Tutorial
Electronic Contracts

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P. Radha Krishna, SET Labs, Infosys, India

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Tutorials
Beijing, China
April 21, 2008
Agenda

• Contracts
• E-contracts
• Examples
• Challenges
• Q & A
• Break !!
• E-contract Systems
• E-Contracts & Web Services
• Open Research Problems
• Q & A
Contracts

Contract is an agreement between two or more parties, especially one that is written and enforceable by law.

- dictionary.com

Contract is a "promise" or an "agreement" made of a set of promises, the breach of which is recognized by the law and for which legal remedies can be provided.

- wikipedia.org

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Many definitions ....

A contract is a legally enforceable agreement, in which two or more parties commit to certain obligations in return for certain rights [Rei89].

A contract is a statement of intent that regulates behaviour among organizations and individuals. An electronic contract is its reification in software that can be instantiated as a set of obligations that are fulfilled between parties, refused or waived as future events occur.

(“Towards the Electronic contract” M. Morciniec, C. Bartolini, B. Monahan, M. Salle, HP Labs)
Some Statistics

• In the USA, the federal government spends about USD$200 billion annually buying goods and services from over 300,000 vendors [1997]

• A typical supermarket chain requires negotiating annually contracts of over 50,000 product items.

• Source: Chiu et al, Decision Support Systems 40 (2005) 51-69
Number of contracts awarded each year by the Canada Firearms Centre from 1997 to 2006.

Source: Office of the Auditor General of Canada

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### No. of Contracts, Value of Contracts Awards in America – July 2006.

#### Number of Contracts Awarded

<table>
<thead>
<tr>
<th></th>
<th>Jul-06</th>
<th>Jul-05</th>
<th>% Change</th>
<th>YTD 2006</th>
<th>YTD 2005</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airport</td>
<td>121</td>
<td>140</td>
<td>-13.6%</td>
<td>476</td>
<td>521</td>
<td>-8.6%</td>
</tr>
<tr>
<td>Bridges &amp; Tunnels</td>
<td>443</td>
<td>367</td>
<td>20.7%</td>
<td>2,869</td>
<td>2,601</td>
<td>10.3%</td>
</tr>
<tr>
<td>Docks, Piers &amp; Wharves</td>
<td>38</td>
<td>30</td>
<td>26.7%</td>
<td>235</td>
<td>181</td>
<td>29.8%</td>
</tr>
<tr>
<td>Highways</td>
<td>2,396</td>
<td>2,640</td>
<td>-9.2%</td>
<td>15,222</td>
<td>14,238</td>
<td>6.9%</td>
</tr>
<tr>
<td>Railways</td>
<td>7</td>
<td>11</td>
<td>-36.4%</td>
<td>94</td>
<td>80</td>
<td>17.5%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>3,005</td>
<td>3,188</td>
<td>-5.7%</td>
<td>18,896</td>
<td>17,621</td>
<td>7.2%</td>
</tr>
</tbody>
</table>

Source: McGraw-Hill F.W. Dodge Data

#### Value of Contracts Awarded (in thousands $)

<table>
<thead>
<tr>
<th></th>
<th>Jul-06</th>
<th>Jul-05</th>
<th>% Change</th>
<th>YTD 2006</th>
<th>YTD 2005</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airport</td>
<td>204,588</td>
<td>248,334</td>
<td>-17.6%</td>
<td>1,286,372</td>
<td>1,137,845</td>
<td>13.1%</td>
</tr>
<tr>
<td>Bridges &amp; Tunnels</td>
<td>933,384</td>
<td>934,350</td>
<td>-0.1%</td>
<td>6,998,245</td>
<td>6,836,938</td>
<td>2.4%</td>
</tr>
<tr>
<td>Docks, Piers &amp; Wharves</td>
<td>69,380</td>
<td>38,499</td>
<td>80.2%</td>
<td>376,955</td>
<td>570,145</td>
<td>-33.9%</td>
</tr>
<tr>
<td>Highways</td>
<td>3,247,530</td>
<td>3,275,679</td>
<td>-0.9%</td>
<td>23,023,855</td>
<td>19,801,114</td>
<td>16.3%</td>
</tr>
<tr>
<td>Railways</td>
<td>18,903</td>
<td>62,651</td>
<td>-69.8%</td>
<td>533,323</td>
<td>1,247,725</td>
<td>-57.3%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>4,473,785</td>
<td>4,559,513</td>
<td>-1.9%</td>
<td>32,218,750</td>
<td>29,593,767</td>
<td>8.9%</td>
</tr>
</tbody>
</table>

Source: American Road and Transportation Builders Association (ATBA)
# Highest Value of Highway Contracts Awards - YTD 2006 (in millions)

<table>
<thead>
<tr>
<th>State</th>
<th>Value (in millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Texas</td>
<td>$2,472.8</td>
</tr>
<tr>
<td>California</td>
<td>$2,170.9</td>
</tr>
<tr>
<td>Florida</td>
<td>$1,334.4</td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>$1,257.5</td>
</tr>
<tr>
<td>Illinois</td>
<td>$1,158.8</td>
</tr>
</tbody>
</table>

**Source:** American Road and Transportation Builders Association (ATBA)
ICICI
LIMITED

(Founded on January 5, 1955 as a Public Limited Company under the Indian Companies Act, VII of 1813)
Registered Office: ICICI Towers, Bandra-Kurla Complex, Mumbai 400 051.

UNSECURED REDEEMABLE BOND(S) IN THE NATURE OF DEBENTURE(S)

TAX SAVING BOND-022002-TSB- ONE

<table>
<thead>
<tr>
<th>OPTION</th>
<th>FACE VALUE PER BOND (Rs.)</th>
<th>ISSUE PRICE PER BOND (Rs.)</th>
<th>DEEMED DATE OF ALLOTMENT</th>
<th>REDEMPTION DATE</th>
<th>INTEREST RATE</th>
<th>TAX BENEFIT U/S</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Issue of Unsecured Redeemable Tax Saving Bonds in the nature of Debentures of face value as indicated above (the "Bond(s)"") out of the total issue of Unsecured Redeemable Bonds in the nature of Debentures aggregating Rs. 600 crore with a right to retain oversubscription up to Rs. 600 crore comprising Tax Saving Bonds, Ecashe Bonds, Monthly Income Bond, Regular Income Bonds, Money Multiplier Bonds and Children Growth Bonds (the "Issue") made under the authority of the Memorandum and Articles of Association of the Company. Resolutions passed by the Board of Directors at their meeting held on July 28, 1997 and January 25, 1999 and in terms of the Prospectus dated January 29, 2002.

The proceeds from these Bonds shall be deployed towards infrastructure projects in accordance with the Income-tax rules.

In case of Option I and II, interest on the Face Value of Bond(s) will be paid at the rate mentioned herein above, on May 1 each year (subject to deduction of tax at source at the rates prevailing from time to time under the provisions of the Income tax Act, 1961, or any statutory notification or re-enactment thereof), and on redemption thereof, provided that, the first interest payment will be made on May 1, 2003 for the period commencing from the Deemed Date of Allotment and the last interest payment will be made at the time of Redemption of the Bond on a pro-rata basis.

The Bond(s) is/are subject to the terms and conditions and the benefits endorsed herein, in the Prospectus dated January 29, 2002 and the Trustee Agreement to be entered into between the Company and the Western India Trustee and Executor Company as Trustee (the "Trustee") which shall be binding on the Company, holders of the Bond(s) (the "Bondholder(s)"), the Trustees and all persons claiming by, through or under any of them. All rights and remedies of the Bondholder(s) against the Company in respect of, arising out of or incidental to the Bond(s) shall be exercisable by the Bondholder(s) only through the Trustees.

This is to certify that the person(s) named below or the last Transferee(s) whose name(s) is/are duly recorded in the Memorandum of Transfers on the reverse hereof is/are the holder(s) of the aforesaid Bond(s) subject to the Memorandum and Articles of Association of the Company and the terms and conditions set out herein, which are deemed to be forming a part hereof for all purposes and to all intents.

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No. of Bond(s)</th>
<th>Distinctive No(s.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ONE</td>
<td><strong>1</strong></td>
</tr>
</tbody>
</table>

Given at Mumbai this

DEPOSITORY ISIN: 

CONSOLIDATED STAMP DUTY PAID VIDE ORDER DATED 

By GOVT. OF INDIA, MINISTRY OF FINANCE, DEPARTMENT OF REVENUE.

For and on behalf of ICICI LIMITED

The Central Board of Direct Taxes (CBDT) has vide letter No. F.No. 179/16/2001-T(A) dated June 14, 2001 declared the Tax Saving Bond as eligible security for the purpose of Section 80(l)(vi) of the Income-tax Act, 1961. The proceeds from this bond shall be deployed towards infrastructure projects in accordance with the Income-tax rules. The tax exemption can be availed of by Nris provided Nris opt not to be assessed under the special provison(s) of Chapter XII-A of the Income-tax Act, 1961.

SClRP CODE BSE : NSE :

Bondholders should confirm the scrip codes of the bonds with the brokers before dealing in them.

7/19/2023
Translating a paper contract into an e-contract is not a trivial process.
Taxes & Payments

"Subject to any deductions of tax at source, if applicable, from the contract price as per clause A of schedule A of the Contract, the CONTRACTOR shall be entitled to receive the Contract Price in the following manner:

1. All the payments shall be released directly by the PURCHASER to the CONTRACTOR

2. The initial advance payment and payments against the delivery certificates and final Acceptance Certificates as referred to in Para B of schedule A of the contract, shall be released on completion of each milestone as indicated in the table of payment in schedule B.

3. All the payments will be made by the purchaser only after satisfying about the satisfactory completion of each milestone as stipulated in Systems Requirements Specifications (SRS) Document referred to in Schedule B, of the Contract by the PURCHASER.

4. ...
“Either Purchaser or Contractor can identify the need for change on the accepted deliverables.

If the Purchaser identifies the change requirement, then *Purchaser will raise Request for Change (RFC) by filling the Change Management Request form. Its format will be provided by the Contractor. It will essentially cover Change Request Description, Requested Date, Priority of the request (i.e. Very Urgent, Urgent, Normal etc.). The priority will be assigned by the Purchaser Project Manager.*

On receiving this request *Contractor will allocate a CMR number to the request and will notify it to the Purchaser. The contractor will then evaluate the need of this change with respect to Priority, Feasibility of the change, and Impact on time frame and cost. The contractor might ask for relevant clarifications regarding the change request. It is the responsibility of the purchaser to provide the clarification in time. *The Contractor will place the results of evaluation to Purchaser.*

The Purchaser can approve/disapprove the change requests after seeking the relevant clarifications on the evaluation from the contractor. In case the change is approved then the *Contractor will schedule the changes based on priority. The contractor will then make the necessary changes and release them to Purchaser for acceptance. The purchaser will carry out the acceptance and provide the acceptance certificate. The Change Management Form will be recorded with the result raised change request, who has incorporated the change, date of release to Purchaser.*
Textile Value-chain contract

Terms of Payment: 100% payment will be made against delivery by cheque after inspection and acceptance of the material at our stores.

“When the material is ready for dispatch”, before supplying the material, please arrange to send three copies of Performa invoice indicating D.C. No. & Date in order to keep the demand draft ready.

Liquidated Damages:

A) Failure to supply the goods by the time specified on the order will make the supplier liable to an unconditional liquidated damage of ½% (half percent) per week subject to a maximum of 10% (Ten Percent) of the price of the goods in arrears at the discretion of the STC.[Clause CL-b]

B) The purchaser shall have the right to cancel either wholly or in part the portion of the contract which is yet to be executed by supplier in case the delivery is not in accordance with the time specified in the order.

Jurisdiction: All questions, disputes of differences arising under, out of or in connection with the contract shall be subject to the exclusive jurisdiction of the court within the local limits of whose jurisdiction the place from which the purchase order is issued, is situated.

Quality: All goods and works must conform to the specifications quoted on the order and are to be strictly in accordance with approved samples of designs. Goods supplied are subject to inspection by our authorized representatives and the inspector has right to reject the goods of conforming to our specifications.

Inspection: All goods and works are subject to our inspection. Inspection, either at your works or delivery as agreed will be carried out. The decision of our officer nominated/authorized by the GM, Materials is final. Rejected goods will be returned to the suppliers at his cost including freight on original shipment.
UNIMPROVED PROPERTY CONTRACT
NOTICE: Not For Use For Condominium Transactions

1. PARTIES:
   (Seller) agrees to sell and convey to
   (Buyer) and Buyer agrees to buy from Seller the Property described below.

2. PROPERTY:
   Lot _______, Block _______, Addition, City of _______, County of _______, Texas, known as
   (address/zip code), or as described on attached exhibit together with all rights, privileges and
   appurtenances pertaining thereto, including but not limited to: water rights, claims, permits.
   strips and gores, easements, and cooperative or association memberships (the Property).

3. SALES PRICE:
   A. Cash portion of Sales Price payable by Buyer at closing: $_________.
   B. Sum of all financing described below (excluding any loan funding fee or mortgage insurance premium): $_________.
   C. Sales Price (Sum of A and B): $_________.

4. FINANCING: The portion of Sales Price not payable in cash will be paid as follows: (Check applicable boxes below)
   A. THIRD PARTY FINANCING: One or more third party mortgage loans in the total amount of
      $_________.
         (excluding any loan funding fee or mortgage insurance premium).
         (1) Property Approval: If the Property does not satisfy the lenders’ underwriting
            requirements for the loan(s), this contract will terminate and the earnest money will be
            refunded to Buyer.
         (2) Financing Approval: (Check one box only)
            (a) This contract is subject to Buyer being approved for the financing described in the
               attached Third Party Financing Condition Addendum.
            (b) This contract is not subject to Buyer being approved for financing and does not
               involve FHA or VA financing.
   B. ASSUMPTION: The assumption of the unpaid principal balance of one or more promissory
      notes described in the attached TREC Loan Assumption Addendum.
   C. SELLER FINANCING: A promissory note from Buyer to Seller of $_________, secured
      by vendor’s deed of trust liens, and containing the terms and conditions described in the attached TREC Seller Financing Addendum. If an owner policy of title
      insurance is furnished, Buyer shall furnish Seller with a mortgagee policy of title insurance.

5. EARNEST MONEY: Upon execution of this contract by both parties, Buyer shall deposit
   $_________ as earnest money with __________, as escrow agent, at
   (address). Buyer shall deposit additional earnest money of $_________ with escrow
   agent within ______ days after the effective date of this contract. If Buyer fails to deposit the
   earnest money as required by this contract, Buyer will be in default.

6. TITLE POLICY AND SURVEY:
   A. TITLE POLICY: Seller shall furnish to Buyer at Seller’s expense an owner policy of
      title insurance (Title Policy) issued by (Title Company) in the amount of the Sales Price, dated at or after closing, insuring Buyer
      against loss under the provisions of the Title Policy, subject to the following exclusions:
      (1) Restrictive covenants common to the platted subdivision in which the Property is located.
      (2) The standard printed exception for standby fees, taxes and assessments.
      (3) Liens created as part of the financing described in Paragraph 4.
      (4) Utility easements created by the dedication deed or plat of the subdivision in which the
          Property is located.
      (5) Reservations or exceptions otherwise permitted by this contract or as may be approved by
          Buyer in writing.
      (6) The standard printed exception as to marital rights.
      (7) The standard printed exception as to waters, tidelands, beaches, streams, and related
          matters.
      (8) The standard printed exception as to discrepancies, conflicts, shortages in area or boundary
          lines, encroachments or protrusions, or overlapping improvements. Buyer, at Buyer’s expense,
          may have the exception amended to read, “shortages in area”.
   B. COMMITMENT: Within 20 days after the Title Company receives a copy of this contract, Seller
      shall furnish to Buyer a commitment for title insurance (Commitment) and, at Buyer’s
• AMAZON RETURNS POLICY
Contract lifecycle

- Business information exchange
- Contract negotiation
- Contract preparation
- Contract enactment
- Contract monitoring & management
Contract Dimensions

- Composited contracts
- Multiparty contracts
- Bilateral contracts
- Sequential contracts
  - Turnkey Contracts
- Cyclic contracts

Axes:
- C2C
- B2C
- B2B

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Contract Dimensions

• Based on the Applications
  – C2C; B2C; B2B

• Based on the Structure
  – Sequential contracts (executes sequentially in a step-by-step manner and ends after certain period of time)
  – Turnkey contracts (has a specific goal that needs to be accomplished within certain time and with a certain budget, and is a special case of sequential contract)
  – Cyclic contracts (exists even after the completion of one cycle of the contract, irrespective of the number of times the contract is fulfilled)

• Based on the Complexity
  – Bilateral contracts (Ex., buyer-seller contract)
  – Multiparty contracts (Ex. House Building contract)
  – Composite contracts (consists of several contracts, for ex., Textile value chain contract)
Contracts

Have

• Parties – Organizations/people involved in a business process

• Activities – representing tasks/e-services to be executed during process enactment

• Clauses – describing restrictions on the execution of activities.

Contracts have some structure.

Also contracts have Negotiation, Commitment, Transactions, Exclusions, Authorization, Arbitration and Jurisdiction.
Contracts - clauses

They are mainly categorized as

a) **Obligations**: These state what the parties involved should do, thus resulting in deliverables and criteria for Quality of Service.

b) **Payments**: These state how the payments are to be made when the obligations are met.

c) **Penalties**: These state what needs to be done when the obligations are not met.

d) **Permissions**: These state what the parties are allowed to do.

e) **Prohibitions**: These state what the parties should not do.
E-Contracts: Background

- Voluminous documents
- Ambiguity and fuzziness of natural languages
- Managing/monitoring is human intensive
- Autonomous nature of individual organizations/parties
- Cross-checking for payments
- Bookkeeping for legal aspects
- Standard formats
- Computer supported contracts
- Transactions and Commitment
- Security

Handling all these aspects is a challenge
E-Contracts

An E-contract is a contract modeled, specified, executed, controlled, and monitored by a software system. All (or a number of) activities carried out by software system.

Simplified Versions..

• An e-contract is an electronic version of a conventional contract, which stipulates that the signing entities (two or more) agree to observe clauses stipulated in the document.
• An e-contract is a contract in electronic format, regulating cross-organizational business processes over the Internet.
E-Contracts: Background

- Voluminous documents
- Ambiguity and fuzziness of natural languages
- Managing/monitoring is human intensive
- Autonomous nature of individual organizations/parties
- Cross-checking for payments
- Bookkeeping for legal aspects
- Standard formats
- Computer supported contracts
- Transactions and Commitment
- Security

Handling all these aspects is a challenge.

An E-contract is a contract modeled, specified, executed, controlled, and monitored by a software system.

All (or a number of) activities carried out by software system.
Electronic Contracts

• An Electronic Contract...
  – is a well-structured document
    • From the perspective of formatting
    • Semantically
  – is edited/viewed in different contexts
    • Composition, Printing, Visualisation, Signing
  – consists of standard elements plus individual extensions
  – needs to be exchanged
  – may be manipulated in a collaborative session
  – is signed by attaching signatures in a standardized way

Source: Griffel et al, 1998
UNIMPROVED PROPERTY CONTRACT

NOTICE: Not For Use For Condominium Transactions

1. PARTIES:
(Seller) agrees to sell and convey to
(Buyer) and Buyer agrees to buy from Seller the Property described below.

2. PROPERTY:
Lot ______, Block ______, Addition, City of ______, County of ______, Texas, known as (address/zip code), or as described on attached exhibit together with all rights, privileges and appurtenances pertaining thereto, including but not limited to: water rights, claims, permits, strips and gores, easements, and cooperative or association memberships (the Property).

3. SALES PRICE:
A. Cash portion of Sales Price payable by Buyer at closing.................. $______
B. Sum of all financing described below (excluding any loan funding fee or mortgage insurance premium)........................................ $______
C. Sales Price (Sum of A and B) ........................................................................ $______

4. FINANCING: The portion of Sales Price not payable in cash will be paid as follows: (Check applicable boxes below)
   A. THIRD PARTY FINANCING: One or more third party mortgage loans in the total amount of $______
      (excluding any loan funding fee or mortgage insurance premium).
      (1) Property Approval: If the Property does not satisfy the lenders’ underwriting requirements for the loan(s), this contract will terminate and the earnest money will be refunded to Buyer.
      (2) Financing Approval: (Check one box only)
         (a) This contract is subject to Buyer being approved for the financing described in the attached Third Party Financing Condition Addendum.
         (b) This contract is not subject to Buyer being approved for financing and does not involve FHA or VA financing.
   B. ASSUMPTION: The assumption of the unpaid principal balance of one or more promissory notes described in the attached TREC Loan Assumption Addendum.
   C. SELLER FINANCING: A promissory note from Buyer to Seller of $______ secured by vendor’s and deed of trust liens, and containing the terms and conditions described in the attached TREC Seller Financing Addendum. If an owner policy of title insurance is furnished, Buyer shall furnish Seller with a mortgagee policy of title insurance.

5. EARNEST MONEY: Upon execution of this contract by both parties, Buyer shall deposit $______ as earnest money with __________________, as escrow agent, at __________________, Buyer shall deposit additional earnest money of $______ with escrow agent within ______ days after the effective date of this contract. If Buyer fails to deposit the earnest money as required by this contract, Buyer will be in default.

6. TITLE POLICY AND SURVEY:
A. TITLE POLICY: Seller shall furnish to Buyer at ___________ Seller’s ___________Buyer’s expense an owner policy of title insurance (Title Policy) issued by ___________ Title Company ___________ in the amount of the Sales Price, dated at or after closing, insuring Buyer against loss under the provisions of the Title Policy, subject to the promulgated exclusions (including existing building and zoning ordinances) and the following exceptions:
   (1) Restrictive covenants common to the platted subdivision in which the Property is located.
   (2) Deed of trust liens securing the encumbrance of the Property.
   (3) Liens created as part of the financing described in Paragraph 4.
   (4) Utility easements created by the dedication deed or plat of the subdivision in which the Property is located.
   (5) Reservations or exceptions otherwise permitted by this contract or as may be approved by Buyer in writing.
   (6) The standard printed exception as to marital rights.
   (7) The standard printed exception as to waters, tidelands, beaches, streams, and related matters.
   (8) The standard printed exception as to liens and encroachments, persons or overlaps, or overlapping improvements. Buyer, at Buyer’s expense, may have the exception amended to read, “shortages in area”.
B. COMMITMENT: Within 20 days after the Title Company receives a copy of this contract, Seller shall furnish to Buyer a commitment for title insurance (Commitment) and, at Buyer’s
E-Contracts

Characterized by
– parties
– activities
– clauses

Can have
– sub-contracts
– payments
– budget

needs synchronization and has a duration

Metadata
Exclusion
Authorization
Arbitration
Jurisdiction
Technologies

E-contract Deployment

Collaboration Processes & Business Processes

Governance (Social, Legal, Govt. etc.)
Why e-contract systems?

- Conventional software is not feasible because of loss of semantic form of contracts during the translation.
- It is human assisted task.
- Multiple modules with different technologies may be required, which has to loosely adapted and integrated.
Potential Advantages of e-contracts

- improved productivity
- accelerated contract lifecycle
- reduced risks and improved security
- increased profits and superior monitoring of contract enactment
- better compliance enforcement
- electronic bookkeeping (including legal aspects)
- authorization
- alerts and tracking

Source: T. Kwok and T. Nguyen, EEE’06
Supporting Technologies for e-contracts

- Active Databases and Transaction Support
- Event Distributed Architecture
- Workflows
- Web services
- SOA

- XML data Management
- Formal Languages
- NLP
- Text mining
- Process/Workflow Mining

Goal?
Document Contracts to Executable Contracts
Steps in Modeling e-contracts

• Identify business entities (parties) and the relations between them
• List the roles to be played by various parties
• List events or actions that take place in different parts of the business processes
• Exceptions that may arise
• Realize and enact using available technologies
• Workflows
• Exclusions, Authorizations, Arbitration, Jurisdiction
Challenges

• Formal Representation languages
  – Contract representation: verbose text documents, semi-structured or structured format

• Contract Modeling

• Developing e-contract systems
  – Frameworks, Architectures
  – Integration

• Contract Enactment

• Contract Monitoring and Management
E-contract systems - Summary

• There are 20 Commercially available software products for electronic contract management (Source: International Association of Contract and Commercial Managers)

• Currently, most of these models are human and system driven prototypes (some of them in the process of developing tool-kits) to popularize e-contracts. These systems reduce the time to learn and deploy new e-contracts and manage workflows for e-contract enactment.
<table>
<thead>
<tr>
<th>Vendor</th>
<th>Estimated number of clients, 2006*</th>
<th>Estimated 2006 revenues from product (US$ millions)</th>
<th>2006 revenue per client (US$ thousands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ariba</td>
<td>120</td>
<td>$26</td>
<td>$218</td>
</tr>
<tr>
<td>CMA Contiki</td>
<td>80</td>
<td>$4</td>
<td>$50</td>
</tr>
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Source: All figures are Forrester estimates, based on briefings from vendors and public data where available.
*Full-year average of month-end client counts during the year
E-contracts: State of the Art

- Electronic contract creation or representation language
- Negotiation
- Management
- Collaboration
- Execution
- Fulfillment

- Enforcement
- Performance
- Digital signature
- Data Mining
Doctoral Work...
Available through web

- Lai Xu, Monitoring Multi-Party Contracts for E-Business, Tilburg University, 2004
Types of e-contracting: Deep and Shallow
Samuil Angelov and Paul Grefen

**Shallow e-contracting** is contracting in which:
(1) Information technologies are used to support the contracting process;
(2) Contracts have digital representation;
(3) The level of automation introduced by the use of information technologies does not lead to new business processes in a company (or to significant changes of the existing ones).

**Deep e-contracting** is contracting in which:
(1)..., (2)..., (3) The level of automation introduced by the use of information technologies leads to new business processes in a company (or to significant changes in the existing ones).
Examples

• Example 1 (for shallow e-contracting) - e-mail contracting

• Example 2 (for deep e-contracting) - a fully automated e-contracting system (no human intervention)
Languages to represent e-contracts

- XML
- ebXML
- ECML (E-Contract Markup Language)
- tpaML
- RuleML
- XPDL
- ........

Open Problem: Comparison and Evaluation to recommend a standard language for e-contracts
E-Contract Methodology

Contract Document

Requirements Collection and Analysis

Data requirements

Application Requirements

Application specifications
(XML-tagged e-contract specification)

Exceptions

ECA Rules

Conceptual schema
(Data model)

Workflows specifications

Physical Design
(Relations, Workflow instances, Metadata)

Deployment

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E-contract Modeling
Modeling e-contracts

- Contract Net Protocol [Smith, 1980]
  - Old model
  - Focus on low-level transaction aspects
- CrossFlow model [Grefen et al, 2000]

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e-Contract Modeling

- Conceptual Level
- Logical Level
- Implementation Level
e-Contract Modeling

- Meta Level
- Conceptual Level
- Logical Level
- Implementation Level

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Need for Meta-Model

- Most of the contracts have similar structure (like clauses related to payments)
- Guided approach to conceptual modeling
- Templates can be designed for specific domains
- Provides generality and flexibility
- Allows reusability and extensibility
Meta-models and Templates

- **Template** is an instance of a meta-model for a specific application domain (with certain constraints).
- Templates guide the modeling and enactment processes.
- Specific business interactions not covered by the clauses in standard contract templates can be provided as contract variations or contact escalations [Chiu et al].
- A contract clause contains a set of template variables.
- For example:
  
  “The Purchaser shall send a Letter of Credit (LC) for the Goods to the Supplier in the currency of { } with in { } days of the invoice date. The supplier shall on receipt of the LC ships the goods to the Purchaser with in { } days and provides the Purchaser with shipment details”. 

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CrossFlow e-contract meta-model

[Greven et al]

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Meta – Model for e-Contract template [Chiu et al, 2005]
A sales e-Contract template as an instance of the meta-model

Chiu et al, 2005

Sales:e-Contract Template

Purchaser:Party

Supplier:Party

Shipping&Insurance:Contract Clause

Deposit Payment:Contract Clause

Pricing:Contract Clause

Delivery:Contract Clause

Freight:Templ. Variable

Deposit:Templ. Variable

Quantity:Templ. Variable

Delivery date:Templ. Variable

Insurance premium:Template Variable

Unit price:Templ Variable

Return policy:Templ:Variable
Meta-Model for ECA rule: *On event if condition then action*

- **Condition**
  - +precondition
  - *

- **Workflow**
  - +action
  - *
  - based on
  - *

- **Rule**
  - exploits
  - *
  - involves
  - *

- **Role**
  - plays
  - *

- **Business Entity**
  - uses
  - *

- **Party**
  - owns
  - *

- **Temporal Event**
  - triggers
  - 1..*
  - +internal event

- **Event**
  - +external event

- **Exception**
  - *

- **CHIU et al, 2003**
Feature Meta-model [Fantinato et al, 2006]

- Feature Group
  - GroupCcardinality
  - Containable ByFG
  - Containable ByF
  - FDReference
  - Grouped Feature

- Attribute
  - name
  - TypedValue
    - String Value
      - name
    - Integer Value
      - name

- Feature
  - name
  - Feature Meta
    - model [Fantinato et al, 2006]

- Solitary Feature
  - Feature Cardinality
    - 0..1
    - 1

- Root Feature
  - Feature Model
    - *
ebXML Meta-Model: Resources and Contracts Grouping
Reject Request

Rule-1

Addition of New Parties

Rule-2

Roles

Rule-3

Stop Work

Contract

Can have

Sub Contract

Has

Activities

Must Have

Clauses

Lists

Synchronization

Budget

Budget Over

Payments

Can Have

Role changes

Allowed

Not Allowed

Rule - 2

Relations

Events

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Most of these are parametric driven template based meta-models
Open Issue:
How to facilitate both domain-specific modeling along with Generic modeling?
E-contract Specification
Logics and Theories for e-contract

- Predicate Logic, first-order logic and speech act theory
- Deonitic Logic
- Model Action Logic
- Temporal Logic
- Subjective Logic
- Petri net and finite state machines
- Event Calculus
Current State of the Art in Logic & theory for e-contracts

• Horn Logic
  – Derivation rules (rule changing), Negation as failure, Procedural attachments, external data integration.

• ECA Rules
  – Active behaviour (events, actions)

• Event Calculus
  – Temporal reasoning over effects of events on fluents (contract tracking)

• Defeasible logic
  – Conflict resolution, default rules and priority relations of rules

• Deontic logic
  – Rights and obligations with violations an exceptions of norms

• Description logic
  – Contract vocabularies, domain-specific concepts

(Source: Adrian Paschke, Rule based service level agreement language, IAWTIC 2005, Austria)
Examples of e-contract models with logic

• Declarative approach to business rules in e-commerce contracts by combining Courteous Logic Program and XML [Grosof, 1999]

• Deontic logic for contract clauses [Marjanovic and Milosevic, 2001]

• Logic formalism to represent the content of business contracts based on the Formal Language for Business Communication [Tan and Thoen, 2002]
Examples of e-contract models with logic contd...

• Finite State Machines are used to attempt to assess contract status and implication of eventualities [Daskalopulu et al, 2001]

• CTR-S: A Logic for Specifying Contracts in Semantic Web Services. [Davulcu et al 2004]
  – extension of the classical first-order logic,
  – Suitable for both static and dynamic aspects of contracting
  – designed to model this adversarial situation through its novel model theory, which incorporates certain game-theoretic concepts.
• Too much language driven solutions may not provide flexible e-contract solutions
• Solutions should be language independent
• **Modeling provides language independent solutions**
E-contract Deployment: Enactment, Monitoring and Management
E-Contracts and Web Services

Contract activities involve inter-organizational Business processes.
Contract activities involve inter-organizational Business processes.
E-Contracts and Web Services

Contract activities involve inter-organizational Business processes.

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Contemporary Web Services technologies Support

• Handling of Cross-organizational Exception and asynchronous Events
• Provide Trust and Security
• Handling long-lived business processes
• Collaboration between independent entities
• Support cross-organizational workflow execution
• Accessing Shared repository (for meta data, business semantics, etc.) in real-time and evolving services
• Match-making between contract components and service components
E-contract Framework

• Framework for legal e-contracts [Gisler et al, 2000]
• 4W Framework
• ER$^{EC}$ Framework
• .....
B2B e-contracts: 4W Framework

(Angelov and Grefen, 2001)

· The participation of “two or more parties” leads to “Who” concept.

· An agreement that is “legally enforceable” shows that there is a context for every contract i.e., a “Where” concept.

· The “obligations in return for certain rights” relates to a “What” concept.

· The parties’ commitment illustrates the existence of “How” concept.
WHO...

• A contract has a number of *actors* associated with it. They participate in the contract establishment and enactment.

• Under the WHO concept, three sub-concepts are identified: a party, a mediator and an auxiliary implementer.
  - The companies that participate in the established contract and exchange values are called parties.
  - A mediator is a company or a public institution that facilitates the contract establishment and contract enactment
  - During contract execution, parties perform processes that are in accordance to the negotiated terms. A party may outsource a part of a process to an auxiliary implementer.
Where ...

- A contract is established and enacted in a certain *context*.
- Three context dimensions are identified under WHERE concept: legal, geographical and business.
What...

- A contract has a *content* that describes the exchanged values, the processes that will take place for the exchanges and the accompanying provisions.

- Depending on the contract context, contracts are classified as complete or incomplete.
  - Complete contracts contain exhaustive specifications of the exchanged values and the provisions that accompany them.
  - Incomplete contracts allow parties unspecified behavior, which requires higher level of trust among them.

- In electronic contracting, where parties are unknown and business relations are short, complete contracts will play dominant role.
How ...

- A contract has a set of concepts related to the contracting processes.
- Under the HOW concept, three sub-concepts are identified: *contract representation and standards*, *contracting phases* and *contract structure*.
- Contract representation is defined by a standard. On the other hand, to achieve interoperability between the contracting parties and processes to be speeded up, standards are set.
- A contract passes through four phases in a standard situation: informational, pre-contractual, creation and enactment.
- For the faster creation of a contract offer, a party can use a partially or completely predefined contract structure.
4Ws: Relations

• Relations between the 4Ws show the tight coupling among them and the complexity of the contracting process.

• Contracting models and software solutions for e-contracting should consider these relations.

• Relations of WHO to
  – WHERE: the participating actors define the contract context
  – WHAT: contracting parties are recorded in the contract content
  – HOW: an actor plays a certain role in the contracting processes.

• Relations of WHERE to
  – WHO, WHAT, HOW: the contract context affects the contract actors, the contract content and contract process.

• Relations of WHAT to
  – HOW: the contract content specifies the contract enactment process

• Relations of HOW to
  – WHAT: the contract content results from the contract creation process.
4W E-contract Model

**Who**
- Actor
- Party
- Mediator
  - Contact data
  - Person
  - E-notary
  - Other

**What**
- Exchange value provisions
  - Financial reward
  - Service
  - Product
- Exchanged value

**Where**
- Context
  - Business
  - Legal
  - Other

**HoW**
- Communication
- Standards
- Contracting
Cross-Flow Project [Grefen et al]

- Models virtual enterprises based on a service provider-consumer paradigm
- Organizations (service consumers) may delegate tasks in their workflows to other organizations (service providers)
- Virtual organizations are dynamically formed by contract-based matching between service providers and consumers
Cross-Flow Project [Grefen et al] contd..

• No sophisticated mechanism such as workflow views for information and control exchange between workflows of different organizations

• Contract enforcement is not straightforward (like E-ADOMÉ workflow views equipped ECA-Rule mechanisms based on cross-organizational events)
COSMOS Project

• Stands for Common Open Service Market for SMEs
• Internet based electronic contracting service to facilitate business transaction process
• Developed based on Contract Object Model to describe an e-contract as a combination of objects, which can be exchanged between different parties and stored in XML format
• COSMOS workflow engine invokes functions in accordance with temporal constraints extracted from contracts
• Developed a CORBA-based system to implement the contracting service

http://vsys-www.informatik.uni-hamburg.de/projects/cosmos/index.phtml

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COSMOS Architecture

Offer Database

Contract Template Database

Offer Selection

Offer / Inquiry

Process Description

Negotiation Signing

Market Participant

Market Participant

M. Merz & P. Hamburg
W3C Dsig Workshop

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COSMOS Project contd...

- It assumes conflict-free specifications and can reason neither about conflicting obligations, not about powers of parties.
- It ignores the possibility of deviation from expected behavior.
- Does not provide reason about the consequences of violation.
SweetDeal system (Benjamin and Poon)

• Rule-based e-contracts (SweetRules)
• Allows software agents to create, evaluate, negotiate and execute e-contracts with substantial automation and modularity.
• Represents contracts in RuleML and incorporates process knowledge descriptions based on the ontologies.
• Semantic Rich system
• Facilitates Monitoring and Exception handling
<table>
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<th>Crossflow</th>
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<th>Sweetdeal</th>
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<td>Management</td>
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Three-Layer Framework by Chiu et. al. (2003)

• An e-contract enactment system has been based on three-layer framework.
  – Business Layer
  – Structural Layer
  – Implementation Layer

• E-contracts are modeled in UML

• Implementation architecture is based on cross-organizational workflows using Enterprise Java Bean and Web services.
• **Business Layer**: (2003) contd..
  - E-contracts are defined through analyzing the contract clauses to business rules and business entities based on ECA paradigm
  - Business parties, business rules, business entities

• **Structural Layer**:
  - Requirements for the e-contract enactment workflow are elucidated through requirement analysis
  - Cover both static and dynamic aspects
  - User case diagrams, activity diagrams

• **Implementation Layer**:
  - Consists of components of contract activities, workflows among these activities and web services
  - Cross-organizational workflows and interfaces are implemented using Enterprise Java Bean and Web services.
Motivated by the *active database paradigm*

Event - occurrence of something interesting to the system itself or to user applications

Event driven execution of rules in event-condition-action (ECA) form

ECA (active) rules: *On event* if condition *then* action

Exceptions and alerts are events too (*action* = handler)

Ensure efficiency and timeliness - monitor becomes only active when an interesting event occurs.
The architecture is inspired by the system architecture of the DR-DEVICE family of applications.

The main differences between DR CONTRACT and the DR-DEVICE is in the use of an extended variant of Defeasible Logic.

The extensions are in the use of modal operator and a non classical operator for violations.

The same difference applies for the SweetDeal approach by B. Grosof
Other e-contract projects/Systems

• SeCo Project [Runge et al]
  – Secure Electronic Contracts
  – Described a SeCo Container which has three layers – logic, information and communication layers

• Coyote Project [Dan et al, 1998]
  – Cover Yourself Transaction Environment
  – Focus on multi-party e-commerce framework

• SORM Model [Ludwig and Stozle, 2003]
  – Simple Obligation and Right Model
  – Runtime management of electronic service contracts
Other e-contract projects/Systems

- **Business Contract Architecture (BCA) [Milosevic et al, 1995]**
  - Assumes contracts are provided a priori
  - Supports static e-contracts - not suitable for dynamically changing business and regulatory environments

- **HP Labs [Morciniec, 2001]**
  - Work-in-progress
  - A high-level architecture for regulating electronic marketplaces using contracts embodied in XML

- **EDEEE contract enforcement system [Bacon and Moody, 2003]**
  - Prototype
  - Based on persistent occurrence histories and incremental continuous query evaluation for monitoring of e-contracts
Monitoring e-contracts

• Event based monitoring
  – Event types: temporal, database, external etc.
  – Contract events are mutually exclusive
  – Specifying and detecting events play an important role in the process of analyzing, monitoring and visualizing the behavior of each party involved in the e-contract
  – Rouached et al presented event-based framework associated with a semantic definition of the commitments expressed in the event calculus, to model and monitor multi-party contracts
Monitoring e-contracts contd...

- **Pro-Active monitoring**
  - Xu and Jeusfeld, 2003
  - Handles the following questions
    - Given the current state of contract execution, which actions are expected from a partner in the future
    - Is a contract violation imminent, i.e., likely to happen within short time? Which partner have to remind to fulfill her obligation?
    - Which partner is responsible for a contract violation?
  - Proposed a framework for monitoring e-contracts during the contract execution.
  - Temporal logic has been used to represent the e-contract, which enables the pro-active monitoring of e-contracts.
Main elements of an e-contract

\[ R = \{ R_1^{ME1}, R_2^{ME1}, ..., R_m^{ME1}, R_1^{ME2}, R_2^{ME2}, ..., R_n^{ME2} \} \]

\[ O = \{ O_1^{ME1}, O_2^{ME1}, ..., O_p^{ME1}, O_1^{ME2}, O_2^{ME2}, ..., O_q^{ME2} \} \]

E-signatures

Manager E1  
Alice

Manager E2  
Bob

E1, E2—Enterprises, R_\text{r}—Right, O_\text{o}—Obligation  
ME1—Manager of E1, ME2—Manager of E2

Mapping of events, conditions and operations of an e-contract into a FSM state
Business Contract Language

The Contract monitoring domain language
Contract Management

- Managing contract effectively requires a powerful semantic model and a generic management framework. If contracts are to be enforced automatically then the representation must capture the relevant semantics in full. [Bacon and Moody, 2003]
ER\textsuperscript{EC} Process Model

- Requirements Collection (subcontracts, parties, activities, clauses, relationships, events, exceptions, etc.)

- Contract Model requirements
  - Structural validation
  - Conceptual schema (ER\textsuperscript{EC} data model)
  - Workflow Mapping (Logical Design)

- Contract Process Requirements
  - XML-tagged e-contract specification
  - A P C Constructs
  - A C D
  - ECA Rules
  - Application Design
  - Log records specification

- Logical Schema
  - Transactions

- Physical Design (Relations, Workflow Instances, Applications)
  - Internal Schema

- Functional Validation

- Behavior validation
- Log Records

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## APC Specifications

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<th></th>
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</thead>
<tbody>
<tr>
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<td>&lt;Party Number&gt; ..&lt;Party Name &gt;.. + &lt;/Party&gt;</td>
</tr>
</tbody>
</table>
| Activity   | <Activity>  
|            | <Activity Number> ...<Description> .... <Start Date >... <End Date> .... < Previous Activity>... <Next Activity>.... <Parties Responsible>..</Parties Responsible> + <Clauses>...< /Clauses> + <Exceptions>...</Exceptions> + </Activity>+ |
| Clauses    | <Clauses>  
|            | <Clause Number> <Description> <Activity Number>....<Party Number> + </Clauses> |
Implementation Architecture for ER\textsuperscript{EC} Framework
E-Contract Commitments
Goals of the e-contract commitment

• We believe that, to handle the complexity of a contract, an e-contract should reflect both the specification and the execution aspects of the activities at the same time, where the former is about the composition logic and the latter is about the transactional properties.

• Hence, the goals of an e-contract include precise specification of the activities, mapping them into deployable workflows, and providing transactional support in their execution.
Execution stages of an activity

1. Start
2. Execution in progress
3. Execution stopped
   - Complete or incomplete f-termination
     - Retry
     - Closed null termination
   - Complete or incomplete s-termination
     - Compensate
     - Closed non-null f-termination
   - Incomplete weakly committed s-termination
     - Complete weakly committed s-termination
     - Retry
     - Closed strongly committed s-termination
E-Contract Evolution

- Evolution of Business Environments
- Changing Market Requirements
- Involvement of multiple organizations
- Competition
- Changes in Government Policies and Laws
- Advancements in Technologies
Evolving Applications

• Two Kinds of Changes
  – Run-Time changes
  – Mini-World changes

• Exceptions
  – Expected exceptions
  – Unexpected exceptions

need of active behavior to synchronize the changes in business logic and business processes across different levels of conceptual/logical models.
Evolving Applications

Modeling active behaviour at various levels
Modeling Evolving Applications

• How to re-design the conceptual models (for instance, ER model)? How to synchronize the changes in mini-world and/or run-time environment to other levels?

• This calls for an iterative active methodology that constantly monitors run-time environment and changes in real-world specifications to keep the deployed applications/processes current.
E-contracts: Commercial Products
Some e-contracts Commercial Products

- LaDorn Systems Corporation's e-Contracts software
  - complete solution for automating the entire procurement process
  - Features
    - Centrally track and manage contracts
    - Route contracts through approval cycle with e-mail notifications
    - Easily add modifications to existing contracts
    - Track contract compliance
    - Create solicitations using templates and pre-existing documents
    - Manage vendor information, history and status
    - Search for vendors by commodity code, business size, classification or LSDBE
    - Evaluate vendor and subcontract performance
    - Customized reports that can be exported, faxed or emailed
    - Built-in multi-level security
    - Interface with other financial and administrative systems

- [http://www.ladorn.com/econtracts.htm](http://www.ladorn.com/econtracts.htm)
Some e-contracts Commercial Products contd...

• **Contract Management Track Software (CMTS)**
  - designed to simplify entire contract management process

• **ContractWeb**
  - enterprise contract management tracking solution
  - designed to streamline entire contract workflow process--from creation to completion
Open Problems

- Moving from existing voluminous document contract to executable e-contract
- Developing a generic meta-model or template models, to support domain specific e-contracts
- Integrated end-to-end solution from e-contract meta-model to e-contract deployment
- Evolving adaptive e-contracts (Spatio-Temporal)
- Developing e-contract Standards including standards for Conceptual modeling, architecture and deployment
Open Problems

• Tools and techniques to perform text analytics on e-contract documents to extract the logical specifications required for e-contract specification

• Supporting e-contract commitment. The monitoring, control and management aspects. Could be meta-workflow driven solution.

• Integrating payments with e-contract progress tracker and e-contract commitments

• Finally, deploying e-contracts using web-services and related technologies to support high volume e-contracts
Fig. 1. E-Contract System
References


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• G. Governatori, and Pham Hoang, Duy, DR-CONTRACT: An Architecture for e-Contracts in Defeasible Logic. In Bartolini, Claudio and Governatori, Guido and Milosevic, Zoran, Eds. 2nd EDOC Workshop on Contract Architectures and Languages (CoALA 2005), 20 September, 2005, Enschede, NL.


• T. Kwok and T. Nguyen, An Automated Method to Extract Data from an Electronic Contract Composed of a Number of Documents in PDF format, Proceedings of 8th CEC/EEE’06, 2006.


• Z. Milosevic, A. Berry, A. Bond and K. Raymond, Supporting business contracts in open distributed systems, SDNE’95, IEEE computer society, 1995.


Q & A

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Thank You
Investment E-Contract: Contracts

1. FI and Banks/agencies for accepting the Application Form and initial amount from Investors and sending the Application Forms to FI and collected amount to the account of FI (with FI’s own bank).

2. FI and Banks (in some cases may be different from 1) for periodic payment of interest/warrant/dividend.

3. Among banks for inter bank funds transfer

4. Bank and investor – investor being the account holder of the bank

5. FI and Investors

6. Among the investors for the transfer of ownership

7. Agencies and banks for transfer of funds
$ER^E_C$ Model
Investment E-Contract: Clauses

1. Who can invest (like say citizen of the country and or institutions), how they can invest (like say singly, jointly etc.)
2. Minimum Amount, Maximum Amount and Other restrictions Maturity Period
3. Promise of return, mode and periodicity of interest payment etc.
4. Other conditions like whether Transfer of ownership allowed, Pre-mature withdrawal allowed or not, reinvestment in other schemes allowed or not etc. and penal clauses like payment of additional penal interest in case the interest is not paid in time.
## Investment E-Contract: Activities

<table>
<thead>
<tr>
<th>Activity FI</th>
<th>Activity Investors</th>
<th>Activity Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Issuing notification for bonds/security</td>
<td>1. Submit the signed and completed application and pay the amount.</td>
<td>1. Receive Application Form and Amount</td>
</tr>
<tr>
<td>2. Entering into an agreement with banks/agencies for acceptance of application forms and amount.</td>
<td>2. Get notification</td>
<td>2. Send Applications to FI and collected Amount to FI’s Bank</td>
</tr>
<tr>
<td>3. Receive Application forms and funds, scrutinize applications, pass accounting entries, allot bonds/securities to investors, return the amounts for rejected applications and unallotted amount, issue bonds and certificates, send acceptance notifications to holding agencies and investors, periodically pay the promised interest, repay or reinvest in new scheme, etc.</td>
<td>3. Hold the Bond/Security till maturity or carry out allowed operations like Transfer, premature withdrawal etc</td>
<td>3. FI’s bank will credit the amount collected to FI’s Account</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. FI’s Account will be debited for periodic interest and repayment, the amount to be transferred to different bank accounts.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Transfer the interest and amount received to the investor’s account.</td>
</tr>
</tbody>
</table>
Activities 
\( \{ A_1, A_2, A_3, A_4 \} \)

**Submission**

**Fund Receipt & Info. To FI**

**Scrutiny**

**Allotment**

**Periodic Repayment**

**Maturity Repayment**

**Change Ownership**

**Funds Transfer**

**Contract**

**Investment** - **have**

**Sub Contracts**

**Agreement**

**Bank Customership**

**Inter-Bank**

**Parties**

**Payments** - **have**

**Agency**

**Investor**

**Bank**

**FI**

**Invalid**

**No Sufficient Balance**

**Invalid Account Details**

**Hold**

**Resend Again**

**Exceptions**

**Invalid Account Details**

**Hold**

**Resend Again**

- **Relations between entity types**
- **Relations between instances of different entities**
- **Contract Events**
- **Output events for exceptions**
- **Input events for exceptions**

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Rule 1

**Rule Name** : Allot_Bonds_To_Investors  
**Triggering_event** : Amount_Received and Application_Scrutiny_Successful  
**Condition** : Decide upon the Bond Allocation policy.  
**Action** : Return the remaining Amount if the Face_Value of Bonds allotted is less than paid amount.  
**Resultant_Event** : {Allot Bonds, Return Amount, Inform_Depository}  

Suppose that investor has applied for Bonds of face value say X and he has paid amount Y (>X) then the amount (Y-X) is returned. The information is sent to the depository.

Rule 2

**Rule Name** : Pay_Interest  
**Triggering_event** : Due_Date  
**Condition** : There should not be any hold on interest payment  
**Action** : Calculate the interest payable and credit it to the investor’s Account  
**Resultant_Event** : {Calculate Interest Due, Amount_Transfer, Bank_Transfer}  

The interest will be calculated and the amount will be transferred to the Account of the Customer  
**Exception** : Not able to credit – Incorrect_Account_Info, Interest cannot be paid
FMS Contract

• Financial Messaging Solution – standard for financial messages among banks and between banks.

• A contract between software developer, service provider, and the participating banks.
FMS Contract

- A modularized Web enabled software enabling financial messaging among the participating banks with flexible architecture.
- Template Builder to support flexible definition of messages in the standard format.
- Directory services for maintenance of branch directory, network configuration, etc.
- Secured messaging and routing based on store and forward principles governed by push technology providing Smart Card based access. Messages will be secured via standard encryption and authentication services conforming to ISO standards.
- Messages can be clubbed and exchanged as a batch of files.
- Complete auditing, logging, time-stamping and warehousing of messages and periodic computation of charges and billing of the services offered to the participating banks.
FMS Contract

The contract document is 200 pages
Involves executing number of activities in synchronized manner

Typical Activities
1. Identify the deliverables of the contract. It will involve a subcontract between the participating banks and software and hardware vendors.
2. The work completed is required to be monitored - Progress Monitoring
3. It has to be inspected for correctness – Testing Activity
4. Depending upon the successful completion, the payments instructions to the banks are generated. – Payments
Either Purchaser or Contractor can identify the need for change on the accepted deliverables. [Clause CL-a]

If the Purchaser identifies the change requirement, then Purchaser will raise Request for Change (RFC) by filling the Change Management Request form. Its format will be provided by the Contractor. It will essentially cover Change Request Description, Requested Date, Priority of the request (i.e. Very Urgent, Urgent, Normal etc.). The priority will be assigned by the Purchaser Project Manager. [Clause CL-b]

On receiving this request Contractor will allocate a CMR number to the request and will notify it to the Purchaser. The contractor will then evaluate the need of this change with respect to Priority, Feasibility of the change, and Impact on time frame and cost. The contractor might ask for relevant clarifications regarding the change request. It is the responsibility of the purchaser to provide the clarification in time. The Contractor will place the results of evaluation to Purchaser. [Clause CL-c]

The Purchaser can approve/disapprove the change requests after seeking the relevant clarifications on the evaluation from the contractor. In case the change is approved then the Contractor will schedule the changes based on priority. The contractor will then make the necessary changes and release them to Purchaser for acceptance. The purchaser will carry out the acceptance and provide the acceptance certificate. The Change Management Form will be recorded with the result raised change request, who has incorporated the change, date of release to Purchaser. [Clause CL-d]”
Example: FMS-Taxes&Payments

“Subject to any deductions of tax at source, if applicable, from the contract price as per clause A of schedule A of the Contract, the CONTRACTOR shall be entitled to receive the Contract Price in the following manner:

(1) All the payments shall be released directly by the PURCHASER to the CONTRACTOR.

(2) The initial advance payment and payments against the delivery certificates and final Acceptance Certificates as referred to in Para B of schedule A of the contract, shall be released on completion of each milestone as indicated in the table of payment in schedule B.

(3) All the payments will be made by the purchaser only after satisfying about the satisfactory completion of each milestone as stipulated in Systems Requirements Specifications (SRS) Document referred to in Schedule B, of the Contract by the PURCHASER.

(4) ...
<table>
<thead>
<tr>
<th>A: Application Software Developer</th>
<th>C: Service Provider</th>
</tr>
</thead>
<tbody>
<tr>
<td>[A-1]. Examine the Request. Seek clarifications and replies</td>
<td>[C-1] Identify the Change Management Request</td>
</tr>
<tr>
<td>[A-3] Accept or Reject the change</td>
<td>[C-3] Examine the impact of acceptance of change</td>
</tr>
<tr>
<td>[A-4] Carry out changes</td>
<td>[C-4] Upgrade Hardware/Software, if necessary</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B: Banks</th>
<th>D: Vendors</th>
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</thead>
<tbody>
<tr>
<td>[B-1] Identify the Change Management Request</td>
<td>[D-1] Receive request for Hardware/Software</td>
</tr>
<tr>
<td>[B-2] Clarifications and Replies about changes</td>
<td>[D-2] Supply Hardware/Software</td>
</tr>
<tr>
<td>[B-3] Examine the impact of acceptance of change</td>
<td>[D-3] Installation</td>
</tr>
<tr>
<td>[B-5] Acceptance of Upgrades</td>
<td></td>
</tr>
<tr>
<td>[B-6] Acceptance of the changes</td>
<td></td>
</tr>
<tr>
<td>[B-7] Payments to different parties like Vendors/Service Provider/Application</td>
<td></td>
</tr>
</tbody>
</table>
(a) Parametric workflows for ‘payments’ (b) Workflow views for ‘Receive Payments’ (c) Dynamic workflows for ‘carryout changes’
Textile Value Chain Contract

(1) STC and Mills
(2) STC and Weavers
(3) STC and Printers
(4) STC and Showrooms
(5) STC and Institutes/organizations
(6) Interbank
(7) Bank Customership
Terms of Payment: 100% payment will be made against delivery by cheque after inspection and acceptance of the material at our stores.

“When the material is ready for dispatch”, before supplying the material, please arrange to send three copies of Performa invoice indicating D.C. No. & Date in order to keep the demand draft ready.[Clause CL-a]

Liquidated Damages:
A) Failure to supply the goods by the time specified on the order will make the supplier liable to an unconditional liquidated damage of ½% (half percent) per week subject to a maximum of 10% (Ten Percent) of the price of the goods in arrears at the discretion of the STC.[Clause CL-b]
B) The purchaser shall have the right to cancel either wholly or in part the portion of the contract which is yet to be executed by supplier in case the delivery is not in accordance with the time specified in the order. [Clause CL-c]

Jurisdiction: All questions, disputes of differences arising under, out of or in connection with the contract shall be subject to the exclusive jurisdiction of the court within the local limits of whose jurisdiction the place from which the purchase order is issued, is situated.[Clause CL-d]

Quality: All goods and works must conform to the specifications quoted on the order and are to be strictly in accordance with approved samples of designs. Goods supplied are subject to inspection by our authorized representatives and the inspector has right to reject the goods of conforming to our specifications.[Clause CL-e]

Inspection: All goods and works are subject to our inspection. Inspection, either at your works or delivery as agreed will be carried out. The decision of our officer nominated/authorized by the GM, Materials is final. Rejected goods will be returned to the suppliers at his cost including freight on original shipment.[Clause CL-f]
## Activities of each party for the Textile value chain contract

<table>
<thead>
<tr>
<th>A: STC</th>
<th>C: Weavers</th>
</tr>
</thead>
<tbody>
<tr>
<td>[A-1] Requirement analysis,</td>
<td>[C-1] Receive the raw material,</td>
</tr>
<tr>
<td>[A-2] Inventory management</td>
<td>[C-2] Process material</td>
</tr>
<tr>
<td>[A-3] Estimation of raw material (yarn)</td>
<td>[C-3] Supplying the weaved material/gray cloth to STC/Printers</td>
</tr>
<tr>
<td>[A-4] Purchase order to Mills</td>
<td></td>
</tr>
<tr>
<td>[A-5] Shipment of raw material to weavers</td>
<td>D: Printers</td>
</tr>
<tr>
<td>[A-6] Shipment of weaved material/gray cloth to Printers along with required design specifications.</td>
<td>[D-1] Receive the weaved material</td>
</tr>
<tr>
<td>[A-7] Shipment of finished goods to showrooms/Institutions/Organizations</td>
<td>[D-2] Process (dying and printing) the material</td>
</tr>
<tr>
<td>[A-8] Training to weavers on modernization of new machinery/tools</td>
<td>[D-3] Shipment of finished goods to STC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B: Mills</th>
<th>E: Showrooms/ Organizations</th>
<th>F: Banks</th>
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<tbody>
<tr>
<td>[B-1] Receive the invoice</td>
<td>[E-1] Send the request for material (cloths)</td>
<td>[F-1] Account Subscription (customership)</td>
</tr>
<tr>
<td></td>
<td>[E-3] Sell the material</td>
<td></td>
</tr>
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Except Clauses

- A-1
- A-2
- A-3
- A-4
- A-5
- A-6
- A-7

- STC
- STC&Mills
- STC&Printers
- STC&ShowRoom

- Design
- Textile
- Mill
- Bank
- Printer
- Weavers
- STC

- STC
- STC&Mills
- STC&Printers
- STC&ShowRoom

- Time Limit
- Crossed

- Bank
- Send
- Clarification

- Design
- Bank

- Mill
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Workflow for e-contract 'Textile Value chain'

STC
(Activities A-1 to A-8)

Mills
(Activities B-1 to B-2)

Weavers
(Activities C-1 to C-3)

Printers
(Activities D-1 to D-3)

Showrooms/Institutions
(Activities E-1 to E-4)

Banks
(Activities F-1 to F-2)
Contract Monitoring using Rules

➢ Carefully look into all the statements in the contract document, especially the clauses.
➢ Extract statements with phrases such as “if then else”, “but”, “contract violates” and other user specified phrases.
➢ Prepare groups of statements in such a way that each activity/task is associated with a particular group.
➢ Identify the set of events and actions for each group of statements, and translate them into “Event-Condition-Action (ECA)” Rules.
➢ List the exceptions associated with each ECA Rules.
➢ Show the rules using parallelograms in the ER^{EC} model.
➢ Link the related entity instances of activities, clauses and exceptions entities in the ER^{EC} schema.
Evolving E-contracts
Modeling of applications requires both human and system driven specification and deployment in order to handle the active behavior of applications.
ER* Methodology

Requirements Collection and Analysis

Data requirements

Conceptual schema (ER data model)

Process specifications (Logical Design)

Structural validation

Conceptual specifications

Function Validation

Logical Schema

Applications

Physical Design (Relations, Workflows, …)

Internal Schema

Run-time Environment

Log Records

Application requirements

Application specification

Exceptions

Active Behaviour

ECA Rules

Behavioral changes

Knowledge Base (Run-time & Mini-world)

Workflow specifications

Application Design

Log records specification

Mini-world
ER* Methodology for Evolving Applications

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ER* Methodology for Evolving Applications

A two-way perspective of actively evolving conceptual models:

i) across the time domain (present, past and future)
ii) at various levels (meta, conceptual, logical and application level).

Approaches for evolution from present to future

- Template selection
- Operator assisted evolution of ER models
- Complete re-design of ER models (from scratch)

The template selection mechanism manifests itself as a ER* methodology problem.
Template Selection Driven Evolution
Approach 1

An appropriate ER model is instantiated from ER* model and necessary modifications can be made on it depending on the revised scenario.
An application requires one or more additional template elements

Template instantiation from multiple ER models
Approach 3

The change could evolve the template itself
Example:
Housing-Loan contract
An ER_EC Meta Model for E-Contract
Standard template of Housing-Loan contract

Housing-Loan

Activities

Have

Roles

Parties

Clauses

Bank

Borrower

Guarantor

Insurance Company

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Case 1: (Run-time change) - Borrower defaults

Template with change of roles
Case 2: (Run-time change) – Borrower’s death/disablement

Template with addition of subcontract
Case 3: (Mini-world change) - road expansion

Template with additional concepts
Template Levels

Generalized Templates
  Active
  Behaviour

Standard Templates
  Active
  Behaviour

Specific Templates
Summary

• ER* meta-model and methodology can actively reflect the changes across various levels of data models in an application.

• The methodology is based on the past, present and future needs of an evolving application system.

• Described an instance of ER* methodology as a template selection procedure for evolving applications through an example.

• Our methodology helps in visualizing evolution procedure and develop specific procedures, methodologies and tools to actively support application evolution.