Smart contracts in banking: foundations, design landscape and research directions

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Agenda

1. Prototype
2. Industry summits
3. First research paper
4. Second research paper
5. Questions

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1. Prototype – introduction

- *Team* – Barclays Investment Bank internal team in Barclays Accelerator
- *Challenge* – each bank maintains it own separate ledgers and systems, huge duplication of effort and cost
- *Solution* – shared ledgers and smart contracts
- *Piece in jigsaw puzzle* – smart contract templates
- *Our focus* – legal document templates to facilitate smart contracts
  - connect legal text to business logic, simplify legal documentation processes
  - drive standards adoption via reusable templates
  - mutualise costs via common components
- *Benefits* – cost reductions, efficiency improvements, risk reductions

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1. Prototype – public demo

- *Aim* – showcase a vision of the future: the lifecycle of a “smart” standardised financial product
- *Software demo* – prototype web application to edit templates, edit agreements, enter trades, affirm trades, and view trades
- *History in the making* – first public demo of prototype application on R3’s prototype Corda platform
- *Venue* – The O2 in London, audience of 800, largest FinTech demo day ever anywhere
- *Collaboration* – Barclays Investment Bank, R3, University College London, ISDA, Societe Generale, Techstars

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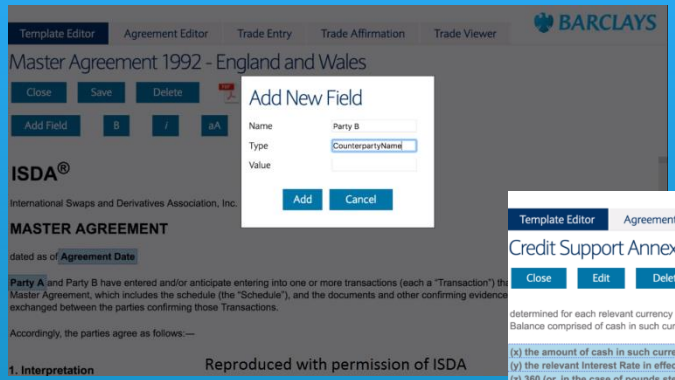
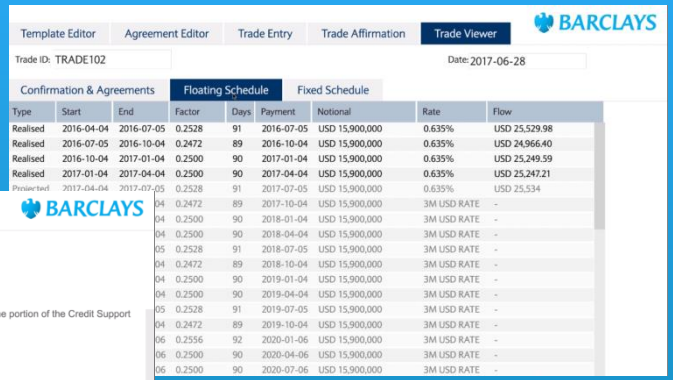
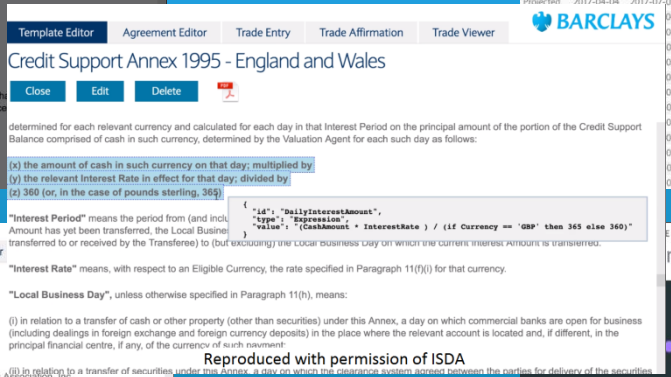
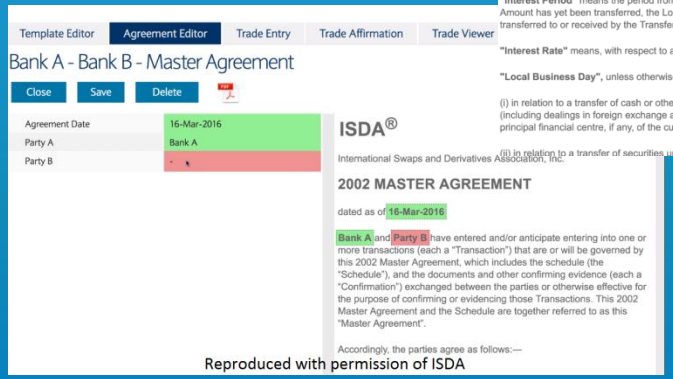
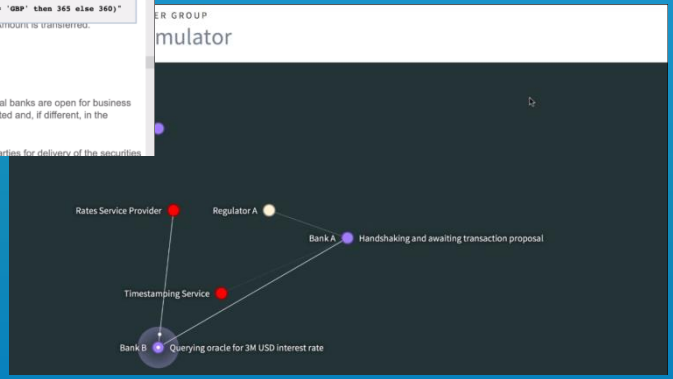
1. Prototype – software demo











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2. Industry summits

Smart Contract Templates Summit

- London and New York, June 2016
- 60 participants, 20 organisations
- Presenters: R3, Barclays, Norton Rose Fulbright, ISDA, University College London

Second Smart Contract Templates Summit

- London and New York, November 2016
- 200 participants, 25 organisations
- Presenters: R3, Barclays, CIBC, Nordea Markets, ISDA, FIA, Thomson Reuters, Norton Rose Fulbright, University College London, Cardoza Law School

Third Smart Contract Templates Summit

- London and New York, scheduled for June 2017

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3. First research paper

- "*Smart Contract Templates: foundations, design landscape and research directions*"
- Joint authorship: Barclays and University College London
- Position paper presenting our vision
- Publicly released on arXiv repository: `https://arxiv.org/pdf/1608.00771.pdf`
- Foundations: terminology, automation, enforceability, semantics
  - ***"A smart contract is an automatable and enforceable agreement. Automatable by computer, although some parts may require human input and control. Enforceable either by legal enforcement of rights and obligations or via tamper-proof execution of computer code."***

– automatable

3. First research paper

- semantics:
  - operational aspects: parts of contract we wish to automate
  - non-operational aspects: parts of contract we do not wish to automate
  - semantic analyses, e.g. semantic equivalence, risk assessment, legal context
  - two perspectives:
    - smart contact code: operational aspects expressed in code, automation by computer
    - smart legal contract: both operational and non-operational aspects of legal contract, some operational aspects must then be automated

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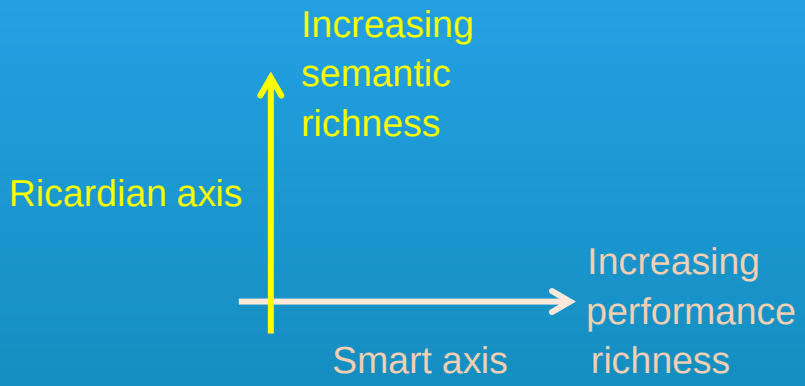
3. First research paper

- Grigg's "Ricardian axis" vs "smart axis":



– design landscape: legal prose, parameter sophistication, code sharing

– long-term research: formal languages (lack of ambiguity, compositional, simple and natural to use by lawyers)

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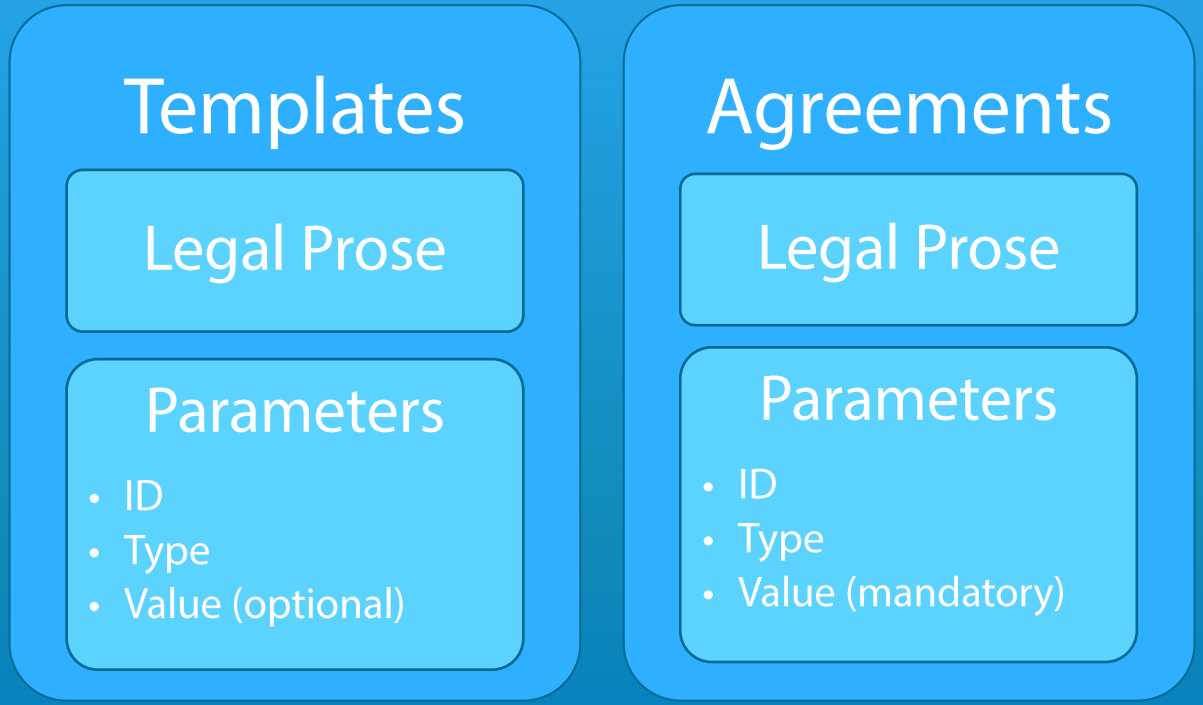
3. First research paper

Simple structure:



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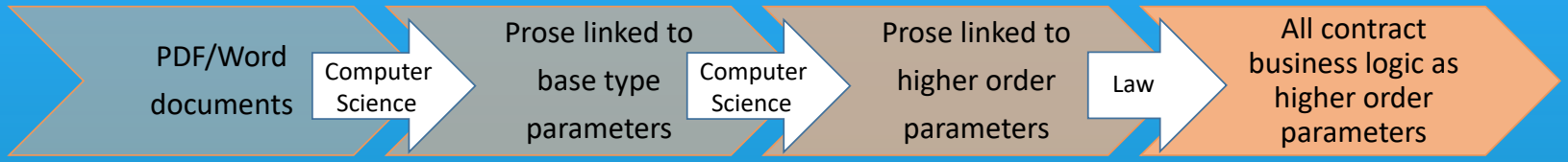
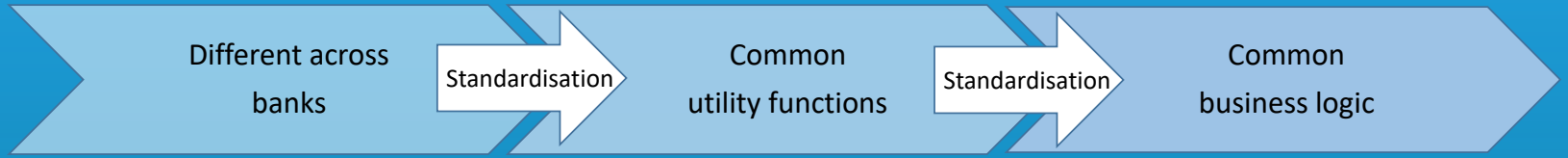
3. First research paper

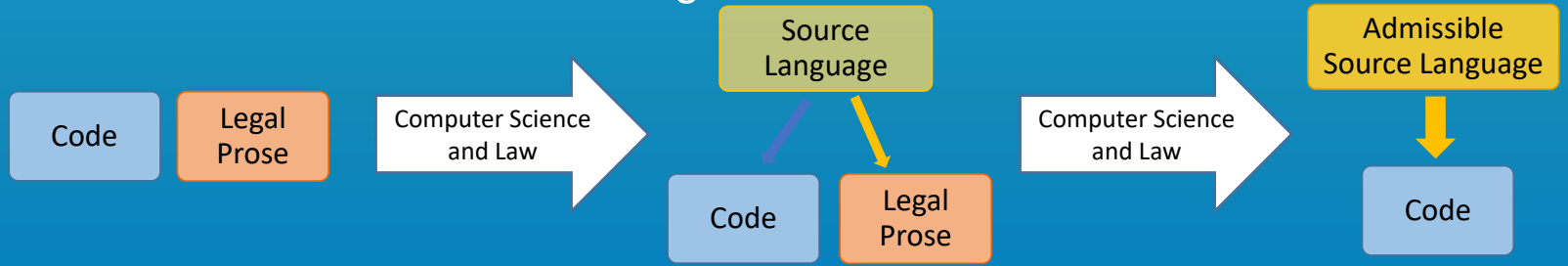
Evolution of legal prose and parameters



Evolution of code sharing



Long-term research



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4. Second research paper

- "*Smart Contract Templates: essential requirements and design options*"
- Joint authorship: Barclays and University College London
- Deeper dive into design landscape of formats for storage and transmission of smart legal agreements
- Publicly released on arXiv repository: `https://arxiv.org/pdf/1612.04496.pdf`
- Design landscape: essential requirements, design options, future developments

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4. Second research paper

- Essential requirements:
  1. Methods to create and edit smart legal agreements, including legal prose and parameters
  2. Standard formats for storage, retrieval and transmission of smart legal agreements
  3. Protocols for legally executing smart legal agreements (with or without signatures)
  4. Methods to bind a smart legal agreement and its corresponding smart contract code to create a legally-enforceable smart contract
  5. Methods to make smart legal agreements available in forms acceptable according to the laws and regulations in the appropriate jurisdiction

4. Second research paper

- Abstract core specification:

smart-contract ::= smart-legal-agreement smart-contract-code**

smart-legal-agreement ::= legal-prose parameters* agreement-header**

- Metadata as markup:

markup ::= presentational-markup | descriptive-markup

Note that descriptive markup can convey structure and/or meaning

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4. Second research paper

- Legal prose:

legal-prose ::= text markup text-with-markup**

text-with-markup ::= markup text*

Lists and tables, cross-references, redacted text, optional clauses

- Parameters:

*parameters ::= parameter**

parameter ::= parameter-name parameter-type parameter-value

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4. Second research paper

- Other design topics:
  - agreement structures (e.g. definitions, schedules, annexes)
  - multi-document agreements: document groups, document types and statuses, document hierarchies, inter-document cross-references,
  - cryptographic hashing; binding legal prose with smart contract code
- Further work:
  - data standards (with trade associations such as ISDA)
  - process standards (with trade associations such as ISDA)
  - semantics (with universities such as UCL)

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Questions?

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