# HYPERLEDGER GLOBAL FORUM

June 8–10, 2021 | Virtual Experience

#hyperledgerforum

HYPERLEDGER GLOBAL FORUM JUNE 8–10, 2021 | VIRTUAL EXPERIENCE

# The "iDeAL" POC

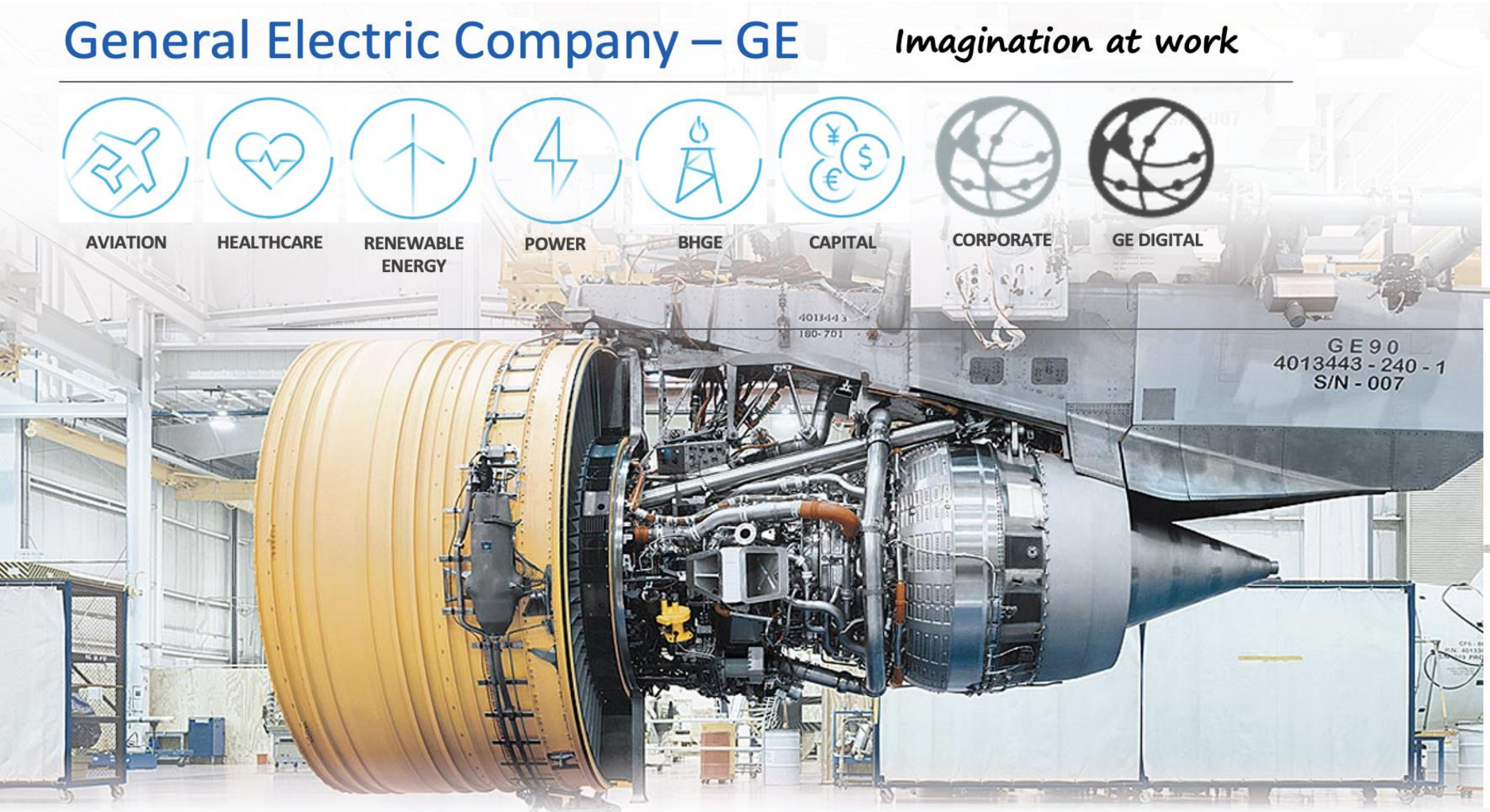
**a Wing-to-wing Proof of Concept for an Inter-company Distributed Accounting Ledger**

Gary Crisci, Principal Architect, General Electric

# General Electric Company – GE

*Imagination at work*

AVIATION | HEALTHCARE | RENEWABLE ENERGY | POWER | BHGE | CAPITAL | CORPORATE | GE DIGITAL




**EVERY 2 SECONDS**
an aircraft powered by GE technology takes off

Everyday, GE is helping doctors save **3,000 LIVES**

GE powers over **30% OF THE WORLD'S ENERGY**

"Our primary focus must be on delivering outcomes. We don't define that solely by the number of gas turbines, wind turbines, jet engines, or CT scanners we manufacture. **The ultimate purpose of our work is the children in distant villages who get access to electricity for the first time, the travelers who get home safely, and the patients who receive better diagnoses and treatments in the moments that matter most. When our teams understand customer needs and deliver outcomes for them, we always end up in a good place for our employees and our owners.**"

# Agenda

- **Problem statement and solution overview**
- **Introduction to Blockchain and Hyperledger Fabric**
- **Solution Architecture**
  - Oracle blockchain as a service platform (OBP)
  - Data Integration
  - Data warehouse
  - Analytics
  - Identity management
- **User experience**
- **Closing and Q&A**


## CHALLENGE

Modernize GE's Internal Billing System (IBS). IBS is a 25 years old mainframe-based application with an average annual flow of 4MM inter-company invoices. As many mainframe apps it brings a high TCO, an increasing technical debt and a reduced talent pool with specialized skills.

# The art of the possible for inter-company transformation

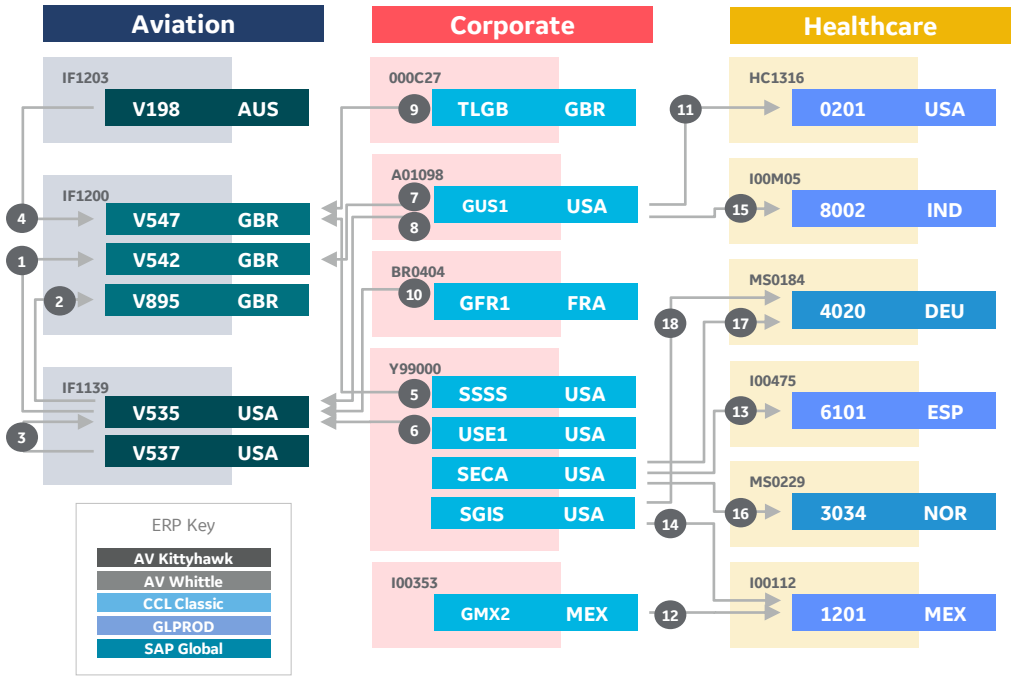
iDeAL Intercompany Distributed Accounting Ledger

- Integration with Finance systems
- Mobile-first front-end application
- Microservices architecture
- Dispute Management platform
- Smart analytics

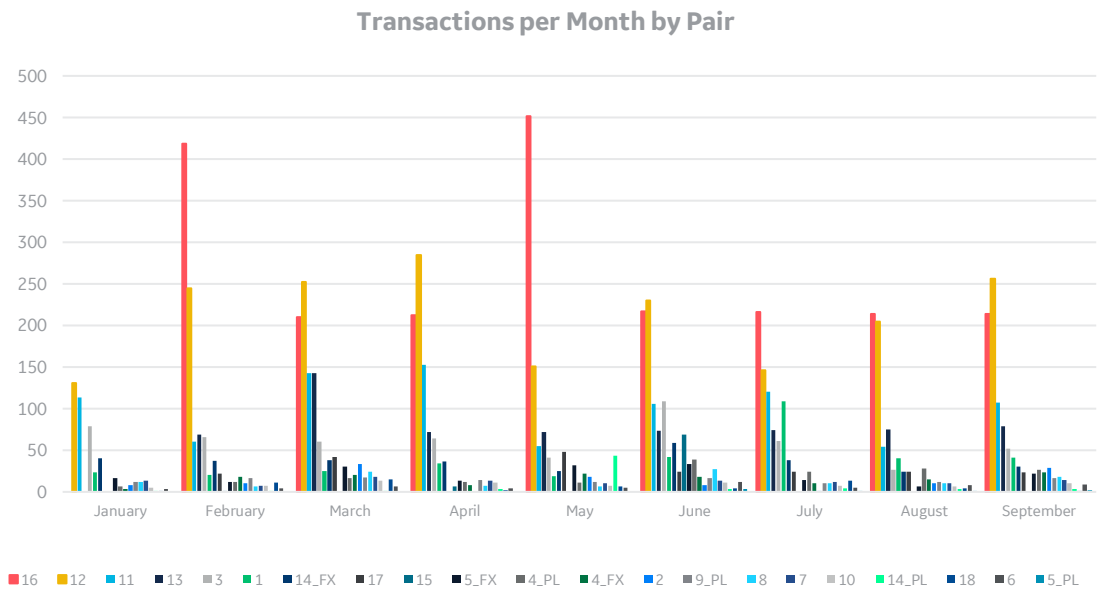
# Current inter-company transaction flow

High Level: In-Scope Entities, and Transactions Flows & Sizing

## Intercompany Transaction Flows




## Intercompany Pairs: Number & Value of Transactions Per Month



# Solution design aligned to Intercompany Business Capabilities Model


The Intercompany Business Capabilities Model was created in collaboration with **functional users** and **process leaders**. It illustrates the activities that the Intercompany function should be able to perform regardless of the technology.

This model was used to drive the technology assessments that will be described in the upcoming pages.

# Blockchain solution design overview

The Blockchain solution connects **independent ERP** systems through an integration layer to applications **governed by** smart contract **business rules** and a web-based user interface

*The solution connects existing ERP transaction systems via*

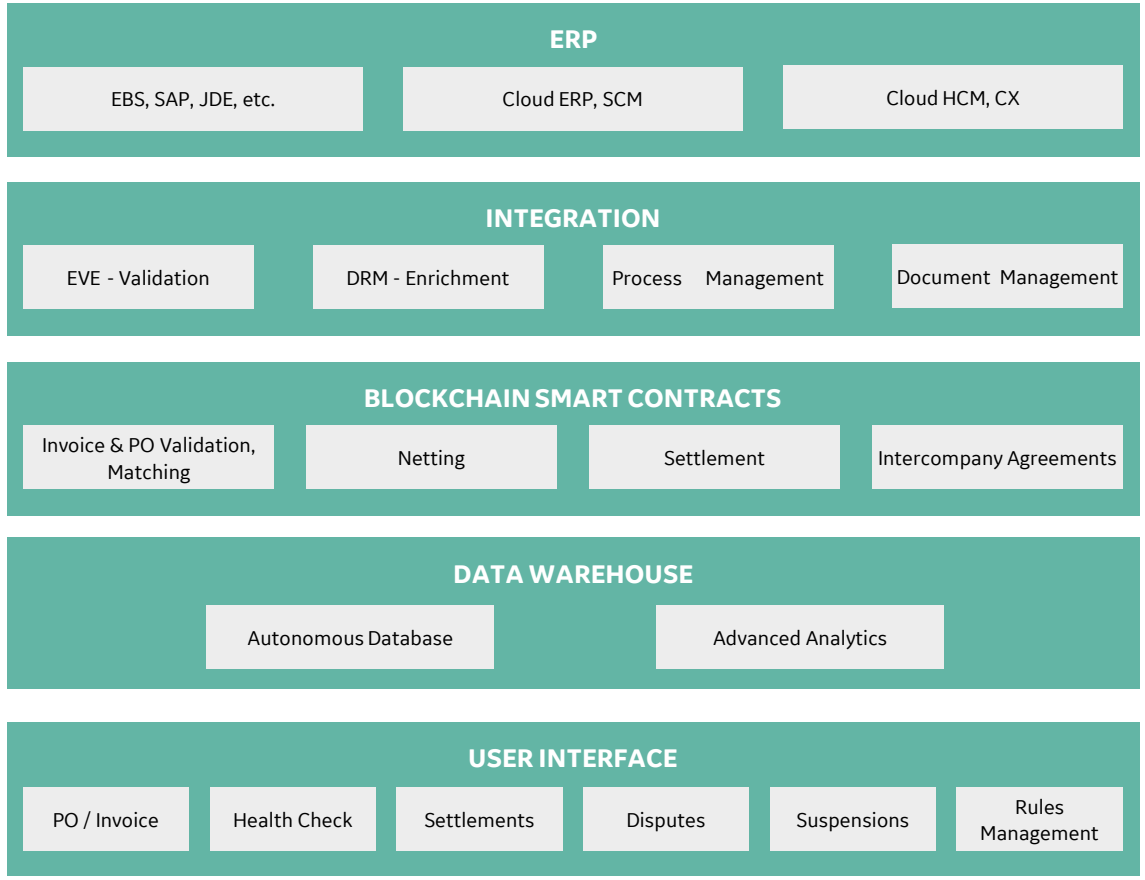
*… internal enrichment and validation services with process and document management …*

*..governed by a universal rule sets…*

*..streaming distributed ledger transaction to a data warehouse with modern analytics tools…*

*… with a common user interface framework that supports various functions.*

**Intercompany Blockchain Solution Architecture**




**Solution Benefits:**

- ***Process Efficiency***
- ***Financial Efficiency***
- ***Business Enablement***
- ***Architecture Modernization***

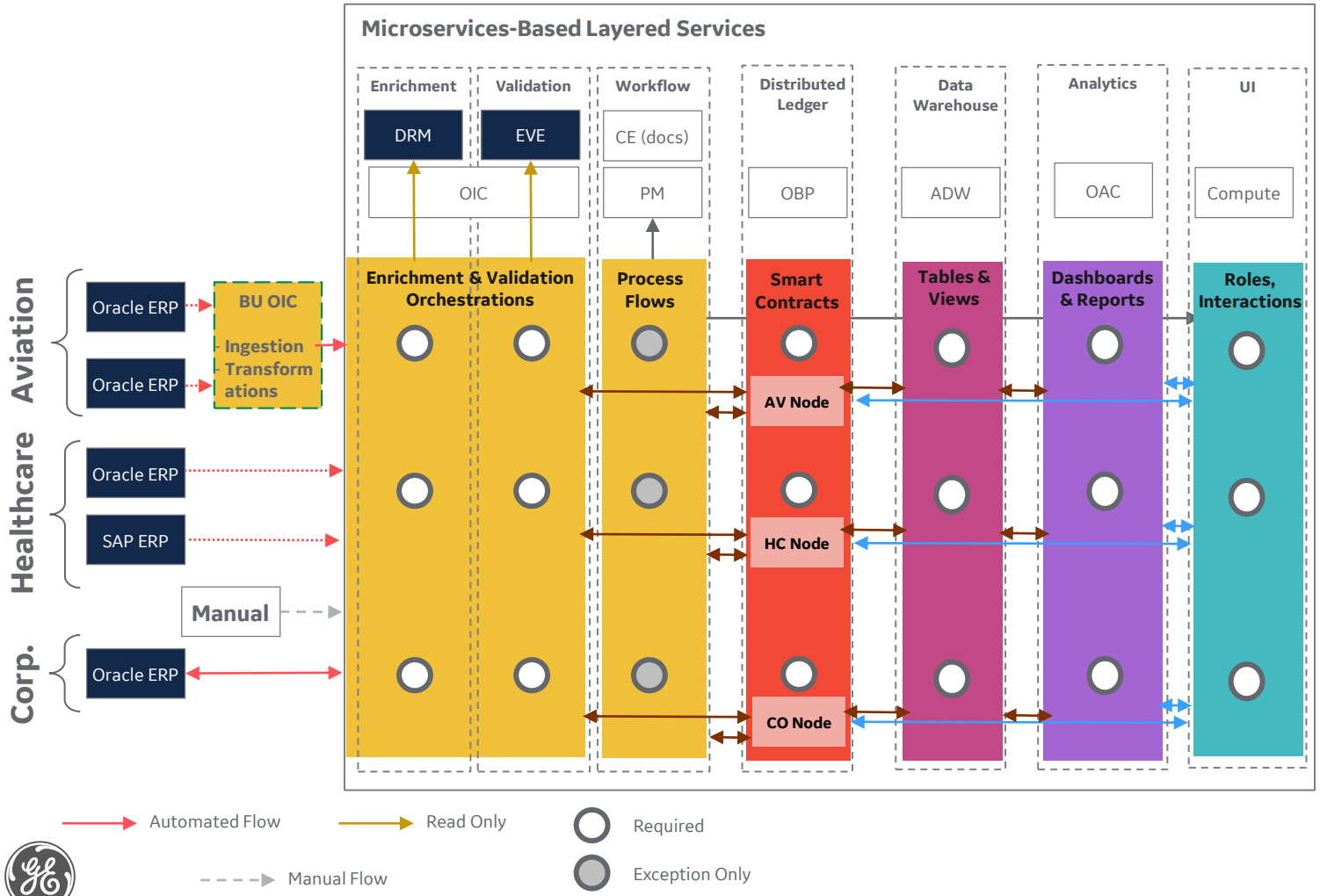
# iDeAL Solution architecture

Transaction Flow and Distributed Network Architecture

## Transaction Flow

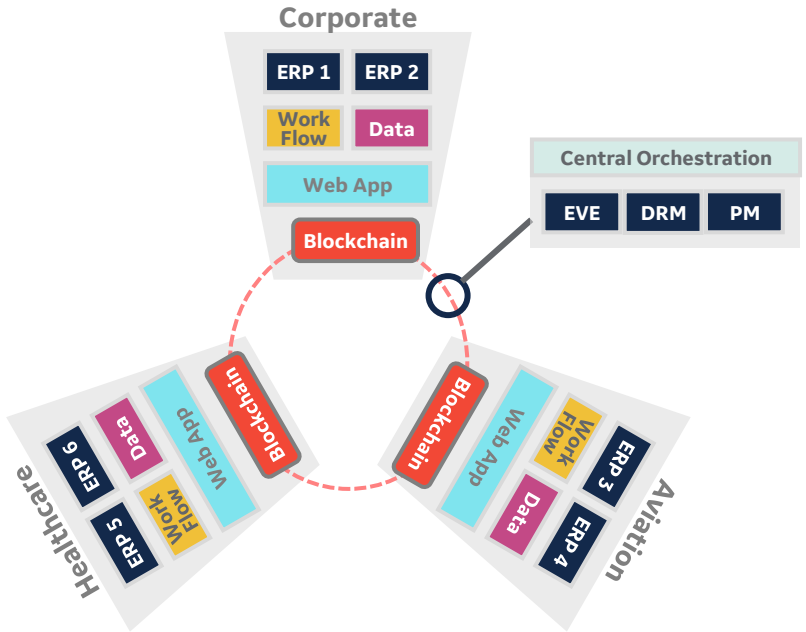
**Max Flexibility**

Ability to add additional BUs and ERPs, validations/enrichments, process flows (disputes, holds, etc.), smart contracts, dashboards, and downstream integrations.




## Distributed Network Configuration

Businesses share a set of common, secure communication protocols that automate processes across the ERPs..



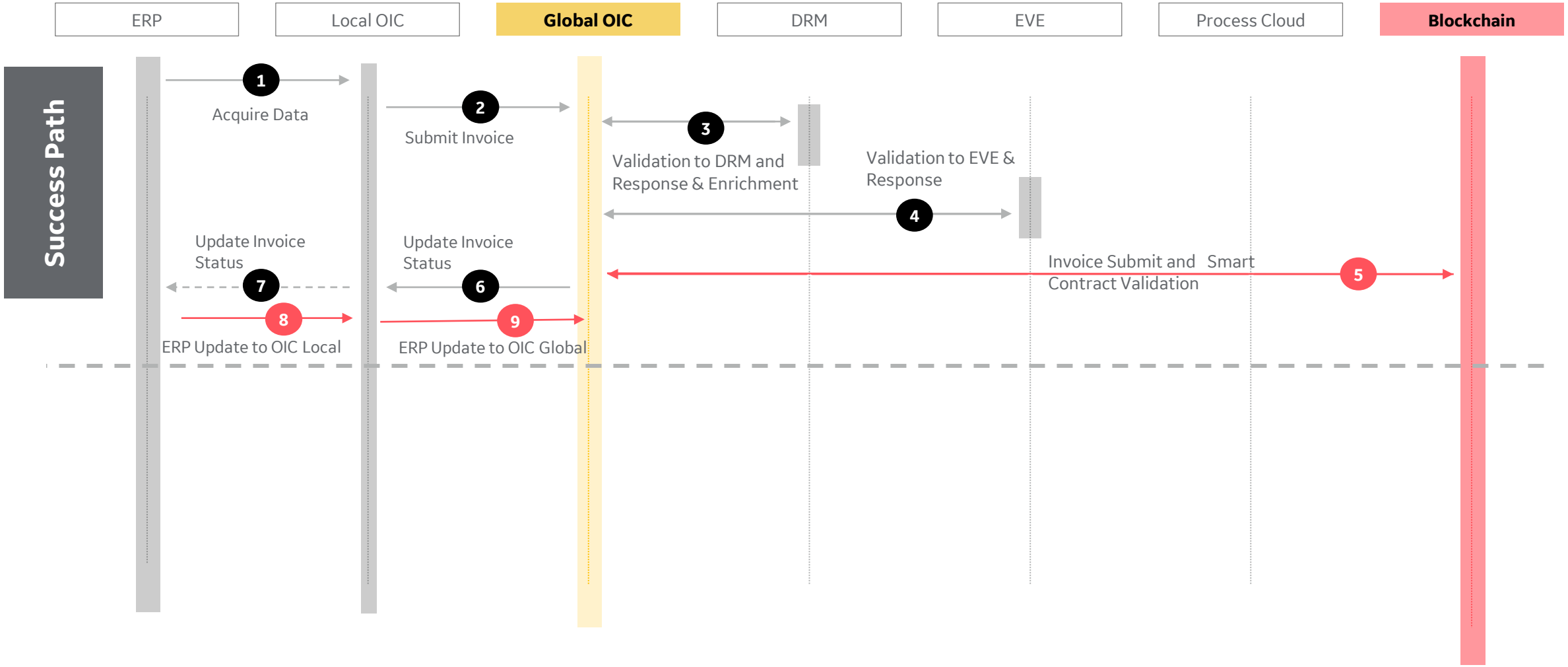

## Tech Stack

- Data Integration (OIC)
- Oracle Blockchain Platform (OBP)
- Data Warehouse (ADW)
- Analytics (OAC)
- Identity access management

# Blockchain Process Flow & Interaction Model

Transaction recordation, business process/logic optimization, DRM/EVE Validation and Enrichment

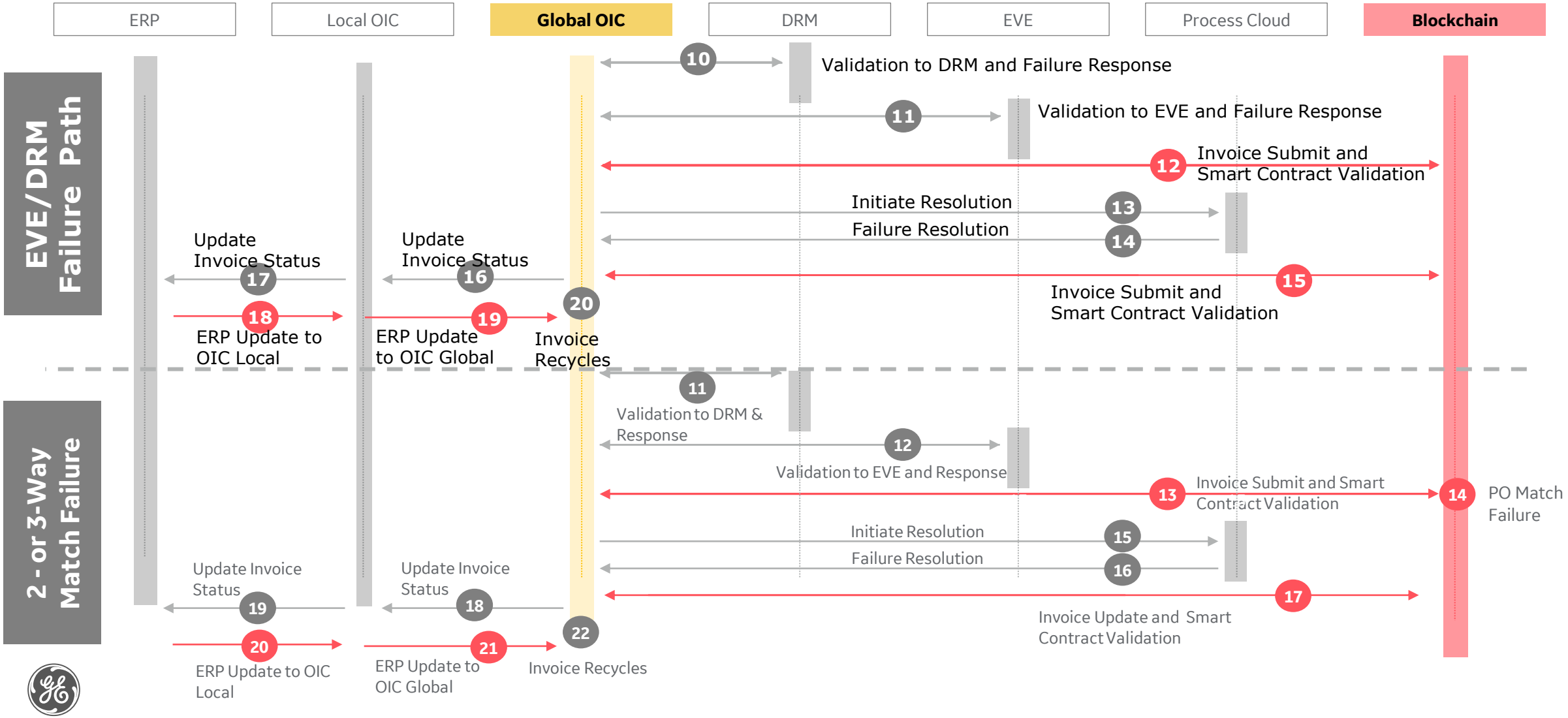
## Generic Interaction Model



# Process Flow & Interaction Model: Failure scenarios

Transaction recordation, business process/logic optimization, 2 - or 3-Way Match Failure

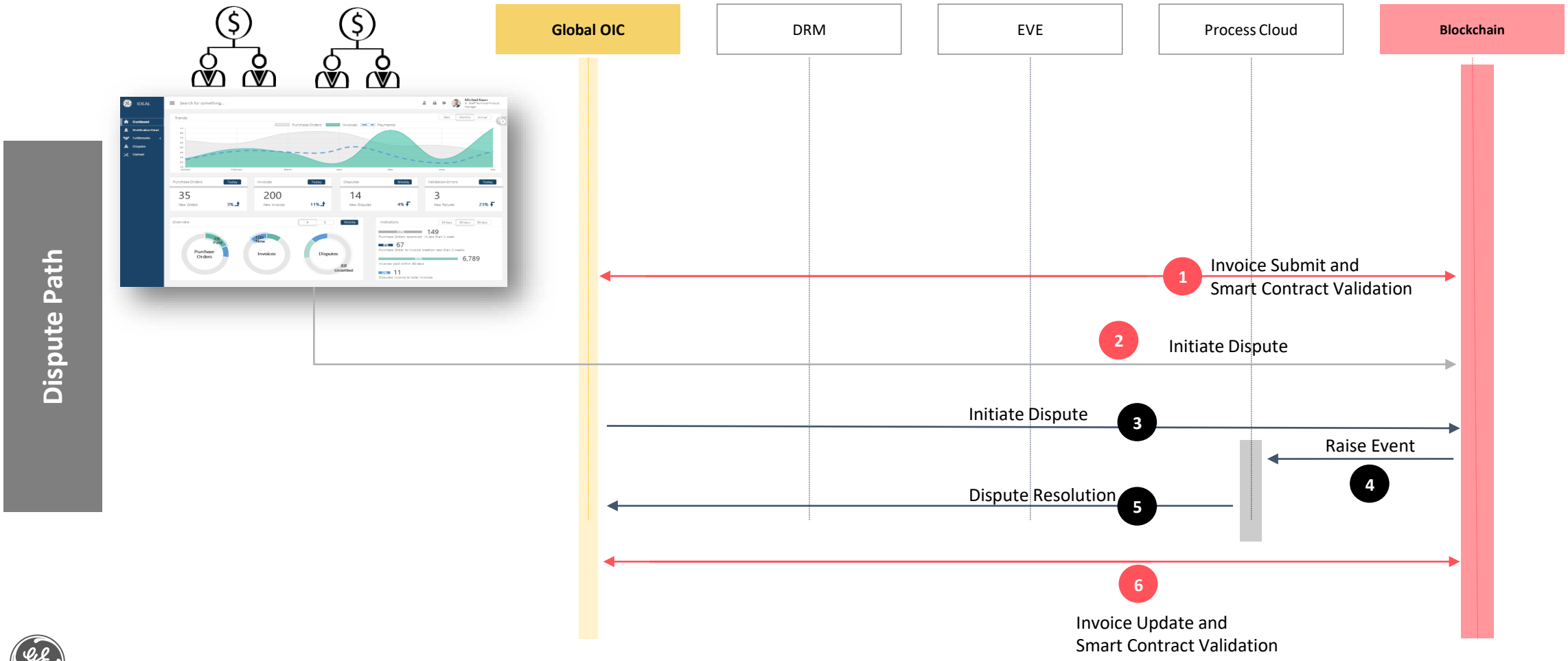
## Generic Interaction Model



# Blockchain Process Flow: Dispute Management

Initiating and resolving disputes

## Generic Interaction Model



# Why Blockchain?

# Blockchain Unique Value Proposition

## Trust

Non-repudiation reduces risk of fraud

Tamper-proof / tamper evident records

Process integrity based on pre-agreed rules

## Transparency

Single source of truth

Optimized decision-making

Self regulating

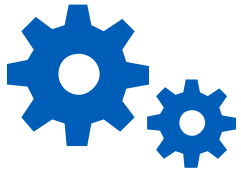
Full audit history

## No Intermediaries

Improved consumer experience

Faster transactions

Lower transaction cost



## Automation

Real-time reconciliation and settlement

Continuous visibility into relative positions

Eliminate risk of human errors

Blockchain has moved beyond the hype, and is poised to deliver value to enterprise

# Spectrum of Blockchain Models

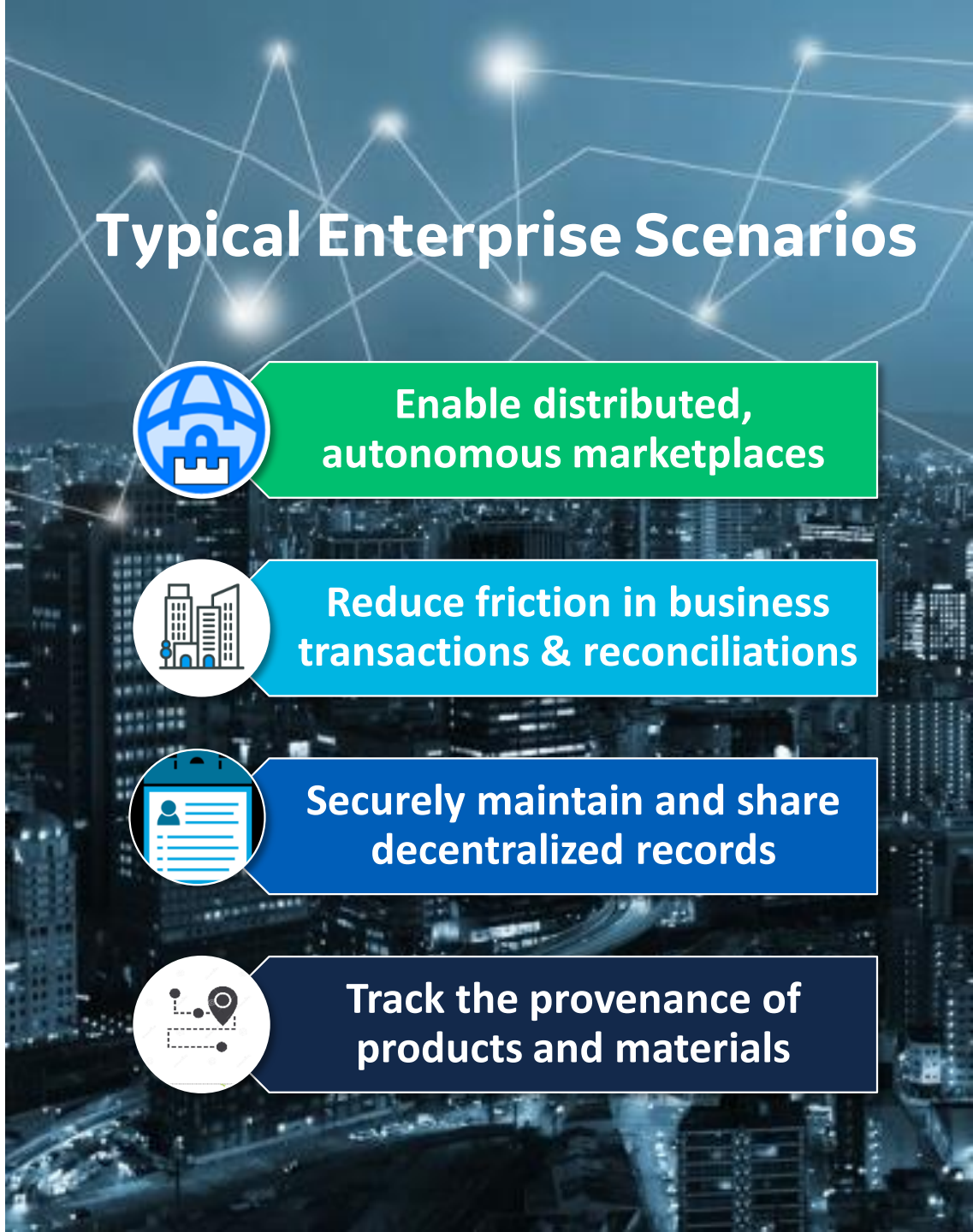
Enterprise Focus

| | Public Blockchain | Private Blockchain | Federated/Consortium Blockchain | Public/Permissioned Blockchain |
|---|---|---|---|---|
| Access | • Anyone | • Single organization | • Multiple selected organizations | • Multiple selected organizations |
| Participants | • Permissionless<br>• Anonymous | • Permissioned<br>• Known identities | • Permissioned<br>• Known identities | • Permissioned writers<br>• "Public" read access |
| Security | • Consensus mechanism<br>• Proof of Work / Proof of Stake | • Pre-approved participants<br>• Voting/multi-party consensus | • Pre-approved participants<br>• Voting/multi-party consensus | • Pre-approved participants update the ledger<br>• Flexible policies for read access |
| Transaction Speed | • Slow | • Lighter and faster | • Lighter and faster | • Lighter and faster |

# Blockchain is not a solution to all problems

## Qualifying questions:

- Do your business processes cross divisional or organizational boundaries?
- Do cross-system discrepancies that impact operations?
- Is there less than full trust among transacting parties?
- Do you rely on intermediaries, possibly charging expensive fees, adding risk or delay?
- Do you rely on periodic (batch) reconciliations?
- Is there a need to improve traceability or audit trail?
- Do you need real time visibility into multi-party transactions or processes?



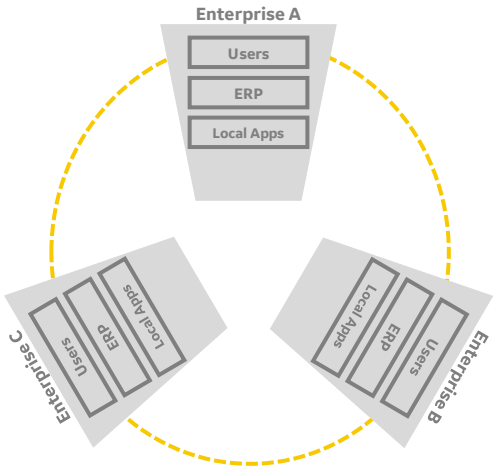
# Enterprise Blockchain in action

Enterprise Blockchain is a type of corporate Blockchain implementation that focuses on the streamlining and automation of operational processes within a secure network of participants

### Current State versus a Blockchain enabled ecosystem

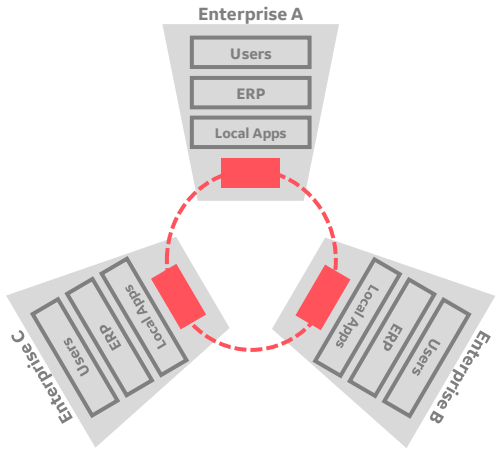
- *Blockchain creates a single source of truth for multi-organization interactions and business processes*

**Current State**




**Disparate systems and processes are (manually) translated between enterprises**

**Future State**




**Enterprises share a common, secure communication protocol that automates intra-firm processes**

**Manual or Exception-prone Process**

**Blockchain Node**

### Key Characteristics of an Enterprise Blockchain

- An enterprise Blockchain is **permissioned; only authorized/enrolled transacting parties can participate**
- Transaction requests are cryptographically signed by their originating members for non-repudiation
- Codified business rules on the blockchain (smart contracts) enable **autonomous transaction processing,** resulting in signed RWSets
- Multi-party consensus is used to agree on the RWSets and the transaction ordering before its committed to the ledger
- Transaction data is stored in cryptographically linked data blocks on participant nodes; signed data cannot be modified without detection
- Transaction information can be stored only on the nodes owned by **parties specific to a transaction,** but a hash to prove the transaction can be stored in a shared ledger
- There is **no single point of failure**, as data blocks are replicated on participant blockchain nodes

**Enterprises share a common, secure communication protocol that automates intra-firm processes**

# Hyperledger Fabric

# What is Hyperledger Fabric?

Hyperledger Fabric (HLF) is a robust and flexible blockchain network architecture that provides enterprise-ready security, scalability, confidentiality and performance. Its unique implementation of distributed ledger technology ensures data integrity and consistency, while delivering accountability, transparency and efficiency. As a permissioned network, the HLF delivers a trusted blockchain network, where members are assured that all transactions can be detected and traced by authorized regulators and auditors.

Fabric offers:

- ✓ A permissioned blockchain model with membership services
- ✓ Programmability – containerized smart contracts for automating business processes
- ✓ Independent Ordering Service delivers transaction blocks consistently to peers in the network and provides greater scalability
- ✓ Channels and Private Data Collections for confidentiality and privacy
- ✓ Modular architecture with pluggable data store, consensus protocols, and multiple providers of membership services
- ✓ No cryptocurrency required!

HYPERLEDGER FABRIC

THE LINUX FOUNDATION

# Smart Contracts

Also known as chain-codes

- A data schema and a set of business rules defined in code that describes all the conditions and steps pre-agreed by the participants for a specific transaction
- Transactions that meet the criteria of the smart contract as executed by multiple member nodes are considered valid and are automatically committed to the ledger without further intervention required
- Foundation of “algorithmic trust”

# Smart Contract Functions and Logic for Reconciliation and Netting

## Smart contract design and process logic

### Smart Contract Functions

**1 PO Submission and Validation**
- Checking Duplicates
- Updating Status

**2 Receipt Submission and Validation**
- Check if PO Exists
- Validating and Ingesting Receipts
- Updating Status

**3 Invoice Submission and Validation**
- EVE Validation
- DRM Validation
- Update Status

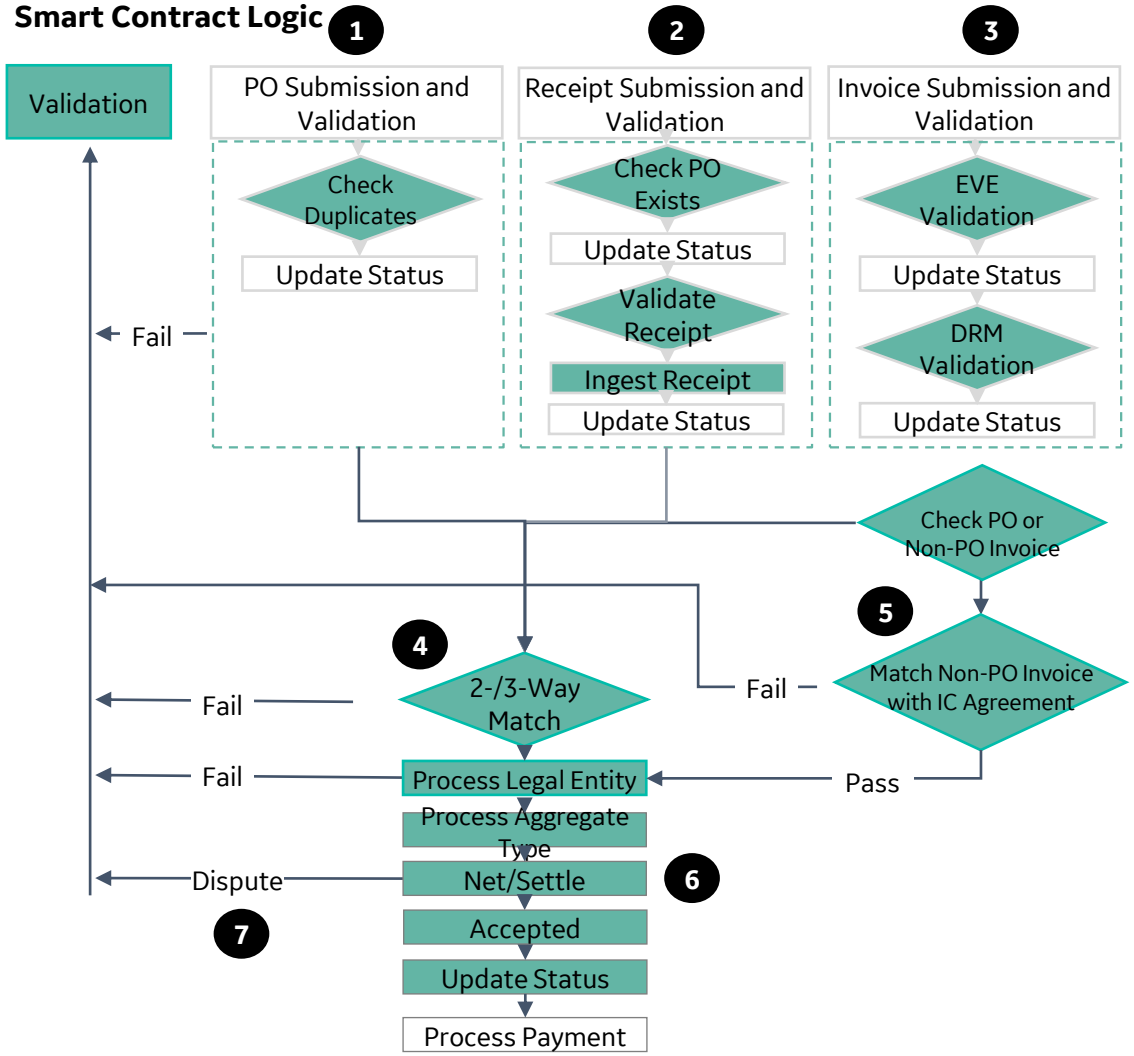
**4 2/3 Way Match**
- 2/3 Way Match (Reconciliation)
- Aggregate Type
- Legal Entity Type

**5 Intercompany Agreement**
- Check ICA Exists
- Check ICA Invoice Matches
- Update Status

**6 Real-time Netting and Settlement**
- Match 2/3 way POs and ICAs
- Check Invoice Receipt Type
- Check Net Settlement Exists
- Update or Create New Settlement

**7 Dispute Handling**
- Check Status If Dispute allowed
- Update Invoice Data
- Update Settlement Data
- Add to Success or Failure List

### Smart Contract Logic



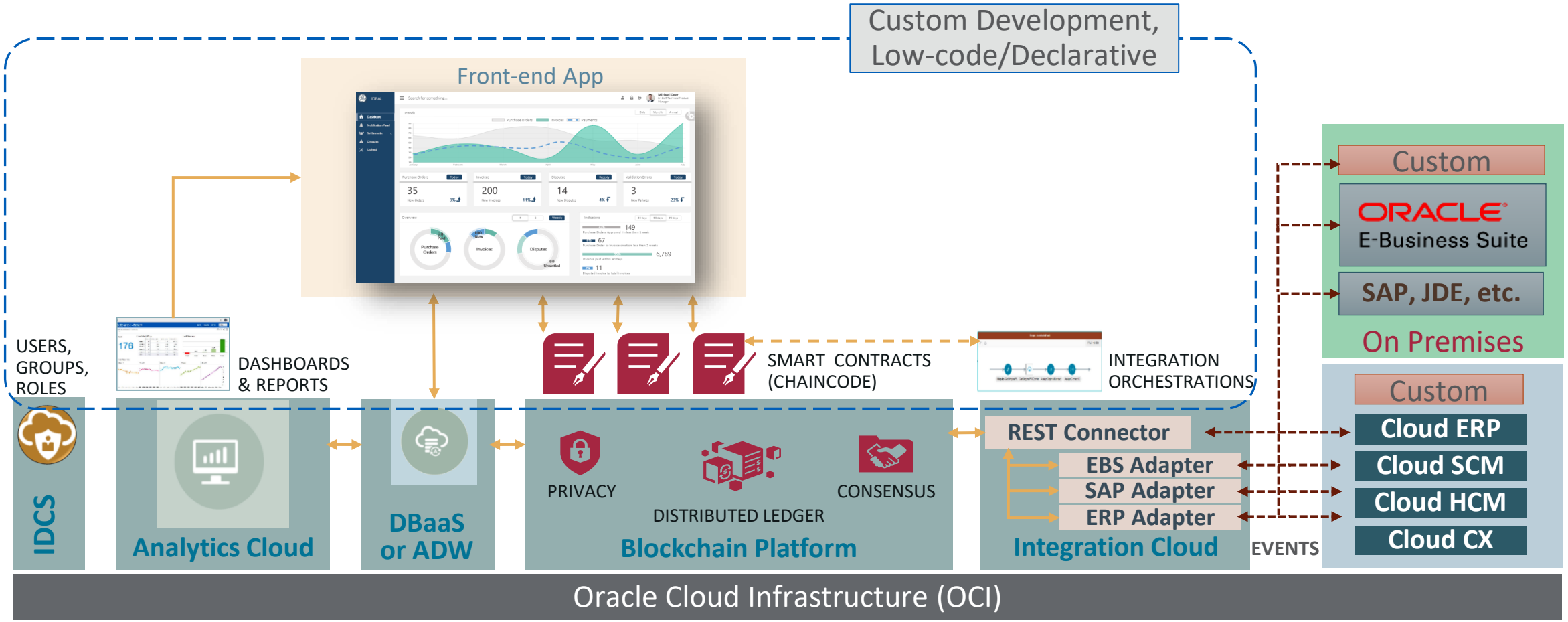
# Open Source Hyperledger Fabric with Key Oracle Value-Add

| | |
|---|---|
| Infrastructure  | **Provisioning & Integration**<br>**Oracle Cloud Managed Service**<br>**Object Store Integration**<br>**Management/Operations Console** |
| Orchestration  | **REST Proxy**<br>Supports rich set of Fabric APIs via REST calls<br>Enables synchronous invocation as well as events/callbacks and extensive DevOps operations<br>Simplifies integration and insulates applications from underlying changes in transaction flow |
| Data Management, Reporting & Analytics  | **Ledger DB replaced by Berkeley DB**<br>CouchDB rich query support at LevelDB performance<br>SQL-based rich query support and results validation at commit time<br>**Rich history database**<br>Streams transaction history to ADW/DBaaS and hooks up with Analytics/BI |
| Security  | **Security Integration**<br>IDCS User/role management<br>Authentication for OBP Console, REST Proxy, CA<br>Fine-grained Access Control Lists capabilities |

# Architecture

# Cloud Services Building Blocks

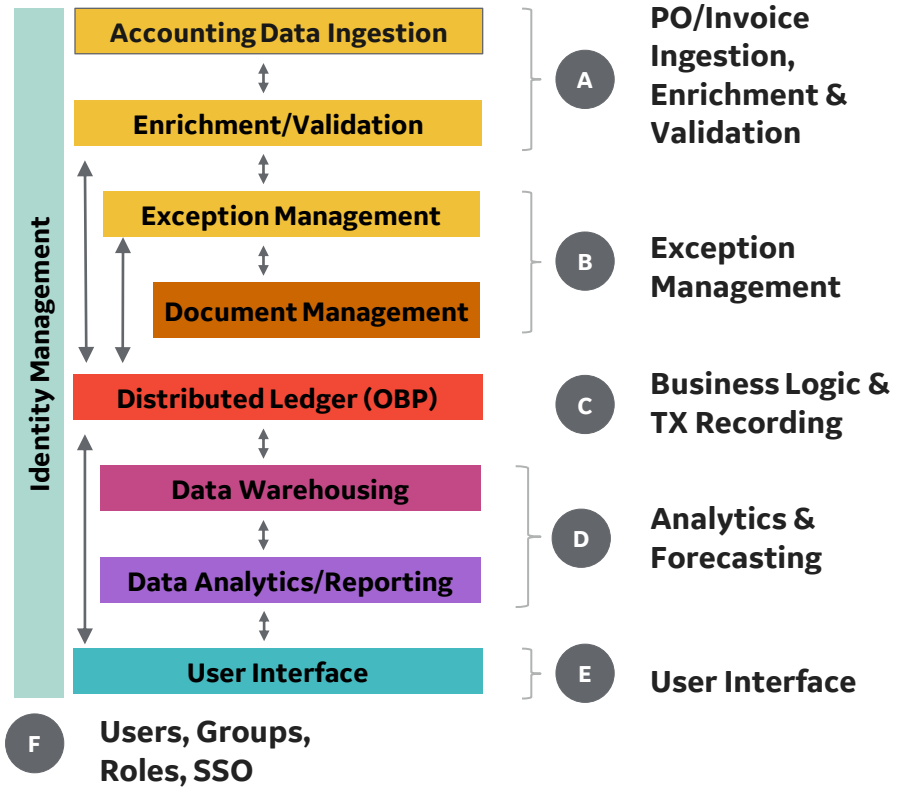
Pre-integrated Cloud Services for rapid development and managed operations



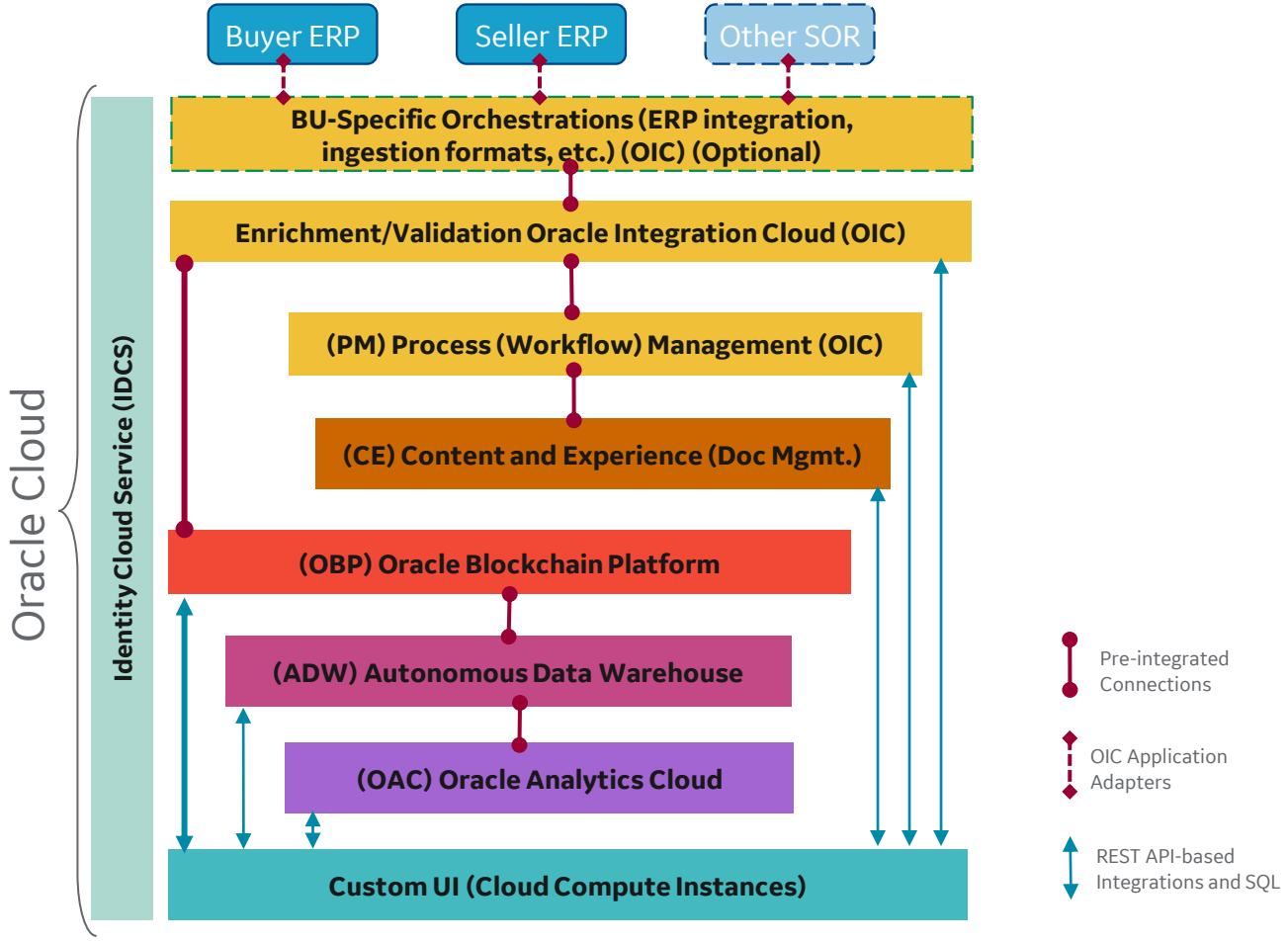
# Solution & Integration with Oracle Products

Solution is built on a suite of Oracle Cloud platforms

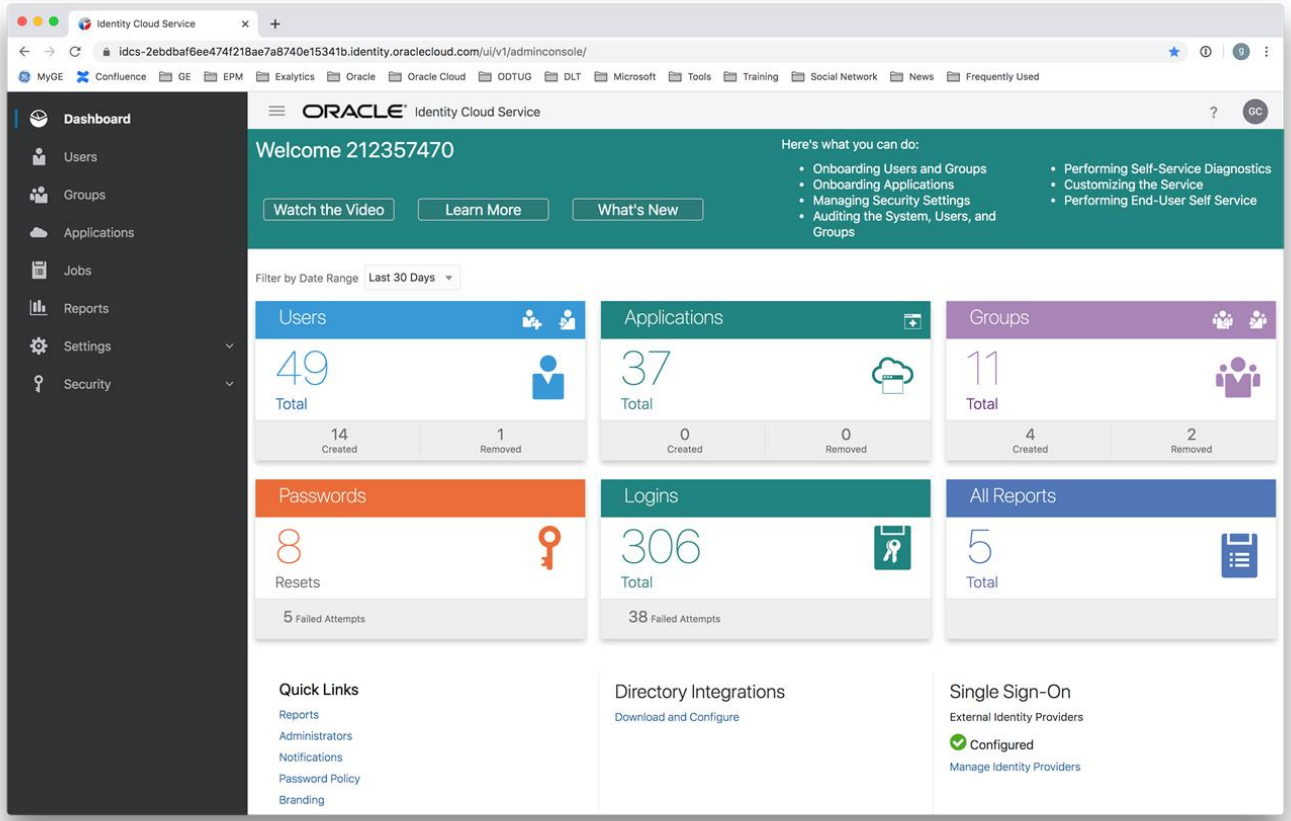
## Solution Overview

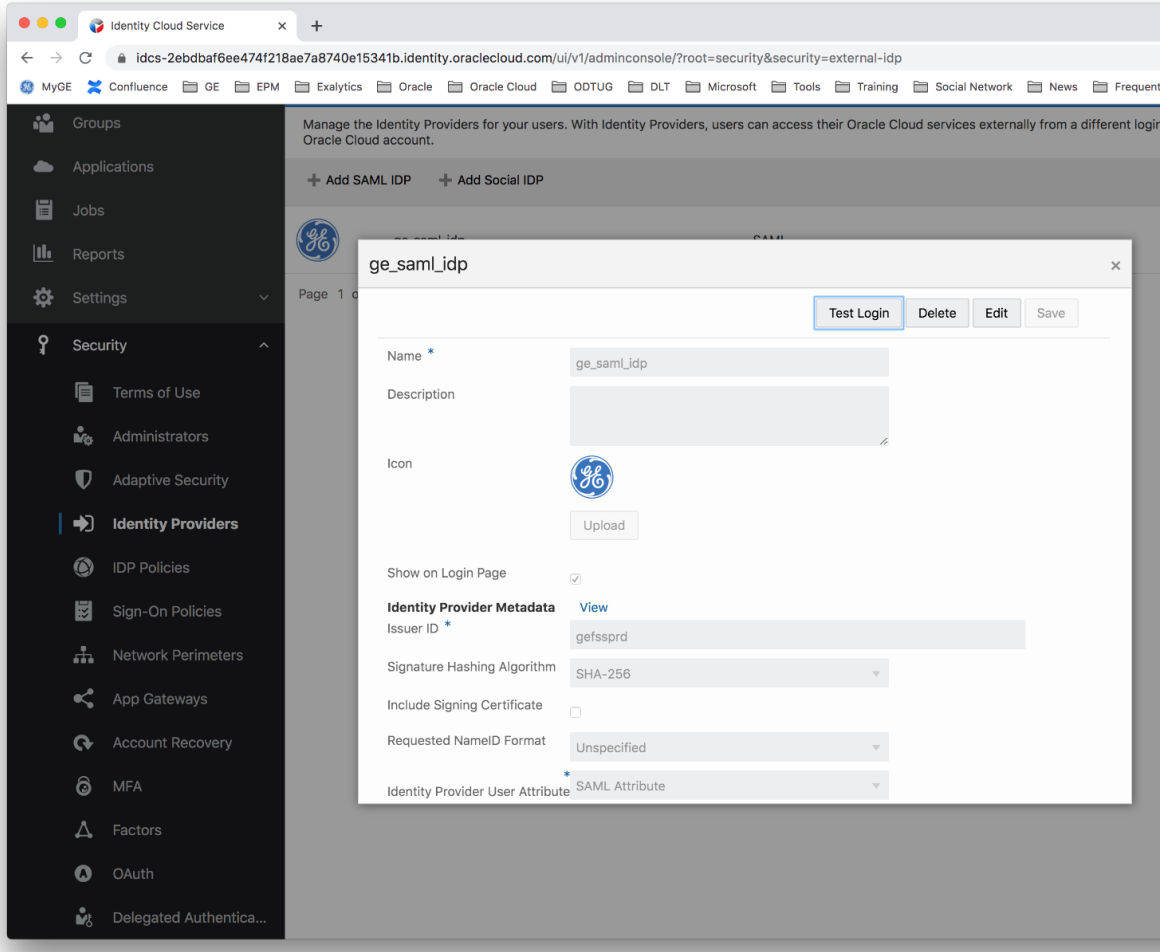



## Technology Stack

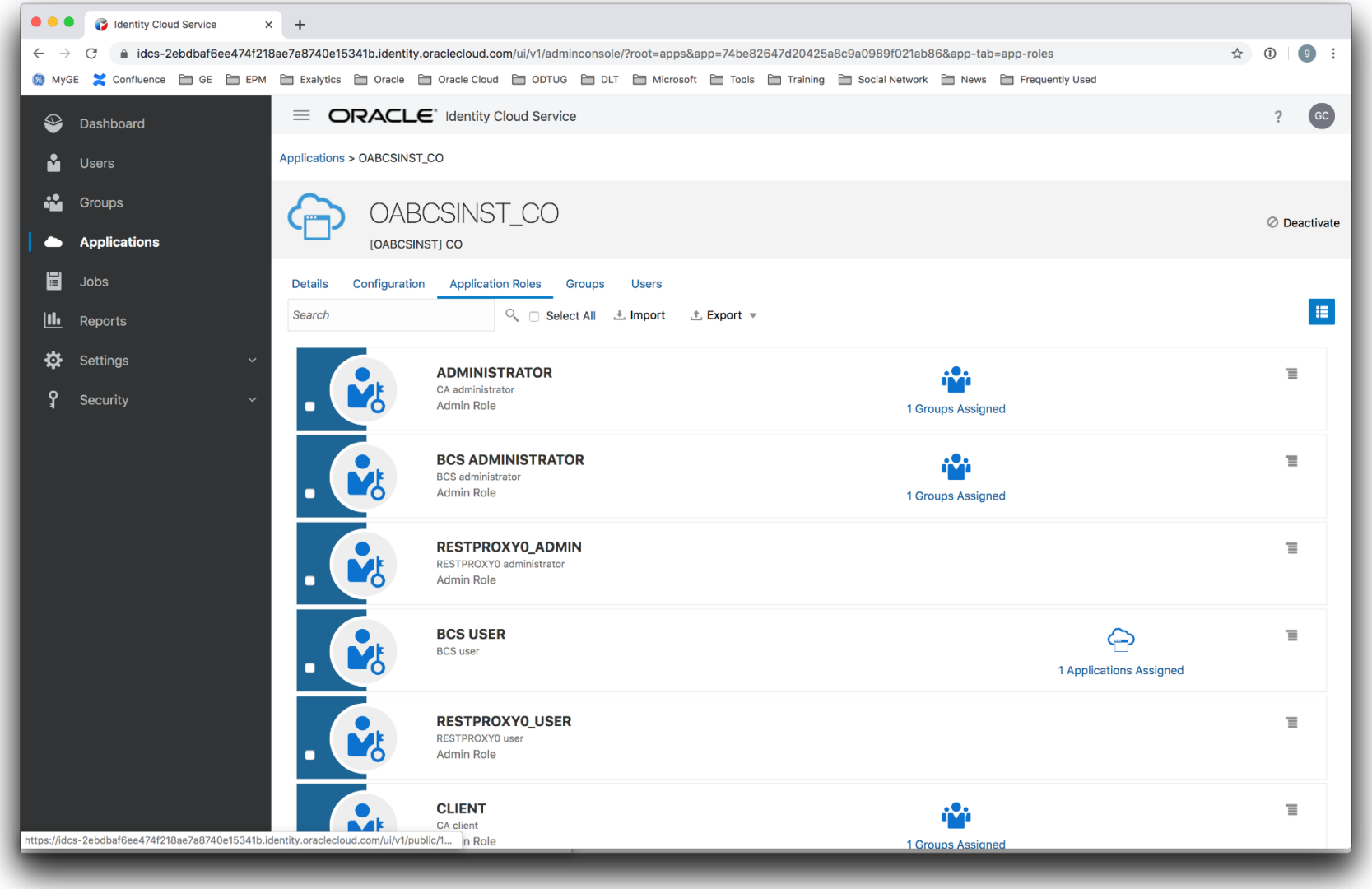


# Security: IDCS and Federation to Remote Identity Providers



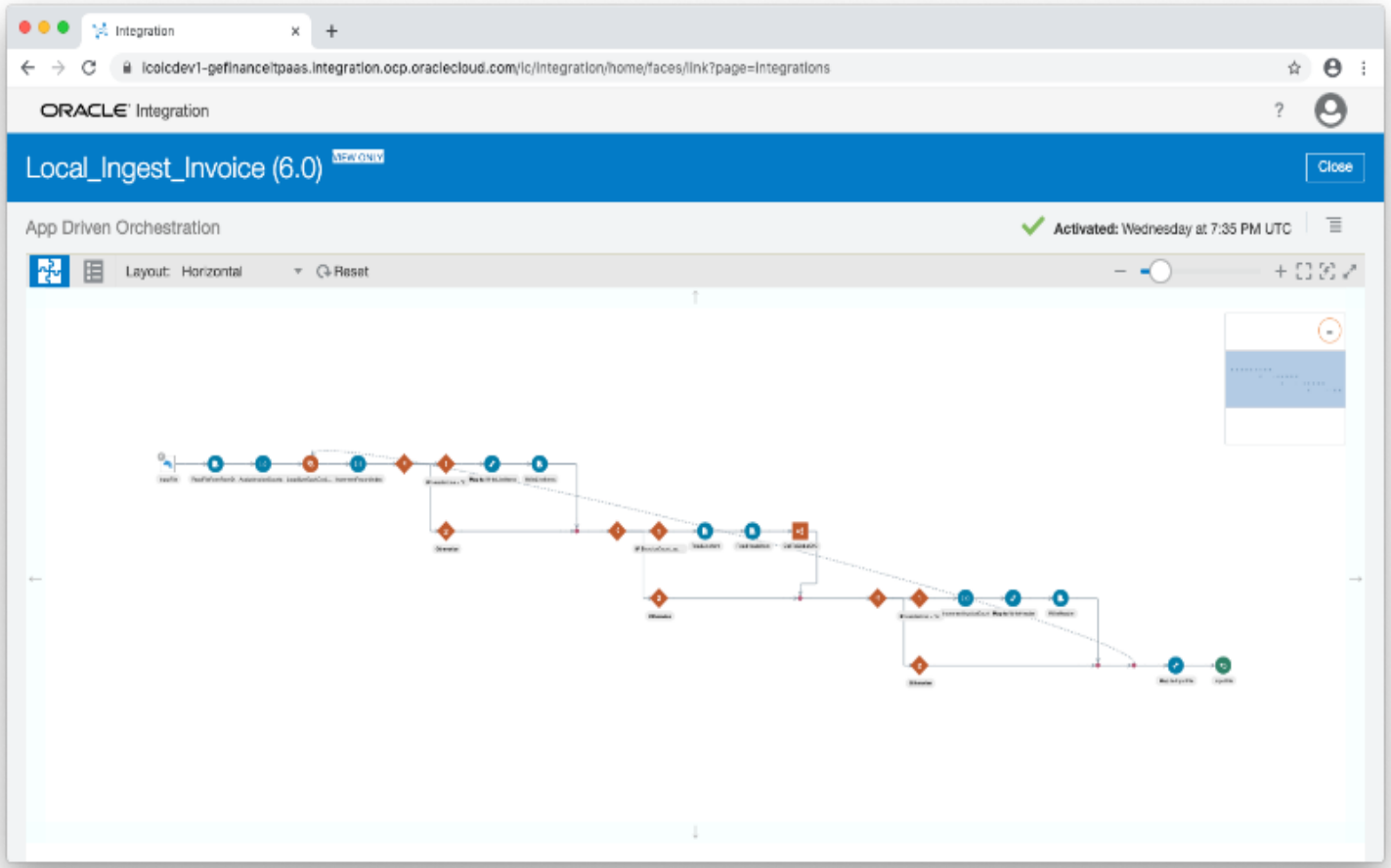



# Security: Authentication and Authorization

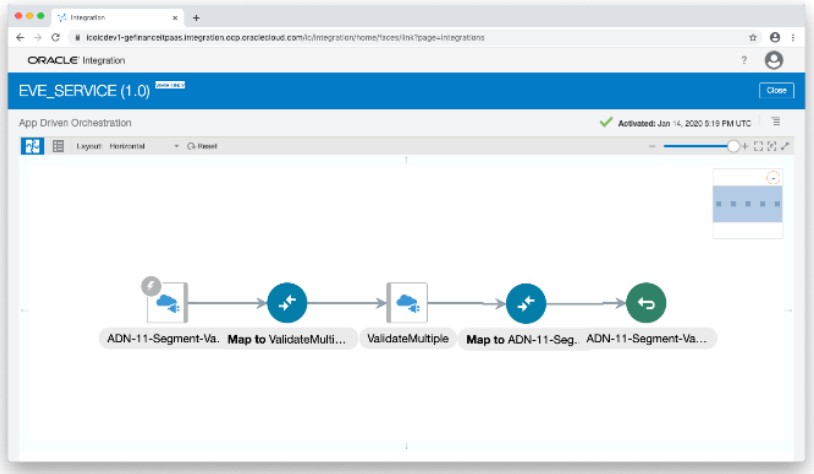


# Data Integration

Reduces code development and provides off-the-shelf integration to existing systems

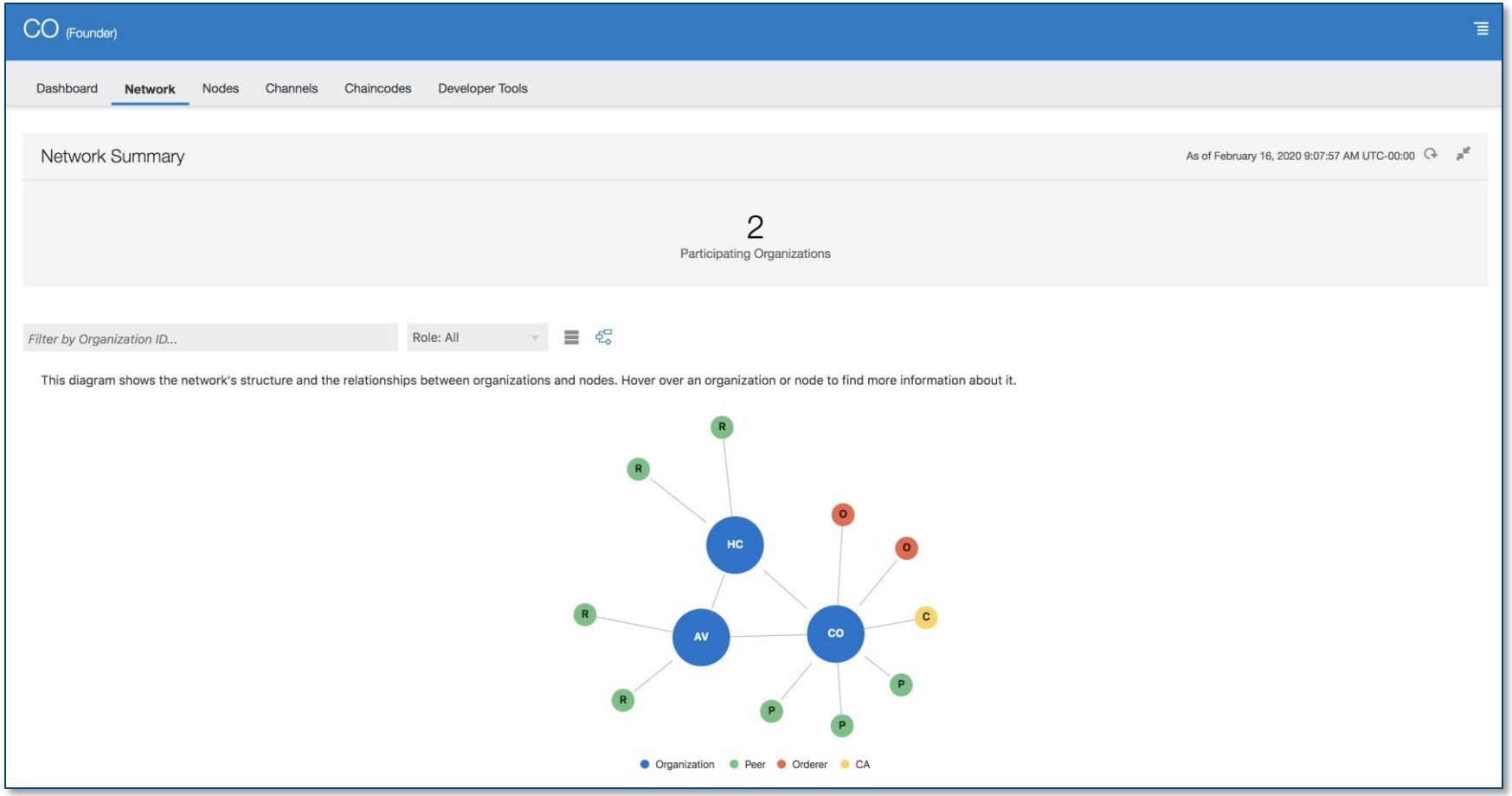



- Integration to break up CSV file into individual invoices and pass to the canonical invoice handling API
- Integration to take in invoice data, enrich the data, and submit to blockchain.
- EVE Validation
- DRM  Enrichment
- Integration to process PO data and submit to blockchain



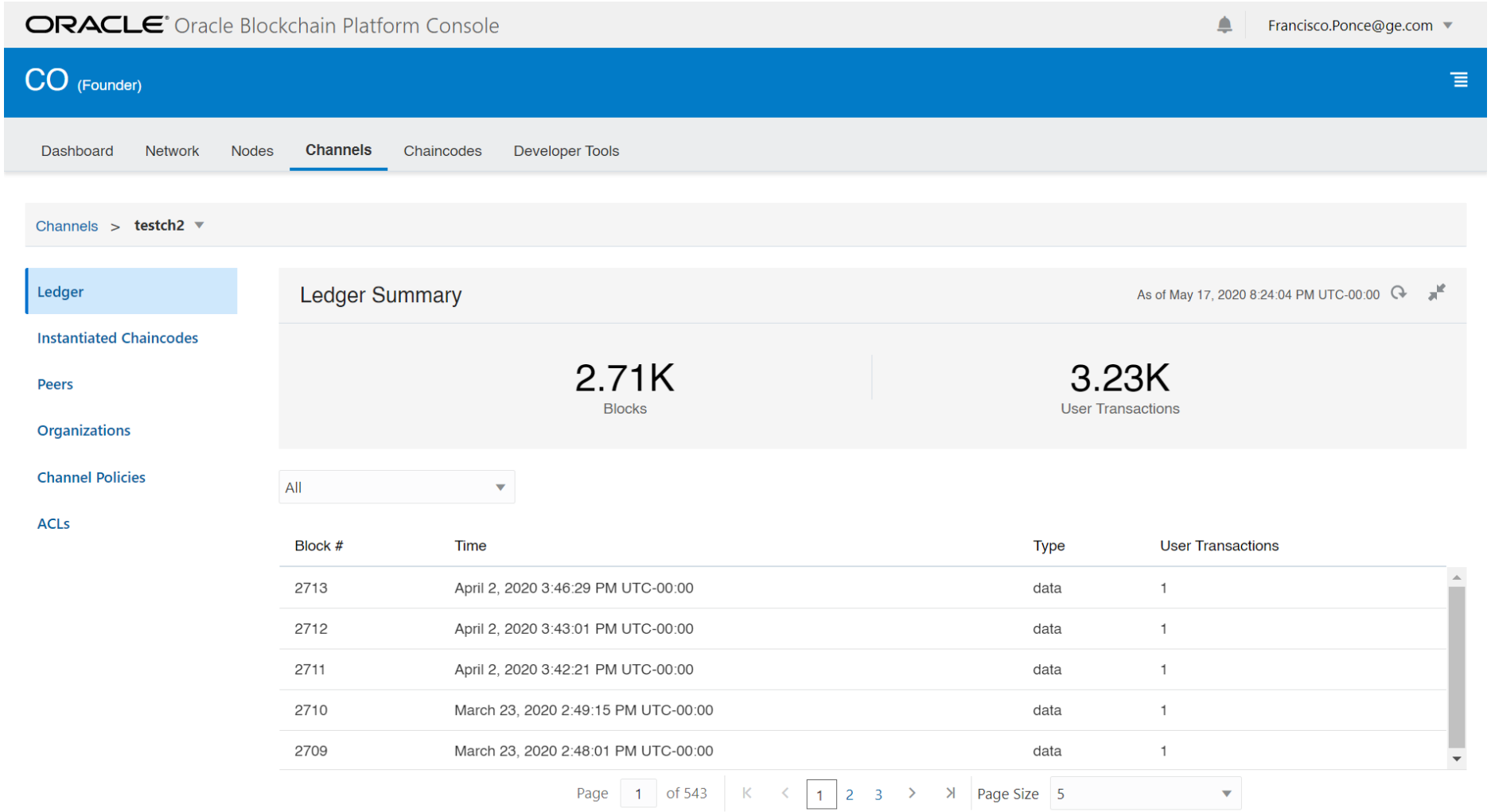
# Oracle BaaS

## Organization Nodes in the Blockchain Network



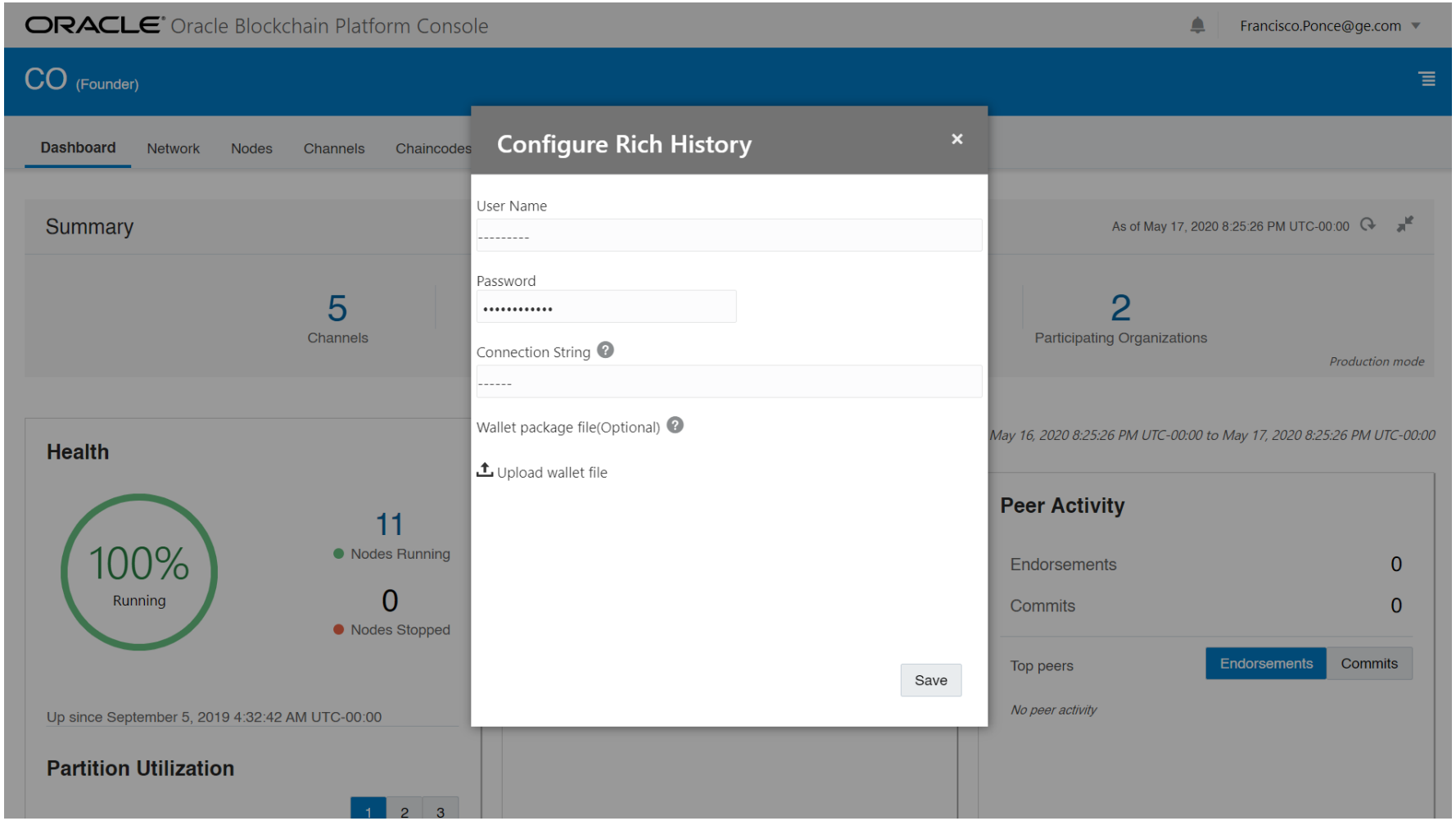
# Oracle BaaS

## Peer Nodes on Channels



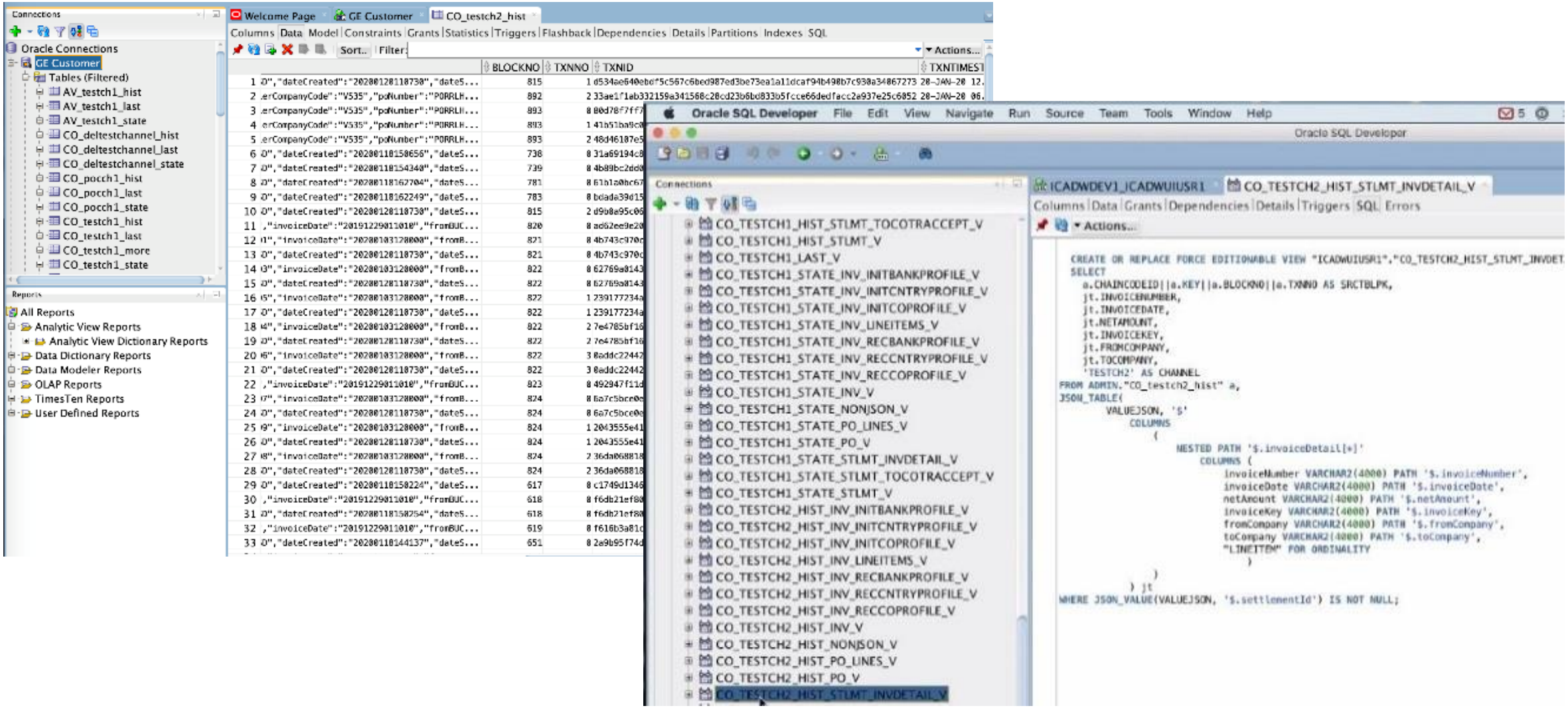
# Oracle BaaS

## Rich History DB

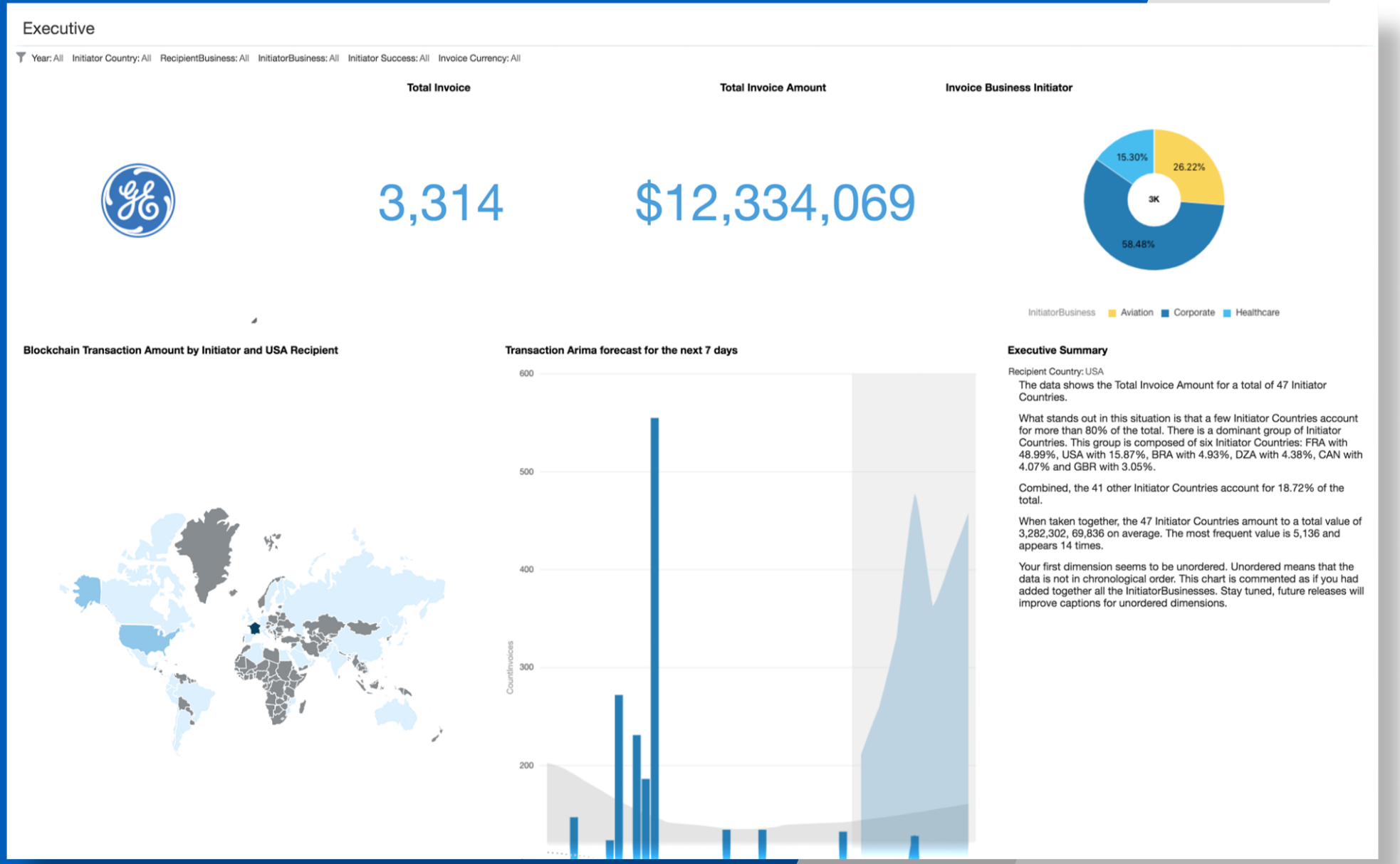


# Data warehouse

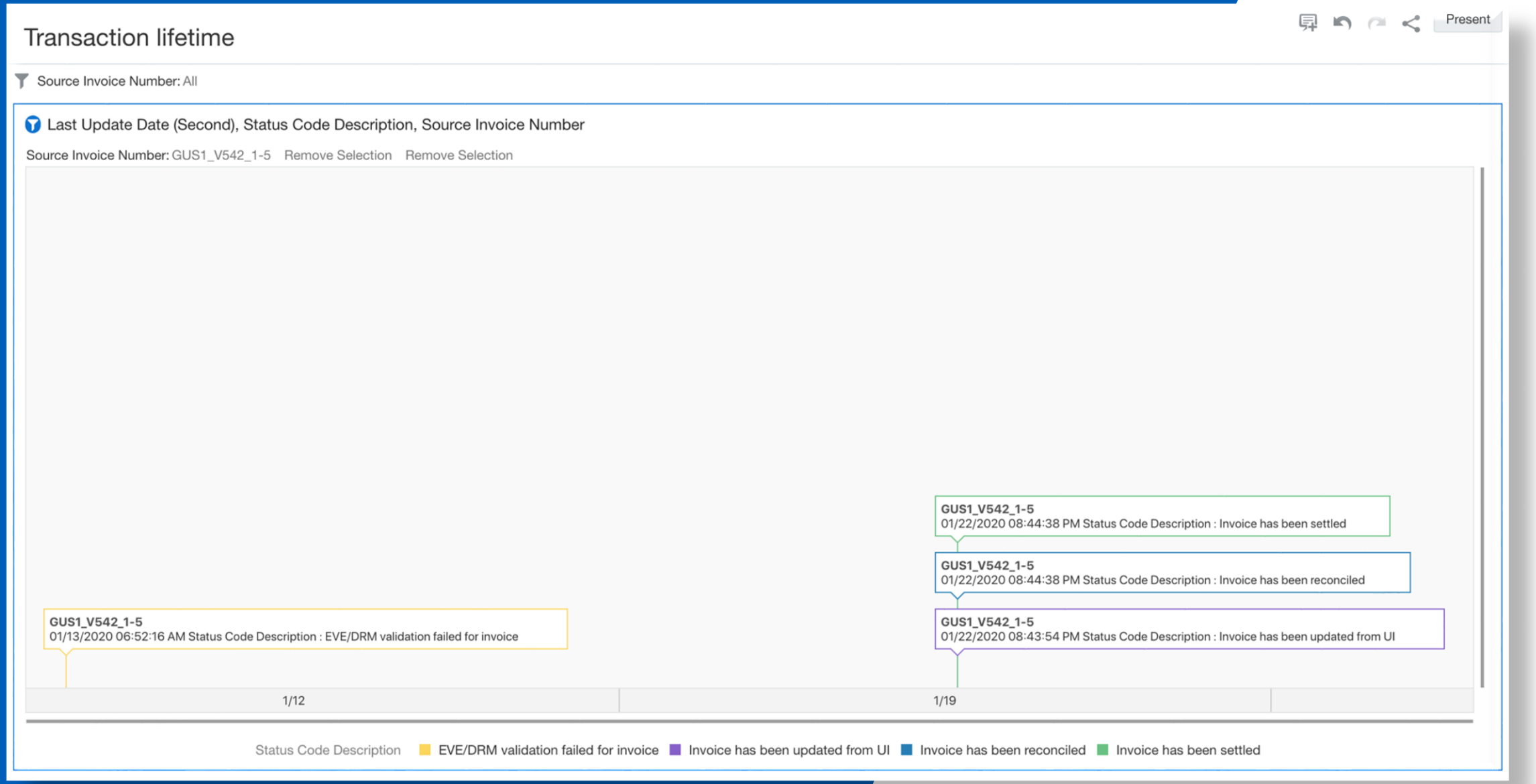
## Rich History Database



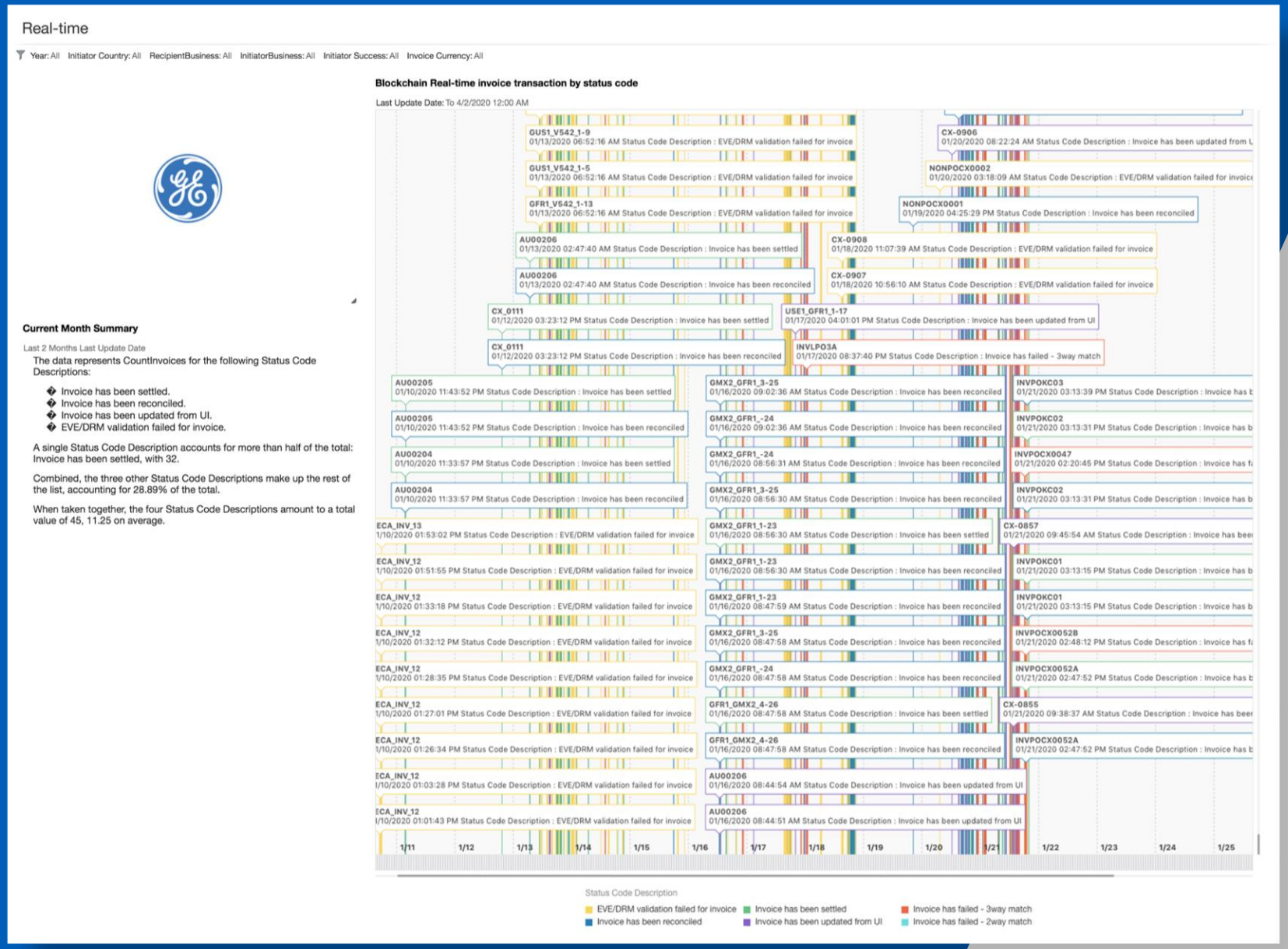
# Analytics – Executive Summary



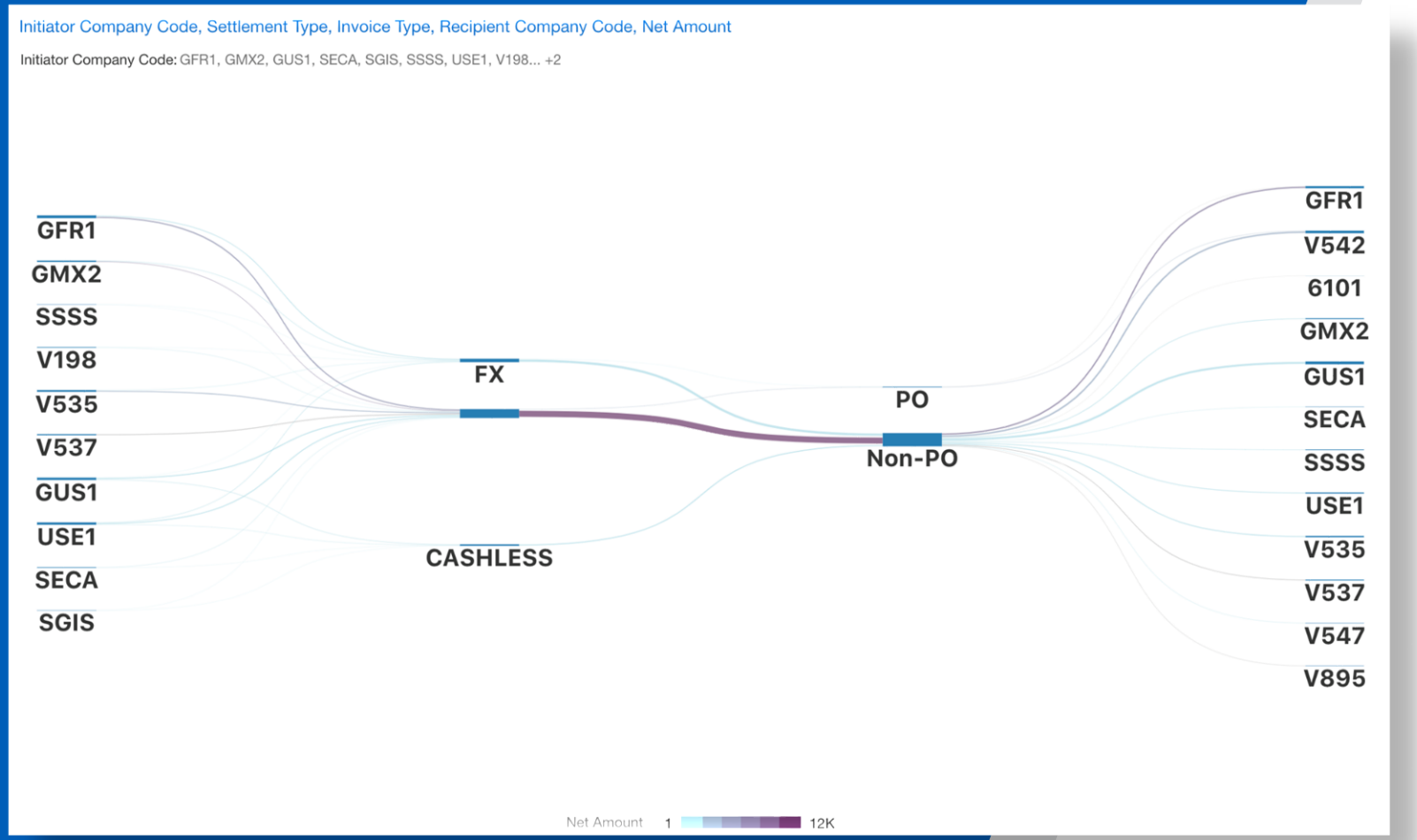
# Analytics – Transactional history



# Analytics – Transaction provenance

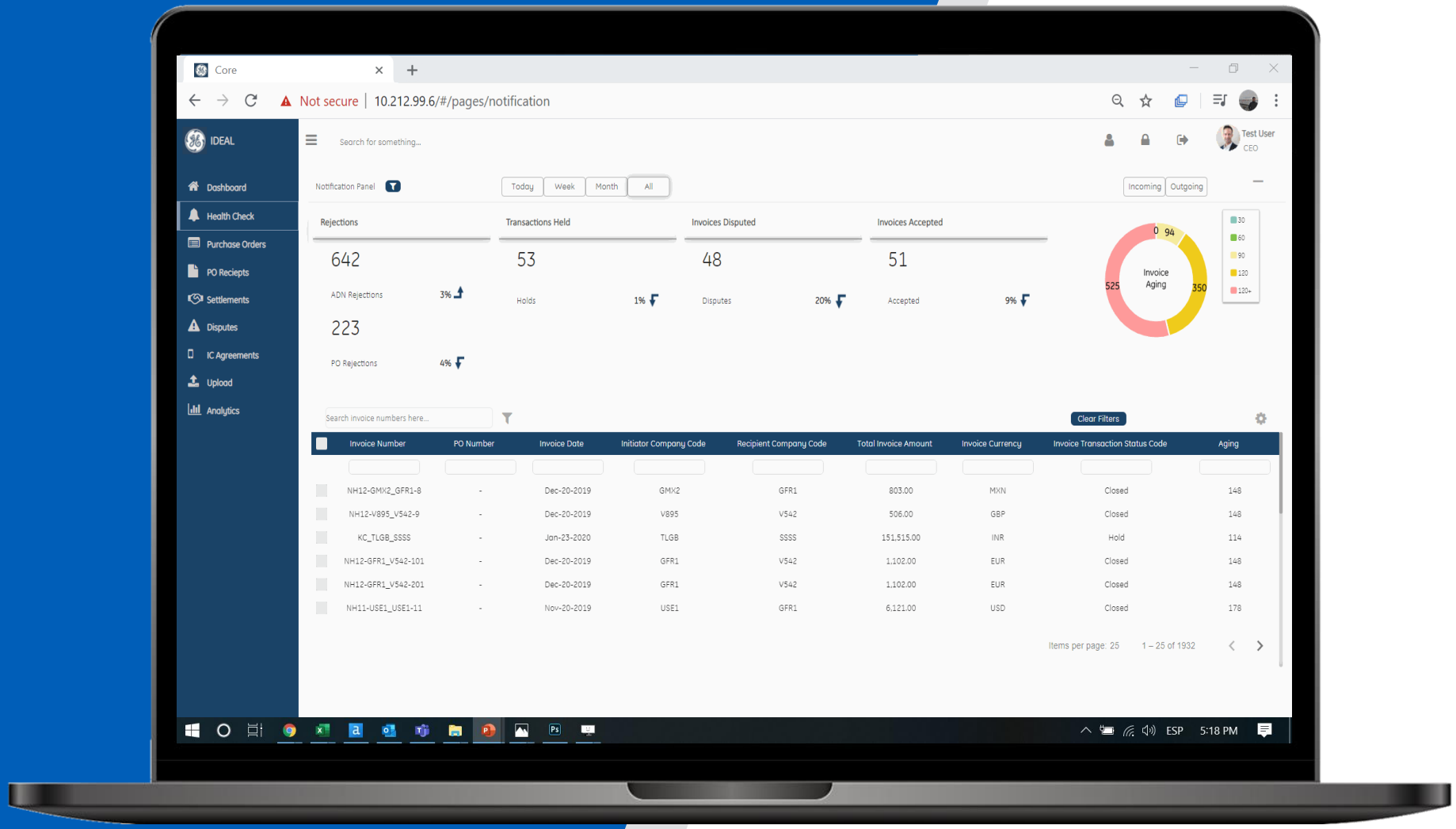


# Analytics




- Distribution of invoices by Company Code initiator and Company Code recipient
- Distribution of invoices by type of payment

# Using Blockchain to manage Intercompany invoices



# Architecture Summary

**iDeAL solution is built on a collection of pre-integrated cloud platform services**

- Integration, Blockchain, Data warehouse, Analytics, Identity management
  - Each strong, but providing greater value when used together
  - Enables rapid development of complex applications using well-defined APIs
  - Supports declarative/low-code development of many components
  - Provides independent layers of Microservices-based functionality
- Enables IT Flexibility and Business Agility
  - Decentralized topology and flexible deployment architecture for corporate and BU needs, speeds up execution of TSAs
  - Provides high availability and resilience of managed cloud services in a cost-effective manner
  - Can easily evolve through ability to add additional BUs and ERPs, validations/enrichments, process flows (disputes, holds, etc.), smart contracts, dashboards, and downstream integrations.

# Q&A

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