

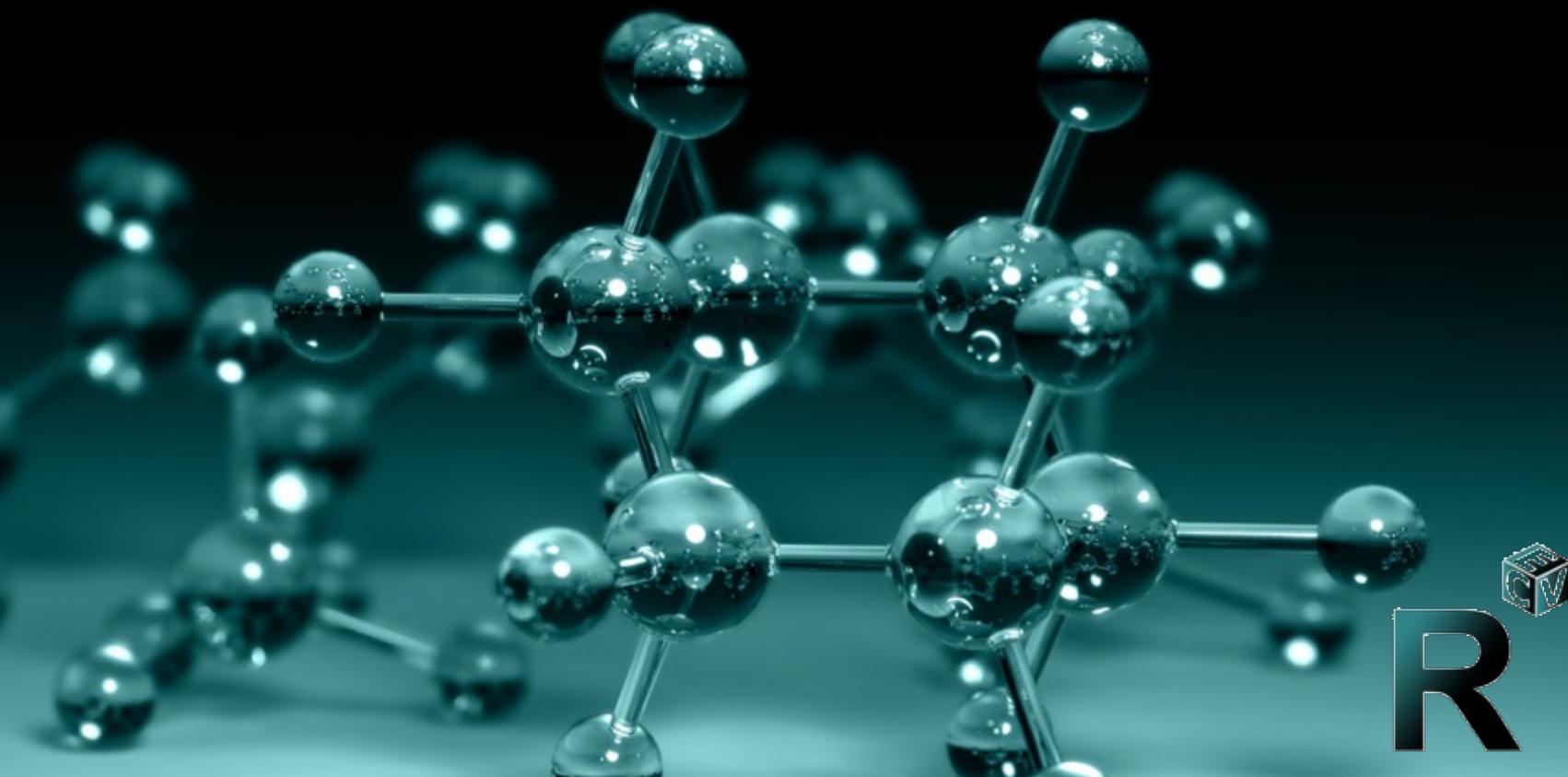
# R3

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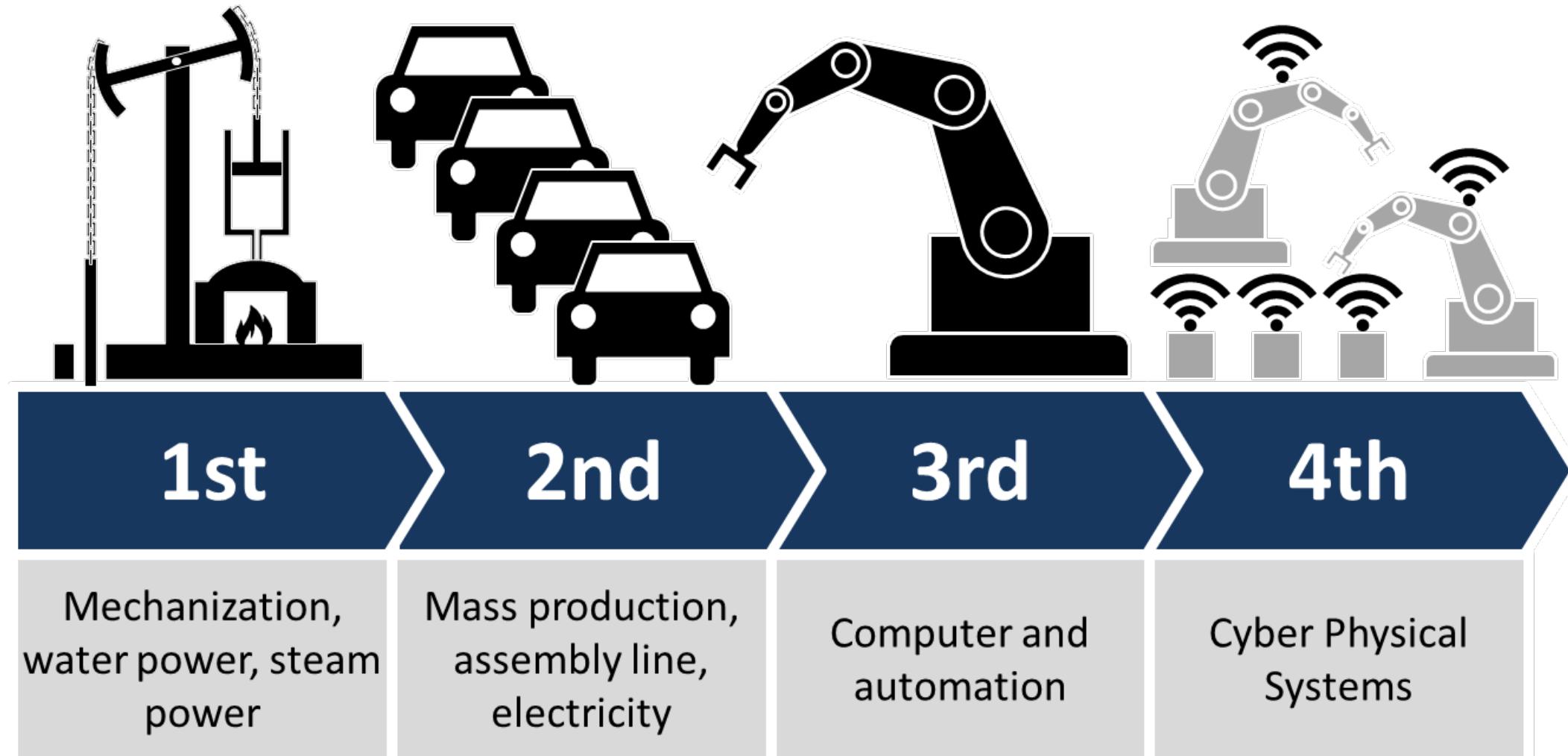
## Innovation through collaboration

*Tim Grant, CEO R3 LRC*

*Wharton  
November 2016*



# The Fourth Industrial Revolution



# World Economic Forum Report on DLT

1 2 3 4 5 6



The World Economic Forum's analysis has yielded six key findings regarding the implications of distributed ledger technology (DLT) on the future of financial services

## Key findings

1 DLT has great potential to drive simplicity and efficiency through the establishment of new financial services infrastructure and processes

2 DLT is not a panacea; instead it should be viewed as one of many technologies that will form the foundation of next-generation financial services Infrastructure

3 Applications of DLT will differ by use case, each leveraging the technology in different ways for a diverse range of benefits

4 Digital Identity is a critical enabler to broaden applications to new verticals; Digital Fiat (legal tender), along with other emerging capabilities, has the ability to amplify benefits

5 The most impactful DLT applications will require deep collaboration between incumbents, innovators and regulators, adding complexity and delaying implementation

6 New financial services infrastructure built on DLT will redraw processes and call into question orthodoxies that are foundational to today's business models

These key findings are explored in depth in the following pages, based on the use case deep-dives conducted across financial services.

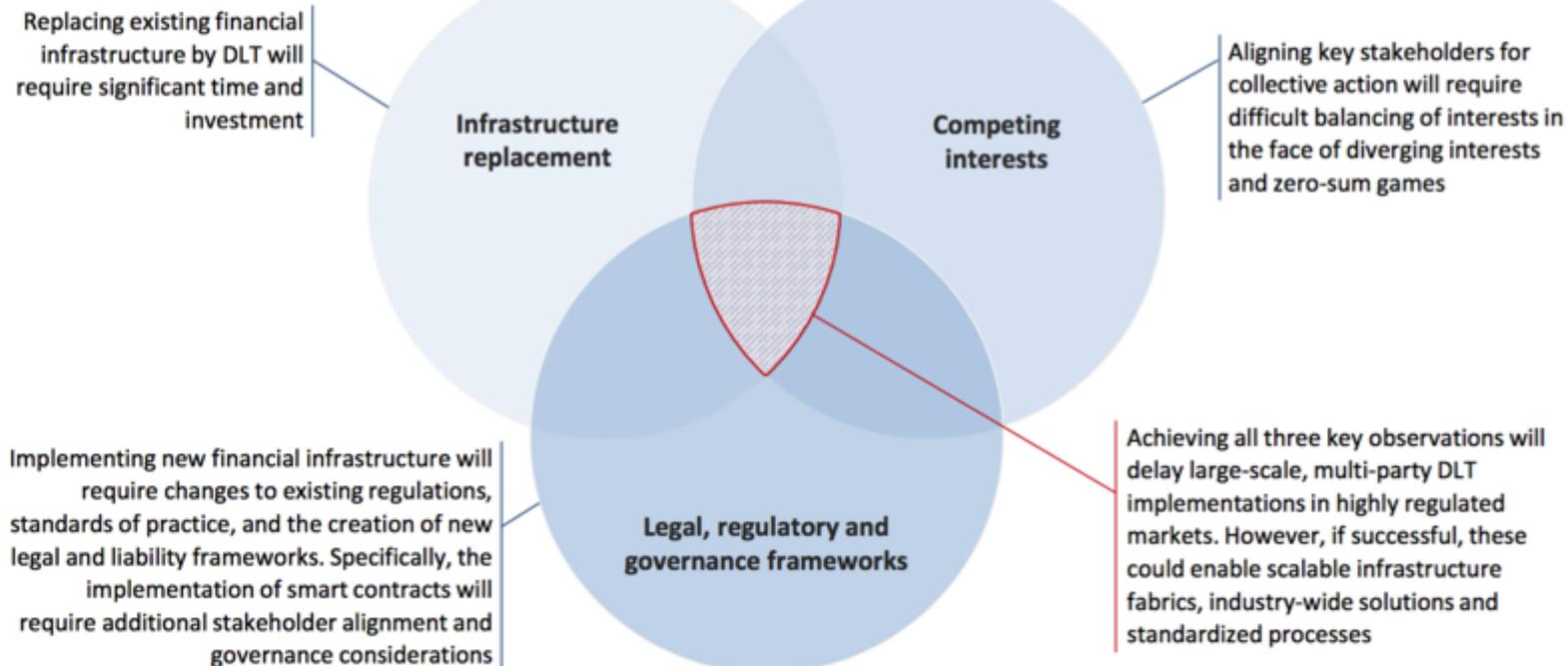
# World Economic Forum Report on DLT



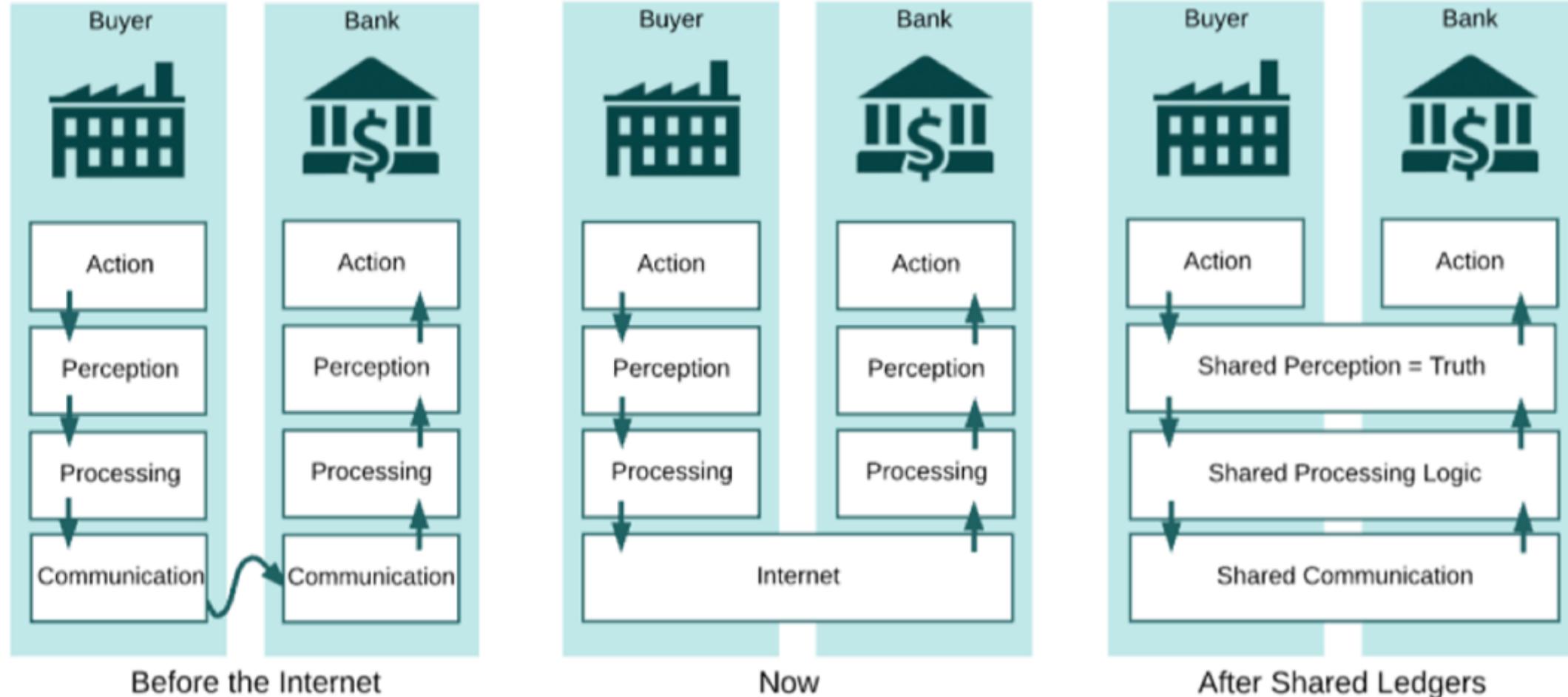
The most impactful DLT applications will require deep collaboration between incumbents, innovators and regulators, adding complexity and delaying implementation

Updating financial infrastructure through DLT will require significant time and investment. Three key observations must be taken into consideration for this implementation to be successful.

## Key observations and insights



# The Significant Evolutionary Step of DLT



# **Introduction to Distributed / Shared Ledgers & Illustrative Use Cases**

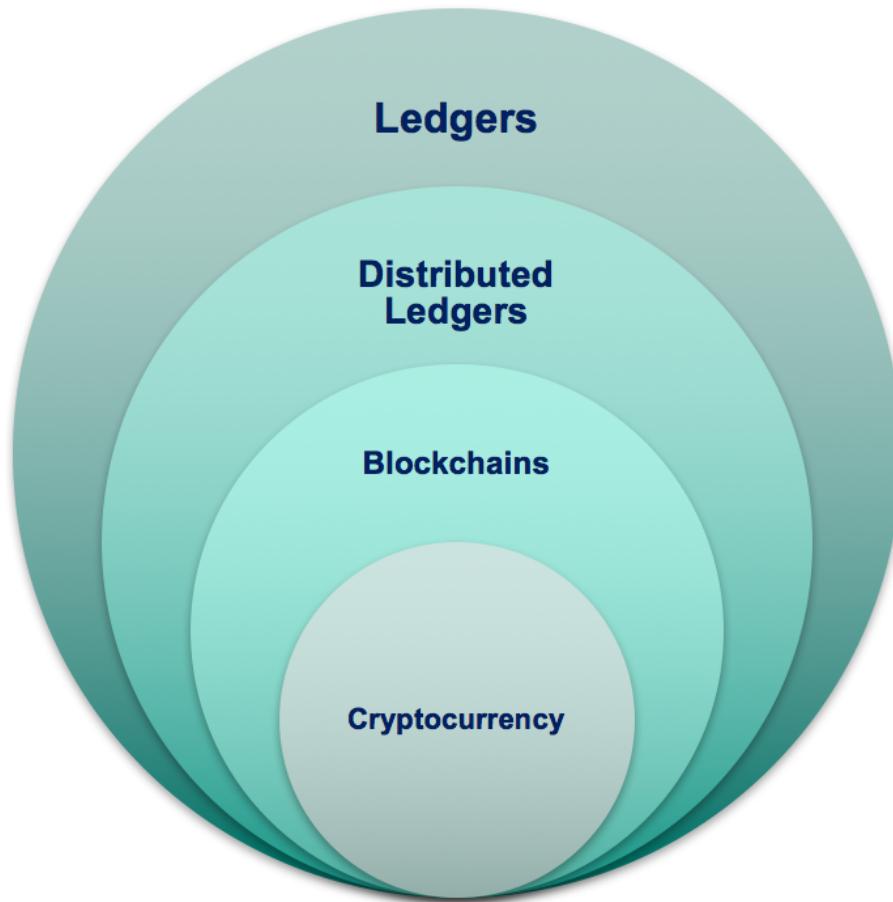
# Separating DLT vs Cryptocurrencies

For the purposes of discussions about R3 we need to differentiate between blockchain technology as cryptocurrencies (such as bitcoin) and blockchain in the sense of distributed ledgers.



ethereum

# Distributed Ledgers at a Glance



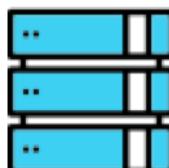
**Cryptography** to ensure identity authentication for each transaction



**Non-repudiation** to preserve integrity of data and create an audit trail.



**Smart contracts** for the automatic execution of business logic when certain criteria are met.



**Shared ledger** so each participant sees the same view of the same data, updated in real time.



**Distributed consensus** to ensure the state of the ledger represents the agreed-upon truth of all stakeholders.

# Benefits of Distributed Ledgers in Capital Markets



Reduction of manual, error-prone processes for the tracking of assets



Ease of validation of financial transactions through smart contracts



Simultaneous, real-time legal entity, auditor, and regulator access to data of multiple institutions



Easier "KYC" identity verification through cryptographic signing of transactions by known participants.

# Illustrative Use Cases Leveraging DL Technology

*Distributed ledger technology has a myriad of potential use cases for financial institutions, regulators, operations & individuals*

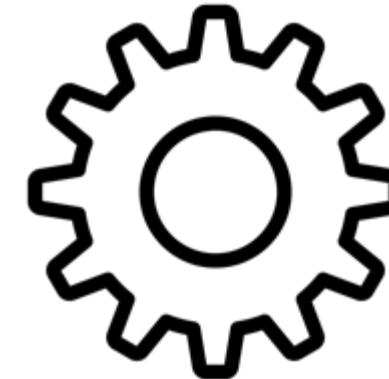
## Financial Institutions



## Regulators



## Operations



## Individuals



- FX Settlement
- Trade Reconciliations
- Transparent Valuations
- Cross Border Payments
- Credit Efficiency
- Loan Settlement
- Derivatives Clearing
- Collateral Management

- Anti-Money Laundering / Know Your Client
- Compliance Reporting
- Risk Visualization
- Basel III Compliance
- Client Fund Transparency
- Trade Reporting

- Client Onboarding
- Intracompany Settlement
- Normalize Reference Data
- Timestamping
- Account Portability
- Broker Fraud Identification
- Securities Agreements as Smart Contracts

- Crowdfunding
- Virtual Identity
- Credit Scoring
- Cross Border Remittance
- Vault/Escrow Services
- Customer Deposit Cost
- Peer-to-Peer Lending

# Introduction to R3

# R3 Overview

**The R3 consortium is the world's largest alliance committed to developing the next generation financial transactions network based on distributed ledger technology (DLT)**

- With 90+ R3 professionals combined with the DLT teams from 70+ members results in an unparalleled team of over 1800 people dedicated to DLT collaboration
- Fast growing team with offices in New York and London, San Francisco, Singapore, Switzerland, Seoul, Sydney, Taipei, Washington DC, Zurich and Tokyo

**Unparalleled cooperation and collaboration between organisations.**

**The bigger the network, the more likely the successful adoption.**

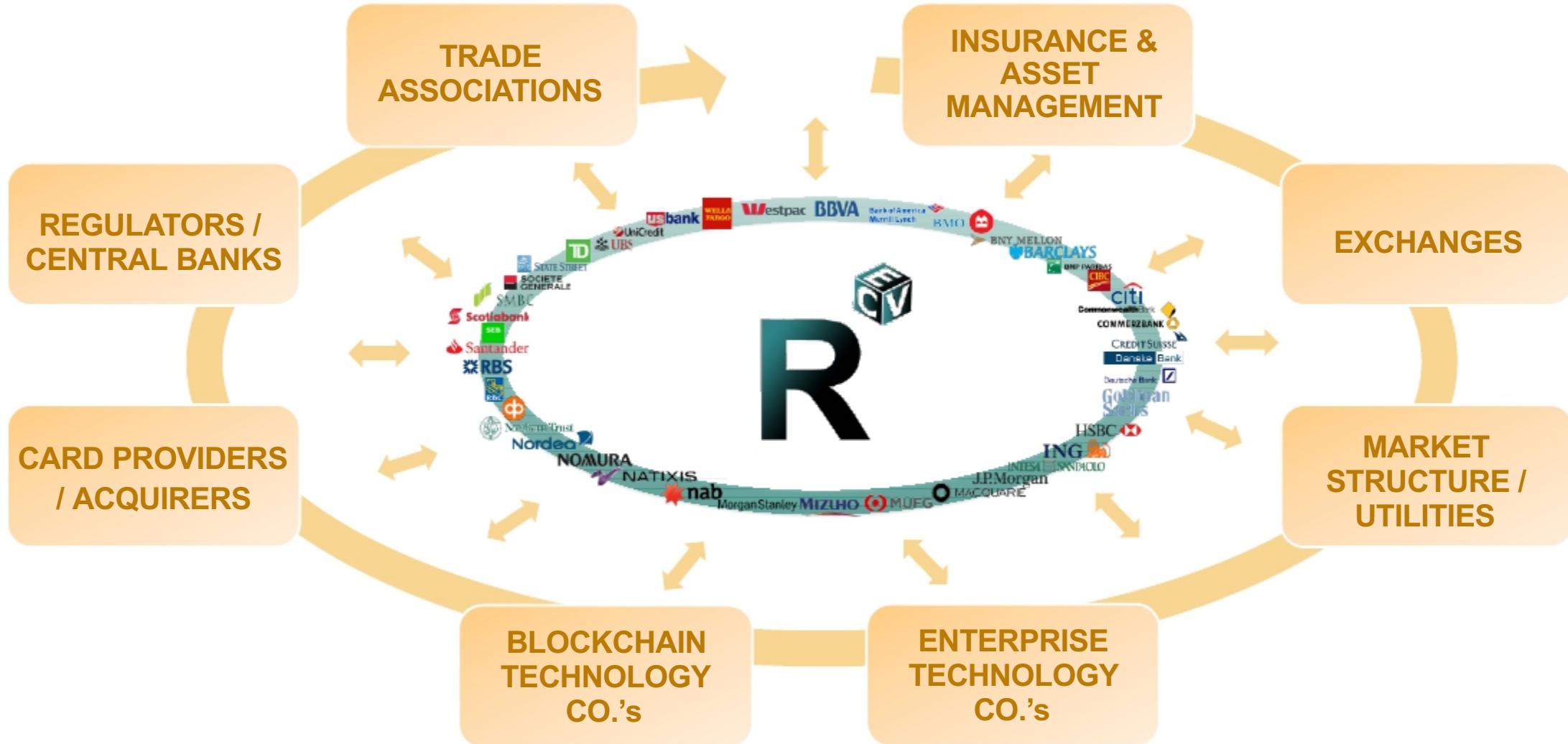
# Our Expanding Membership



# R3: A DLT Centre of Gravity



*R3 has been instrumental in creating collaboration across a diverse range of financial services industry participants*



# R3 Structure

## Architecture

**Building a blockchain-inspired distributed ledger platform designed and built specifically for financial markets incorporating interoperability and shared services.**

## Lab & Research Center

**A Center of excellence for members to evaluate, design and develop projects which will utilise DLT.**

**Strength in research, community and regulatory outreach.**

## Product Development

**LRC projects will result in viable commercial products developed by R3 or by best-of-breed partners where appropriate.**

# Introduction to Corda

# Architecture Working Group



**MISSION :** To establish an architecture for an open, enterprise-grade, shared platform for the immutable recording of financial events ...

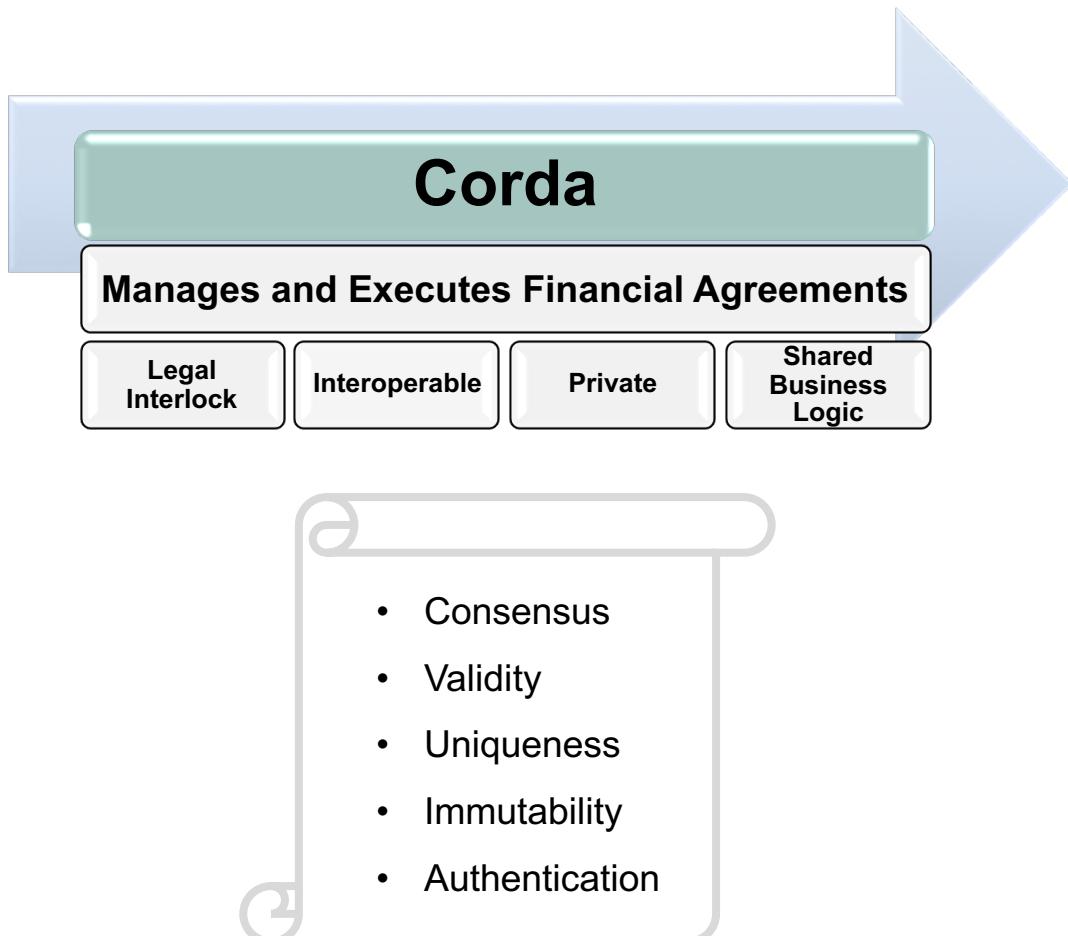
- Our Vision
- Architecture Themes
  - Assumptions - Cross-Theme
- Interoperability
- Cash
- Asset Modelling
- Identity
  - Dispute Resolution
  - Business Case:
  - Architecture Stream
    - Overview: An Enterprise-Grade Ledger
    - Architectural Context and Overview
    - Layering and Staging Analysis
    - Working Pages - Architecture Stream
  - Platform Stream: Corda
  - Key Concepts and Terminology
  - AWG Program Governance

Theme	Description
1. Interoperability (inc layering and staging)	Together with the Industry Business Case, this theme will define our overall end-game for shared ledgers in Finance, describing what an industry fabric for shared ledgers comprises and how different ledger archetypes (protocols) may predominate or co-exist for the different business domains. We will look at how ledgers would interact with existing banking infrastructures first, before considering how ledgers of the same archetype may talk to each other and how ledgers of different archetypes may need to talk to each other. The interoperability question exists at several levels and will be explored from a business viewpoint first, breaking down to the technical interactions that will need to support the business interactions as a second step.
2. Cash	There are many potential applications of cash on shared ledgers. These can be broadly separated into: consumption of cash movements occurring off the ledger, generation of cash movements off the ledger, execution of cash movements on the ledger related to other assets on the ledger and execution of cash movements on the ledger related to assets held elsewhere. There are other variables too where banks are either settling on their own account, their customers account or net settling with central banks. With central banks also talking about issuing their own coin directly onto ledgers there is a lot to consider! Given the massive investment in existing payments infrastructure this Theme will focus on identifying and testing the Use Cases of highest potential. Project Argent will provide an initial opportunity to explore some innovative cash applications and it is expected others will follow.
3. Asset Modelling	This Theme will start to define what assets we expect to be on shared ledgers, how they should be represented, how business events associated with them are represented (coupons, corporate actions, position calculations) and how they are related to other assets, either on-ledger or off, e.g. for derivatives and convertibles. This is another huge area and the challenge for the Theme is to try and distil a set of high-level business focussed principle and/or requirements that are relevant at an industry level to improve performance and competitiveness of either through new business models or improvements to existing business models.  There is a close interaction with the Collaterals, Valuations and Risk Management Theme below which looks at the next level of ledger sophistication, including how to represent and manage collateral and margin for derivatives.
4. Collateral, valuations and risk management	This Theme will explore the trade-off between the advantages offered, and the challenges posed, by the three inter-linked components of collateral management, reduction of risk and capital; shared valuation could be used also for closeout calculations and margin calculations. It will also look at how to manage initial margins at the same time. There are already successful business cases for shared collateral management and shared valuation, so this theme will focus on the application that would be easier and more effective on a shared ledger.

# R3's Corda Platform: A Unique Shared Ledger Approach



*A blockchain-inspired distributed ledger platform designed and built specifically for financial markets*



## Key Features

- Data is shared only among relevant parties
- Choreographs workflow between firms without a central controller
- Consensus at individual deal level, rather than system level
- Design directly enables regulatory/supervisory observer nodes
- Transactions are validated by parties to the transaction rather than a broader pool of unrelated validators
- Supports a variety of consensus mechanisms
- Strong link between legal prose and smart contract code
- Uses industry-standard tools
- No native cryptocurrency
- Will be open-sourced

# Smart contracts in Corda = Financial Agreements

The ability of a network of computers to run, store and execute legal contracts between parties in a tamper resistant fashion.

“Legal prose written as code”

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Bank A - Bank B - Master Agreement

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Agreement Date	16-Mar-2016
Party A	Bank A
Party B	-

**ISDA®**  
International Swaps and Derivatives Association, Inc.

**2002 MASTER AGREEMENT**

dated as of **16-Mar-2016**

**Bank A** and **Party B** have entered and/or anticipate entering into one or more transactions (each a "Transaction") that are or will be governed by this 2002 Master Agreement, which includes the schedule (the "Schedule"), and the documents and other confirming evidence (each a "Confirmation") exchanged between the parties or otherwise effective for the purpose of confirming or evidencing those Transactions. This 2002 Master Agreement and the Schedule are together referred to as this "Master Agreement".

Accordingly, the parties agree as follows:—

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Credit Support Annex 1995 - England and Wales

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determined for each relevant currency and calculated for each day in that Interest Period on the principal amount of the portion of the Credit Support Balance comprised of cash in such currency, determined by the Valuation Agent for each such day as follows:

(x) the amount of cash in such currency on that day; multiplied by  
 (y) the relevant Interest Rate in effect for that day; divided by  
 (z) 360 (or, in the case of pounds sterling, 365)

"Interest Period" means the period from (and including) the date on which the Cash Amount has yet been transferred, the Local Business Day on which the Cash Amount was transferred to or received by the Transferee to (but excluding) the Local Business Day on which the current interest amount is transferred.

"Interest Rate" means, with respect to an Eligible Currency, the rate specified in Paragraph 11(f)(i) for that currency.

"Local Business Day", unless otherwise specified in Paragraph 11(h), means:

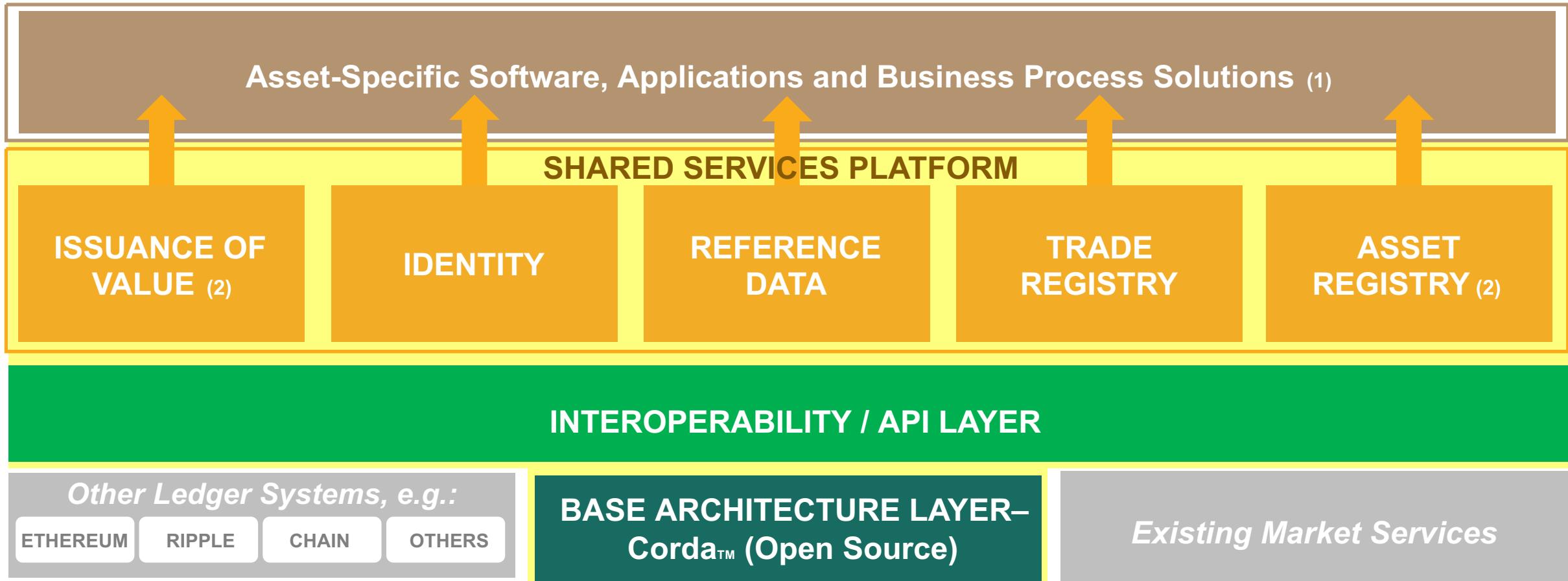
(i) in relation to a transfer of cash or other property (other than securities) under this Annex, a day on which commercial banks are open for business (including dealings in foreign exchange and foreign currency deposits) in the place where the relevant account is located and, if different, in the principal financial centre, if any, of the currency of such payment:  
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(ii) in relation to a transfer of securities under this Annex, a day on which the clearance system agreed between the parties for delivery of the securities

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# R3 Technology “Stack”

*Concord Platform will leverage Corda™ base architecture and seamless interoperability functionality to power the Platform, which enables commercial products and software on top*



(1) Developed by R3, LRC Members and third party software providers.

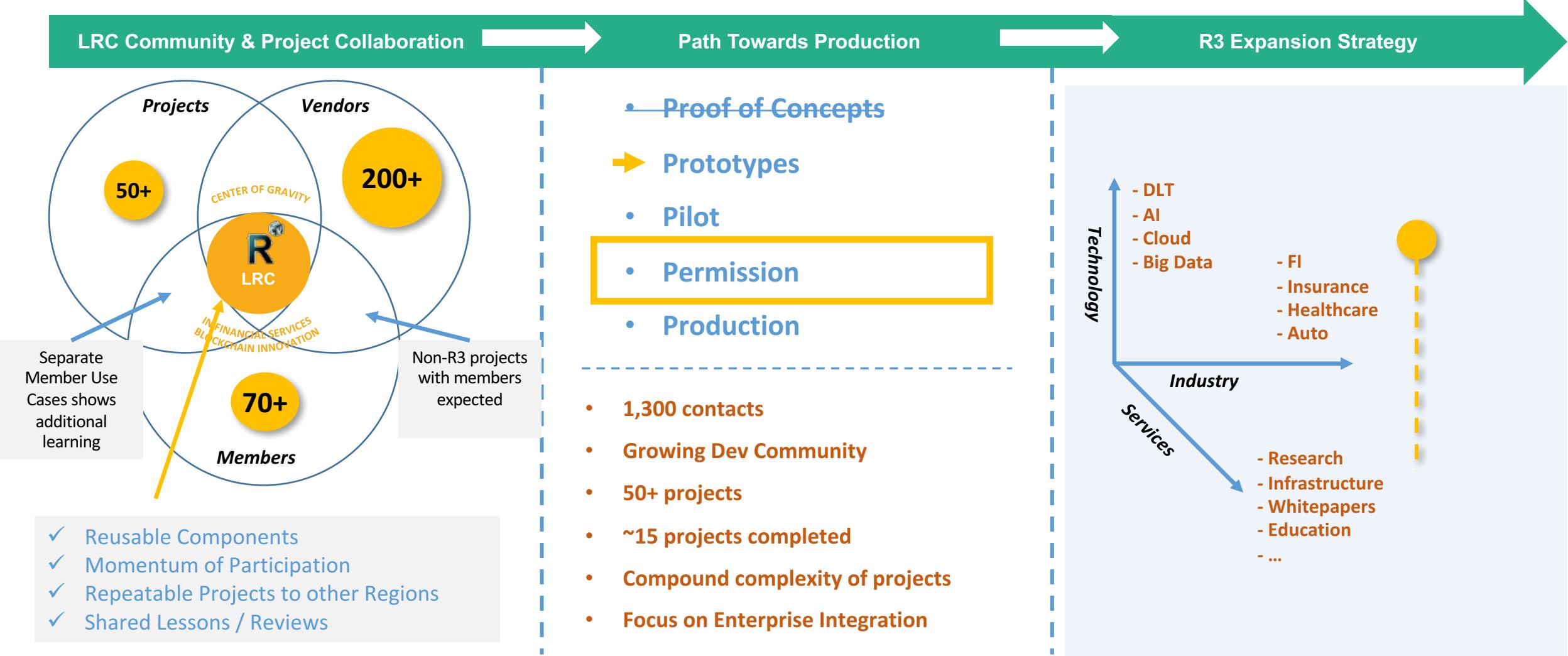
(2) Includes cash and securities.

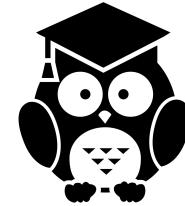


# R3 Lab & Research Center

# R3's Vision and Path

✓ Global presence ✓ Cross-industry use cases ✓ Proven Collaboration 200+ Members



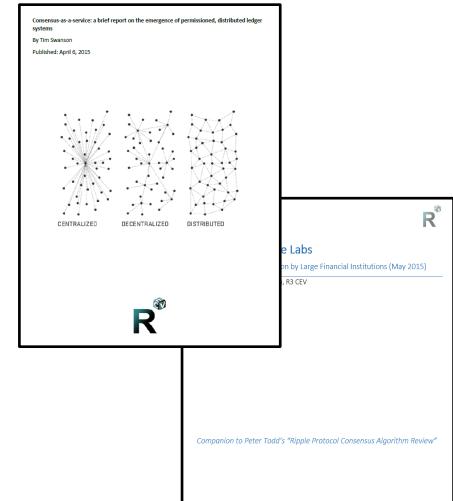


# R3 Research

Our research team delivers content for our membership through three approaches.

## Internal Content

- Blogs            *The “R3 Blockchain Byte,” by Emily Rutland, “Tim’s Blockbuster” by Tim Swanson, and “Ledger Beat,” by Kathleen Breitman.*
- Papers, Reviews    *“Dao Hack Analysis,” by Mike Hearn, “Consensus-as-a-service,” by Tim Swanson, “The Cryptic Currencies,” by Kevin Rutter.*



## Co-branded Research

R3 collaborates with experts in certain facets of the technology, law, and economics of distributed ledgers. Recent release (9/9): “Chain Interoperability” by Vitalik Buterin.  
In-flight: Papers by JP Koning, Rod Garratt, Zooko Wilcox and Danny Yang.

## Academic Advisory Board (AAB) and Academic Partnerships

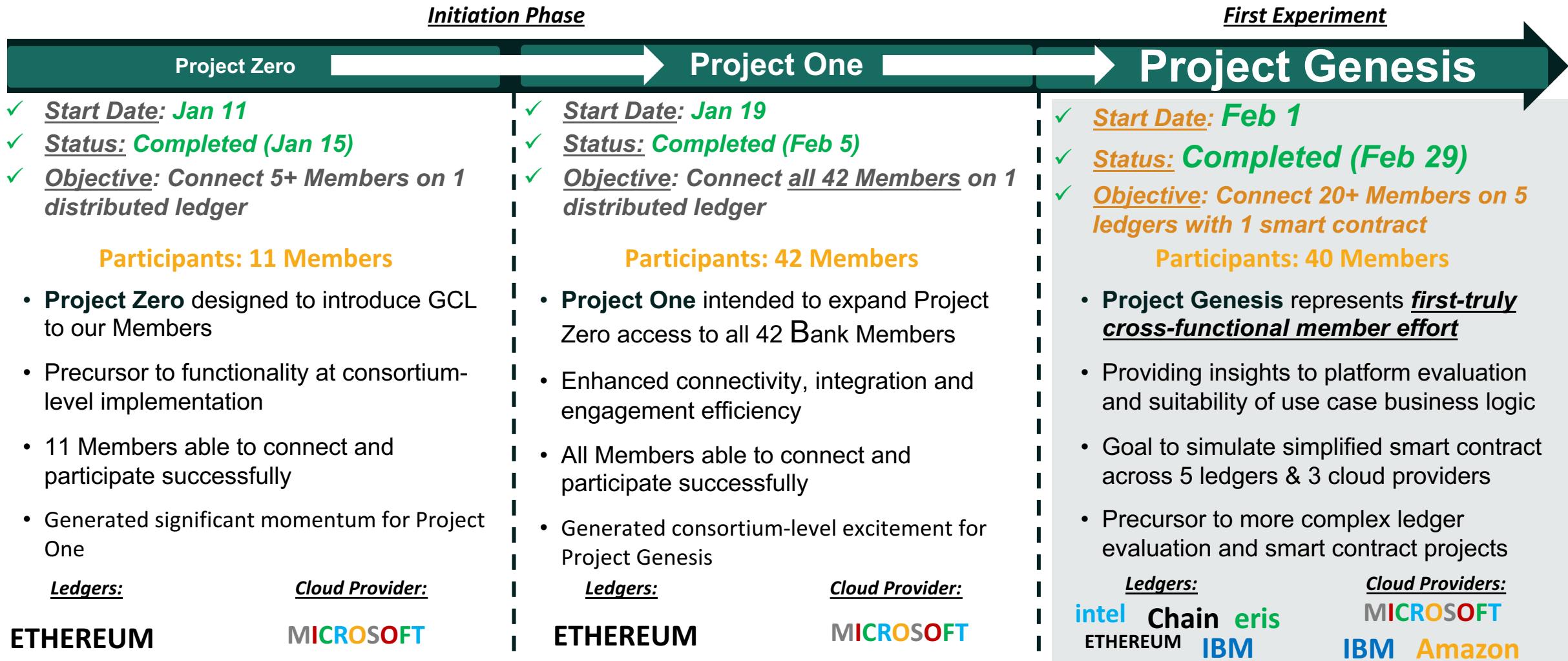
- AAB            The Academic Advisory Board is a source of thought leadership in the space. Current advisors include Prof. Rod Garratt with the potential to include law and computer science professors.
- Alliances        Through partnerships with leading institutions like UCL, R3 works to drive conclusions and pressure-testing hypotheses in the space.

## Resources:

- [Ledger Beat](#)
- [Tim’s Blockbuster](#)
- [R3 Blockchain Byte](#)
- [Commentary & blogs](#)
- [Whitepapers](#)
- [External Industry Reports](#)
- [Paper and Book Reviews](#)
- [Vendor Landscape](#)
- [R3 Sustainability Initiatives](#)
- [Consensus 2016 Digest](#)

# Initial Experiments Move LRC from Vision to Execution

R3's Global Collaborative Lab has made significant progress with 40+ Bank Members experimenting across 5 ledgers, 3 cloud providers & 1 smart contract



# LRC Evolution to Come

*With overwhelming support from initial Bank Members, other institutions & technology firms, LRC has identified several projects that are currently in flight*

## Illustrative GCL Experiment Pipeline by Category & Participation

