}	C | {P, D}	P | {C, D}	P | D | C
Space					
{P, D, C}	1	2	3	4	5
D | {P, C}	6	7	8	9	10
C | {P, D}	11	12	13	14	15
P | {C, D}	16	17	18	19	20
P | D | C	21	22	23	24	25

Apte & Mason: "Disaggregation" of "Information-Intensive Services"

DISAGGREGATION is the "reformulation" and "geographical dispersion" of value chains

There are plenty of good reasons for doing this...

How can we analyze the "disaggregation potential" of a service or business model?

Apte & Mason's Three Dimensions

Business models / occupations can be characterized by their intensity on three dimensions:

- INFORMATION actions that involve symbolic manipulation
- INTERPERSONAL actions that involve dealing with customers and other people
- PHYSICAL actions that involve manipulation of physical objects

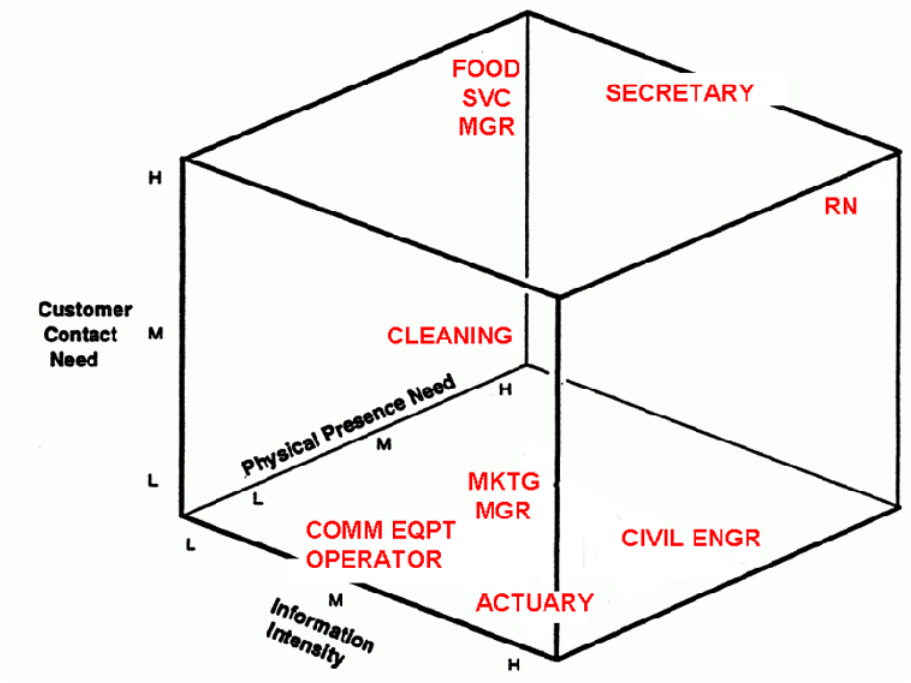
In addition, many interpersonal actions are predominately information exchanges

(A fourth dimension is the extent of "non-value adding" activities)

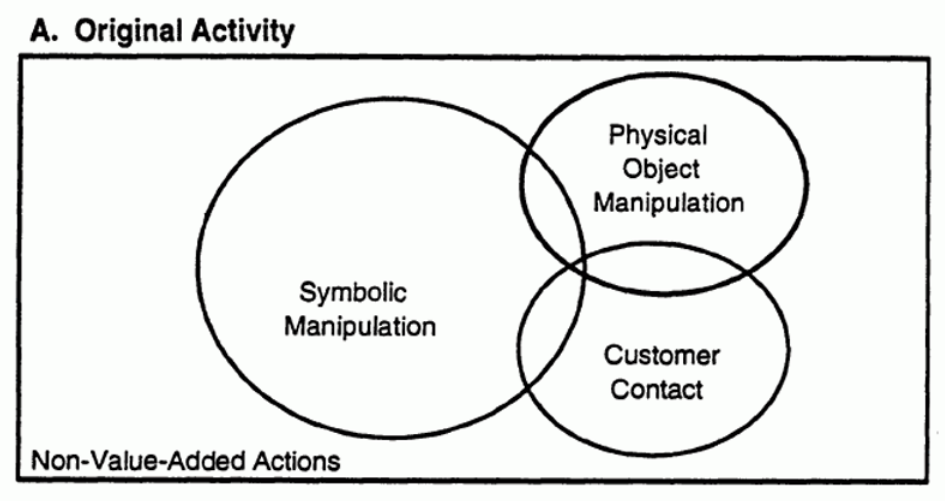
Examples on the Three Dimensions

Occupation	Information Intensity	Customer Contact Need	Physical Presence Need
Actuary	H	L	L
Marketing Manager	H	M	L
Civil Engineer	H	L	M
Comm. Eqpt. Operator	M	L	L
Cleaning	L	L	H
Food Service Manager	L	H	H
Secretary	M	H	H
Registered Nurse	H	H	H

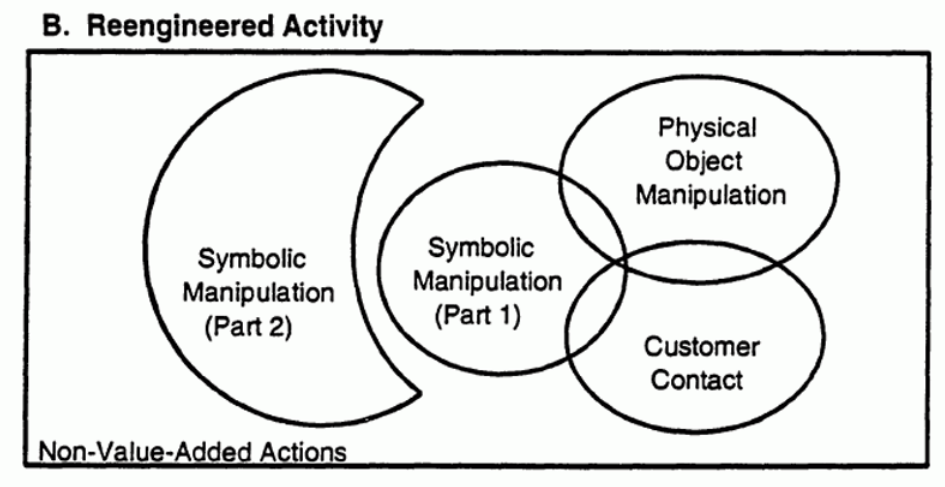
Apte & Mason: To Disaggregate, or Not To...



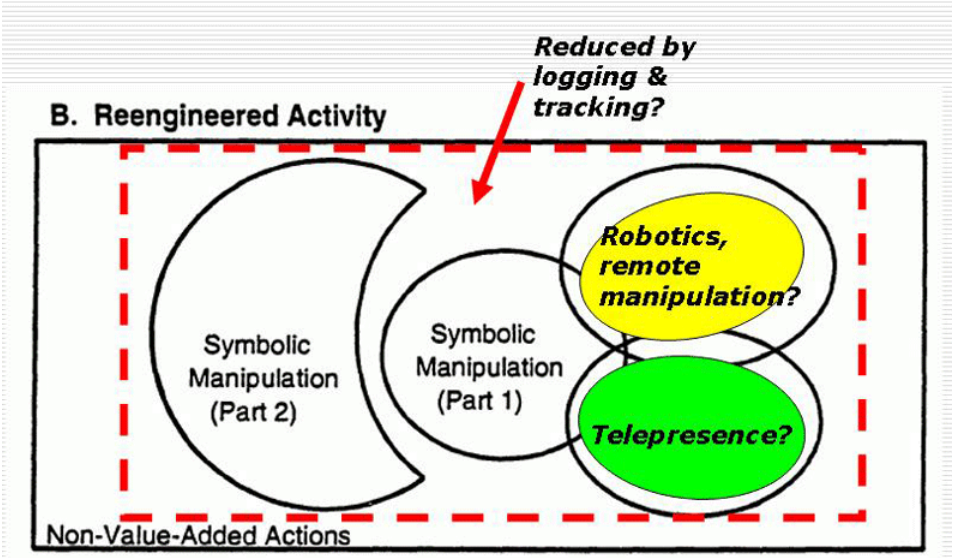
Apte & Mason -- Before Disaggregation



Apte & Mason -- After Disaggregation



Underestimating the Impact of Technology?



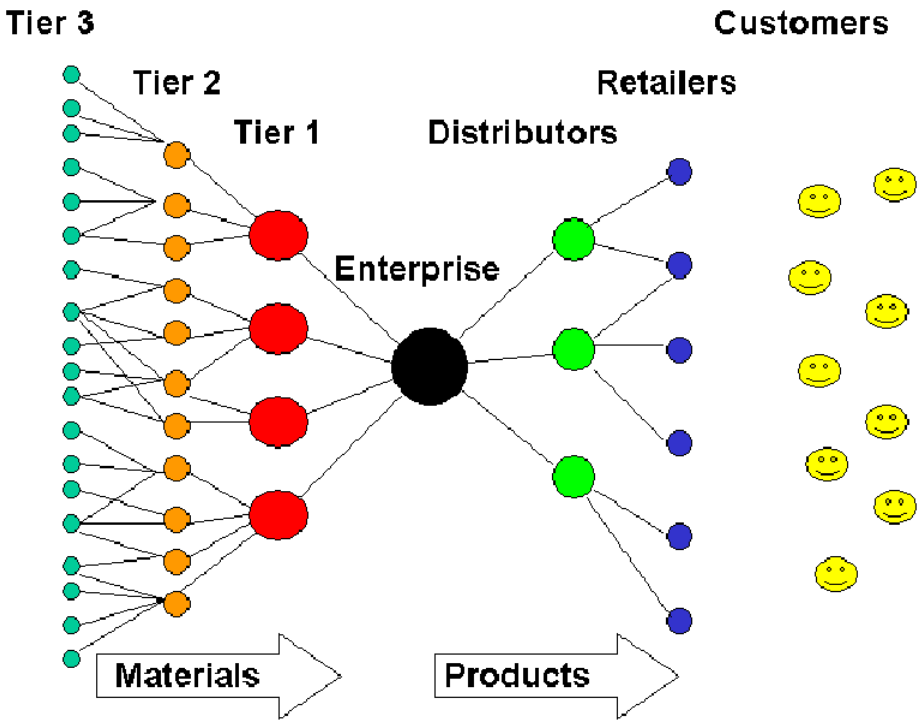
The Supply Chain Pattern

A supply chain is an aggregated and end-to-end view of the buy-side and sell-side relationships of an enterprise

A supply chain is the network of facilities and distribution capabilities an enterprise uses to:

- "Source" (or "procure") raw materials (chemicals, ores, grains, ...) or components
- Transform the materials or assemble the components into products
- Deliver the products to customers (indirectly through distributors or stores or directly to the purchaser)

Supply Chain - Conceptual Model



The Information Supply Chain

The flow of materials and goods in a supply chain is accompanied by information about it

But information about supply chain activities and processes is increasingly separated from the physical flow of materials and goods, and for information-based services there is no physical stuff

Information also flows in the opposite direction from the customer, retailers, and distributors back into the supply chain – this is also called the DEMAND CHAIN

The information supply chain has become especially important because increased global competition and better informed customers are forcing forms to shift from forecast to demand (i.e. customer) driven business models

Design Issues for the Information Supply Chain

What information is exchanged?

Which entities in the supply chain are able to exchange information?

What is the frequency of this information exchange?

"Document Automation" or STP Pattern

Many business processes can be described as "moving information around" and so they can be described in "information supply chain" terms

At each step information might be added to the input document or a new document might be created that contains most of the input document's content

However, even though the end-to-end process might span multiple departments (or companies), the business applications (run by separate departments) may not have been designed to share information with each other

The overarching design goal is to use standardization or interoperability to achieve "straight-through processing" or STP

STP is usually possible for clerical processes

Processes carried out by knowledge workers can often be partially automated

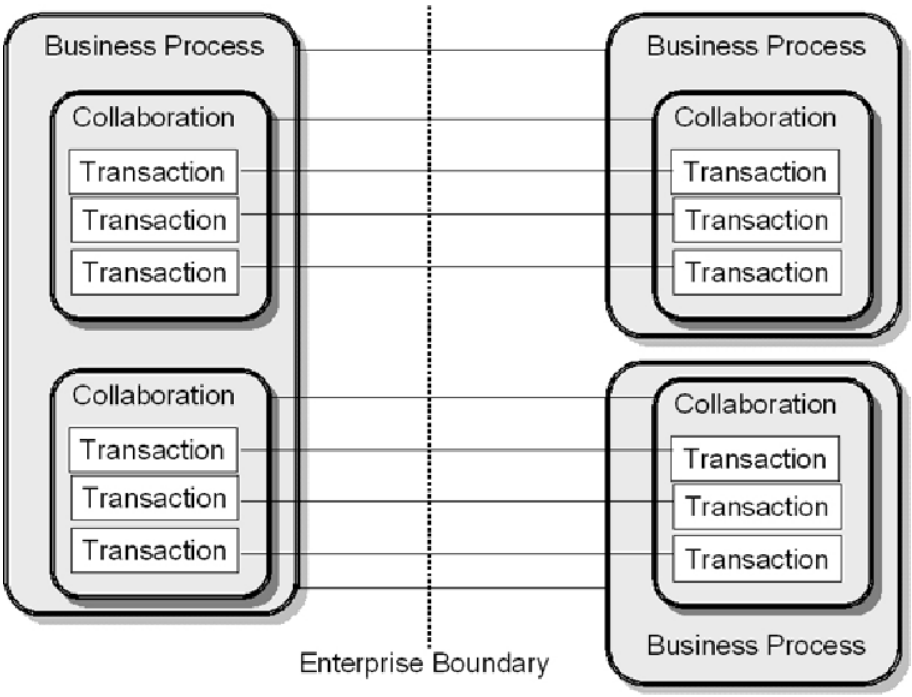
Design Template for STP Applications

Create documents with templates or via guided assembly (aka "wizards")

Re-design processes to minimize manual intervention using rule-based routing, access control, exception handling

Regenerate information automatically when source information changes and push to affected processes or parties

Reminder: The ebXML Process Metamodel



Business Transaction Patterns – Exercise

1. A) Where can I buy a notebook computer?
2. B) Here's my catalog of notebook computers.
3. A) I'd like to order this one.
4. B) OK.
5. B) And here's your invoice.
6. A) OK.
7. A) When will the computer arrive?
8. B) By next Tuesday.
9. B) Here's my complete catalog, in case you're interested in other products besides notebook computers.

Business Transaction Patterns

Business Transaction Patterns describe typical ways that business documents are exchanged:

Offer-Acceptance (Commercial Transaction)

Request-Response

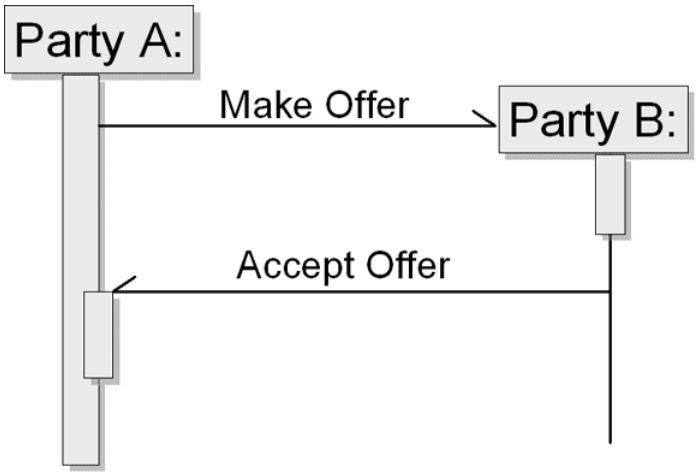
Request-Confirm

Query-Response

Notification

Information Distribution

Offer-Acceptance (Commercial Transaction) Pattern (1)



Offer-Acceptance (Commercial Transaction) Pattern (2)

This is the common "offer and acceptance" or "contract formation" pattern

The standard and simplest example is "Place Order"

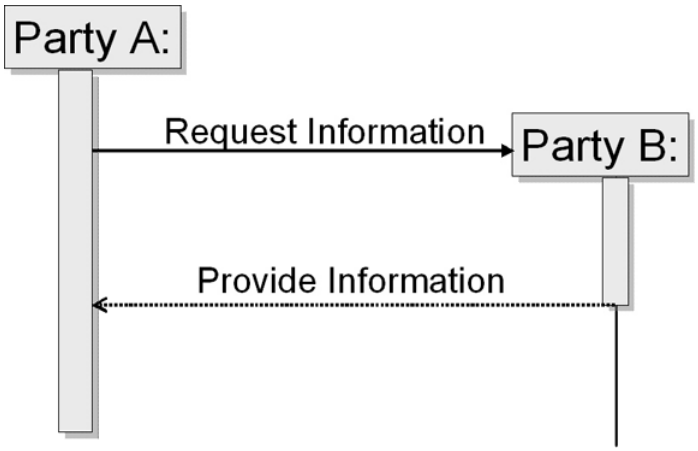
The party making the offer "exposes itself to the imposition of legal liability by another" if the offer is accepted

The accepting party must send an acknowledgment when it determines that the offer document passes the "business acceptance" test (this is often an "Order Response")

Because of this legal exposure and the time it may take for the recipient to decide on the offer, the recipient might send receipt and confirmation signals

The offer and the acceptance are "non-repudiable" – the party making the offer guarantees that the offer came from it (typically done with signatures) and the party accepting it guarantees that the acceptance came from it

Request-Response Pattern (1)



Request-Response Pattern (2)

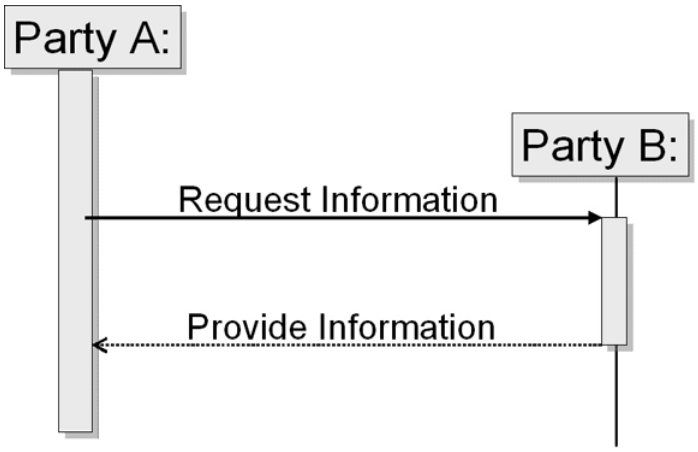
This pattern is used to model the situation where one party makes a request for information when the responding party has to apply some business logic to answer, because it may be dependent on the identity of the party making the query or because it needs to be dynamically generated

Typical examples are "Request Quote" or "Check Inventory"

This transaction might require non-repudiation on the responder's part

The response doesn't create any obligations for the responding party

Request-Confirm Pattern (1)



Request-Confirm Pattern (2)

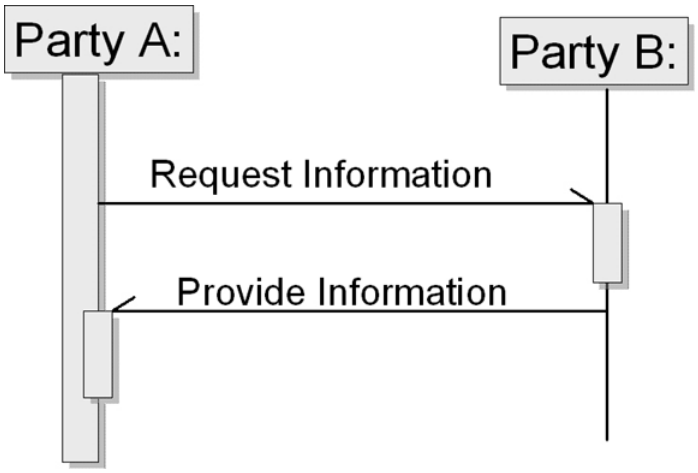
This pattern is used to model the situation where one party requests confirmation about a previously established contract or obligation

It might be used to get status information or obtain authorization

A typical example is "Request Order Status"

This transaction will typically need non-repudiation on the responder's part

Query-Response Pattern (1)



Query-Response Pattern (2)

This pattern is used to model the situation where one party makes a request for information that the responding party already has, that is static (or slow-changing) and that isn't dependent on the identity of the party making the query

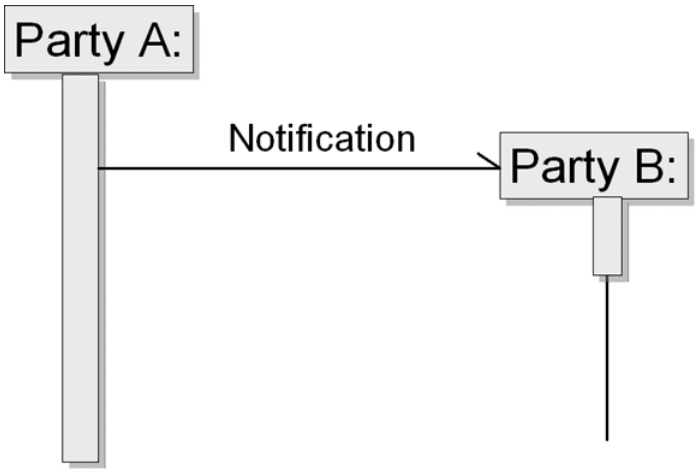
A typical example is "Request Catalog"

The response consists of a collection of results, each of which meets the constraints specified in the query

Usually no receipt or confirmation signals

And usually no non-repudiation requirement

Notification Pattern (1)



Notification Pattern (2)

This pattern is used to model a formal information exchange

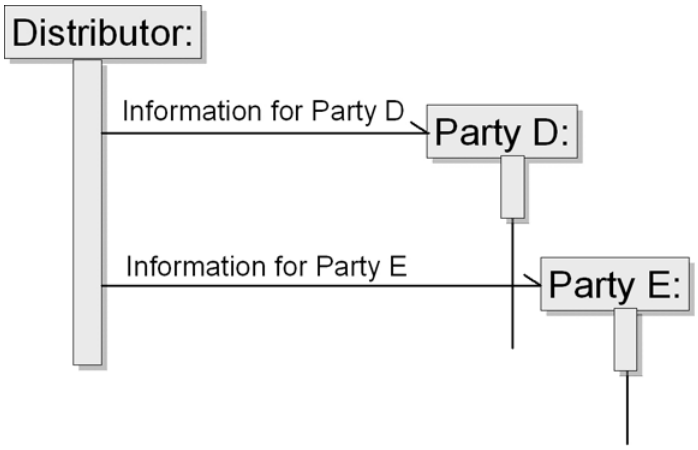
The standard example is "Notify of Invoice"

It has non-repudiation requirements for the sender

The recipient should respond with a receipt business signal

It is like the Commercial Transaction pattern but there is no business response document

Information Distribution Pattern (1)



Information Distribution Pattern (2)

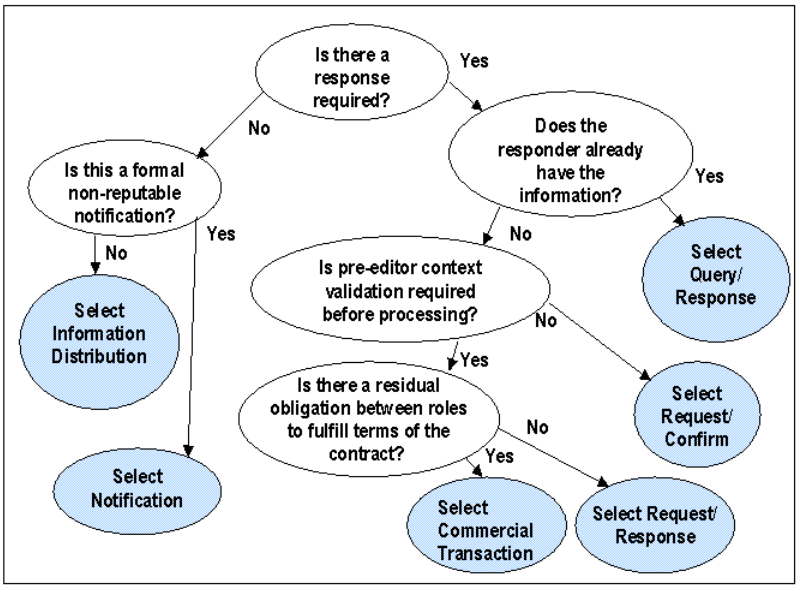
This pattern is used to model an informal information exchange

A typical example is "Publish Catalog"

This transaction will typically not use non-repudiation

It is similar to Query-Response but without a responding business document.

Decision Tree for Transaction Patterns



Midterm: Monday 27 October

We will mail the midterm exam to you on the list serve at noon on Monday 27 October (no class meeting that day)

You will have a choice (5 out of 8) short essay questions (each answer 300-500 words)

Open book, open note, open Internet

"Cut and paste" strongly deprecated; quality of answers more important than quantity

Exam due at midnight Friday 31 October