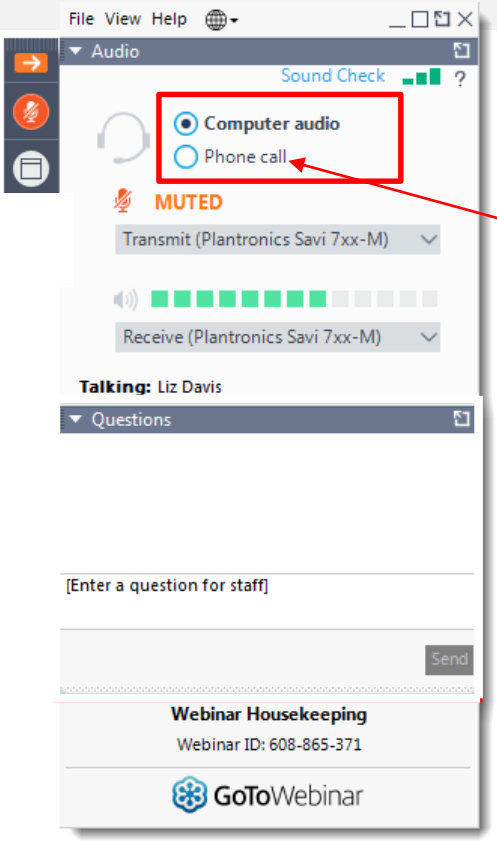
CHESS Replacement Project

Webinar 2
Connectivity & Integration
Direct Integration (Nodes)

18 October 2018

ASX

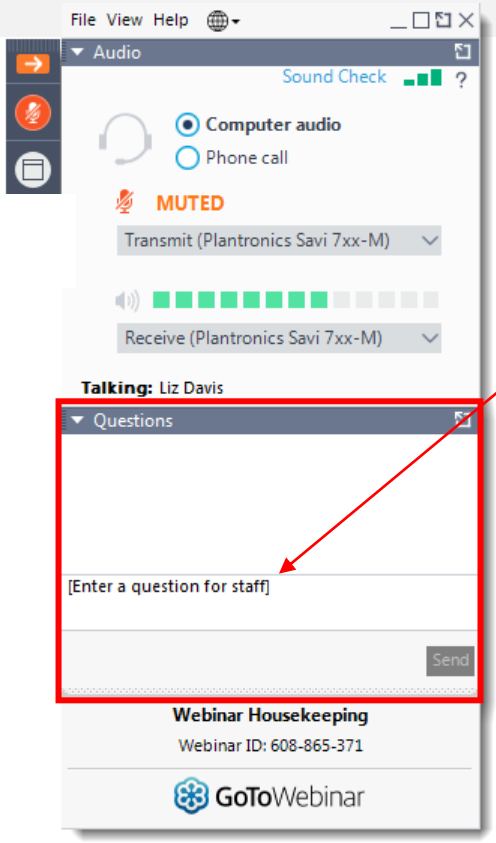
Housekeeping: audio trouble shooting



Your Participation

- Having trouble hearing via Computer Audio? Switch to Phone call!
- Refer to your registration and / or reminder email for dial in details

Housekeeping: how to submit questions



Your Participation

- To submit your text questions and comments use the Questions panel
- Note that your questions will not be seen by other attendees

For more information - refer to the webinar tips published on the ASX CHESS Replacement web page

Presenters and introductions

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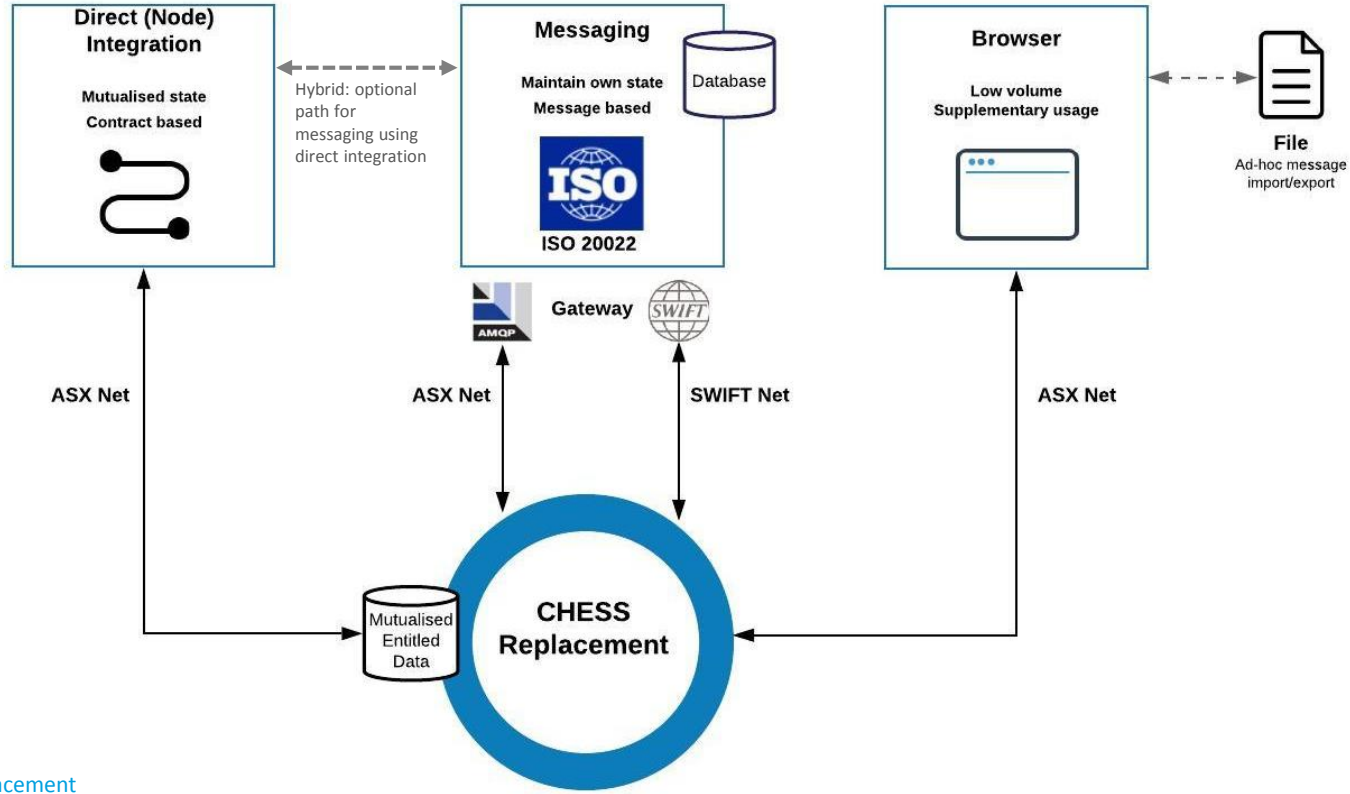
Agenda

- Recap on connectivity options
- What is a node and node hosting
- Features of a node
  - Streaming
  - Transacting
- DAML SDK
  - Ledger API
  - Application framework and applications
- Example use cases
- Benefits of a node
- Q & A

Connectivity options (summary)

Connectivity options – recap from webinar 1



Direct integration – what is a node?

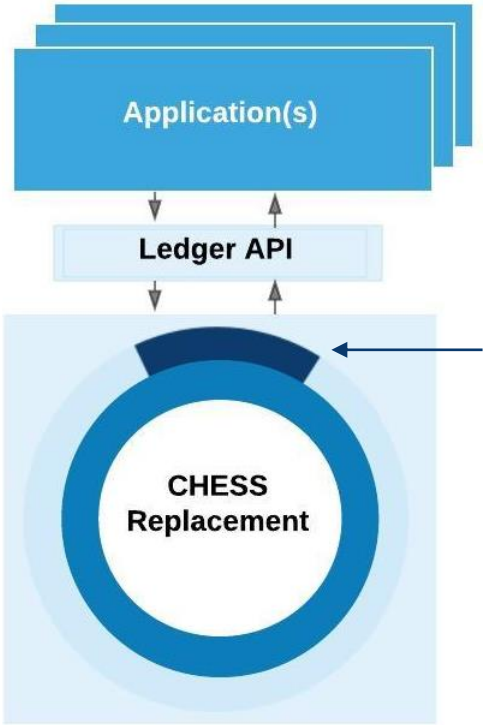
Node overview

A node is a collection of software that allows stakeholders to interface directly with the CHESS Replacement solution.

Node provides real-time shared golden-source data.

Key Terms

- Contracts
- DAML Parties
- DAML Libraries
- DAML Software Development Kit (SDK)
- Private Contract Store (PCS)
- Active Contract Set (ACS)



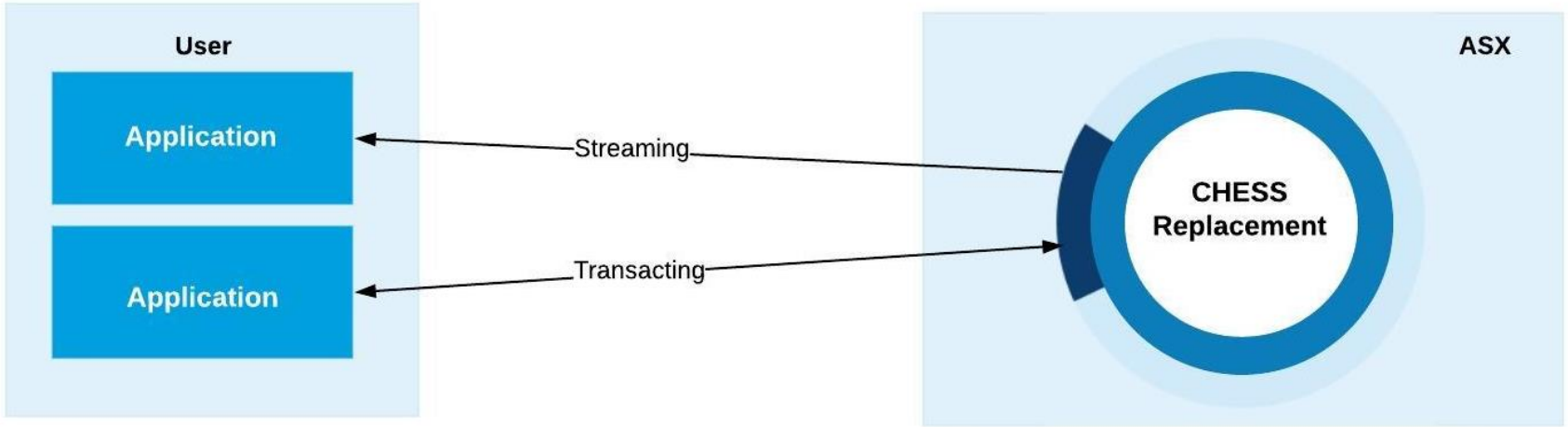
Node Hosting

- ASX will host and manage all infrastructure related to a node (including back up / BCP)
- All ASX infrastructure located in Australia
- There is no hosting or management responsibilities for users relating to a node outside of managing connectivity options via ASX Net
- Support and SLAs (monitoring and overall system health)
- Nodes will be initially offered to Clearing and Settlement users and/or their vendors

Features of a node

Features of a node

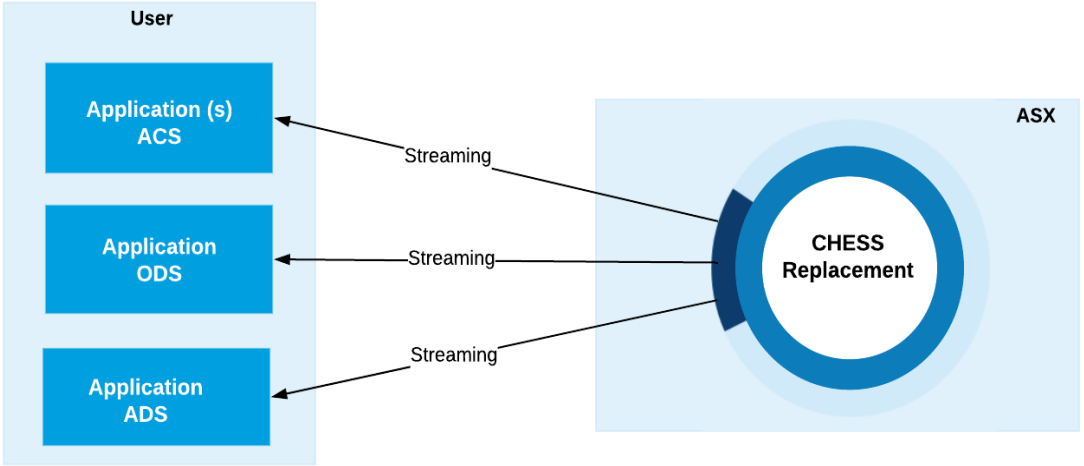
Ability to stream and transact



Direct - data streaming

Data streaming - introduction

Direct connectivity provides data streaming capabilities directly from the Ledger Event Stream (part of ledger API)



Active Contract Set (ACS)
- Current State
- Vendor / Participant developed application(s)

Operational Data Store (ODS)
- Current State and History
- ASX developed application

Analytical Data Store (ADS)
- History
- ASX developed application

Streaming – Active Contract Set (ACS)

Participant / vendor developed applications

- Nodes provide the flexibility to stream data privately
- Data is published via the Ledger Event Stream (a function of the Ledger API)
- When state is changed, for example HIN creation, movement of holdings, DvP matching etc. this causes a resulting state change and this data is automatically published to subscriber(s)
- Digital Asset provides an application framework to manage current state in memory (ACS)
- Applications with workflow will typically incorporate the ACS for managing workflow

Use cases:

- Applications that need current state for transacting or real-time querying

Streaming – Operational Data Store (ODS)

ASX developed applications

ASX is offering users with direct connectivity (node) access to an ‘ODS Application’

- The ODS Application utilises the Ledger Event stream and populates a database hosted by the client
- Participants can configure the ODS to subscribe to specific contract templates
- It designed to record and represent current state (and configurable history)
- Data represented in SQL tables, participants can develop their own SQL extracts
- PostgreSQL is used as data store – open source

Use cases:

- Participants who want to keep a copy of their active contracts (and history) in a SQL style queryable database.
- Reports/extracts can be developed by participants.

Streaming – Analytical Data Store (ADS)

ASX developed applications

ASX is offering users with direct connectivity (node) access to the 'ADS Application'

- The ADS Application utilises the Ledger Event stream and populates a database hosted by the client
- The ADS provides a full verifiable and auditable copy of a client's ledger
- Provides a complete store of the entire ledger history, which can be transformed into queryable extracts
- Data represented in exactly the same way as it is on the ledger
- Hadoop is used as data store – an open source, big data distribution system

Use cases:

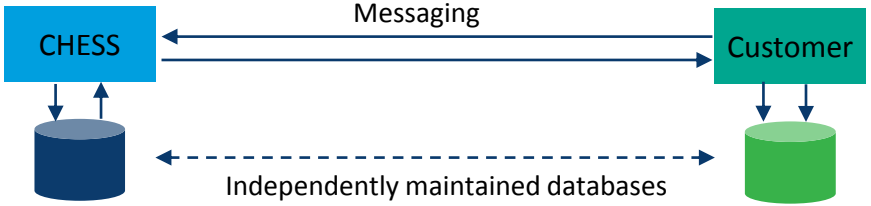
- Participants who want to keep a separate and persistent copy of their ledger
- Those interested in big data and analytical reporting

Direct - transacting

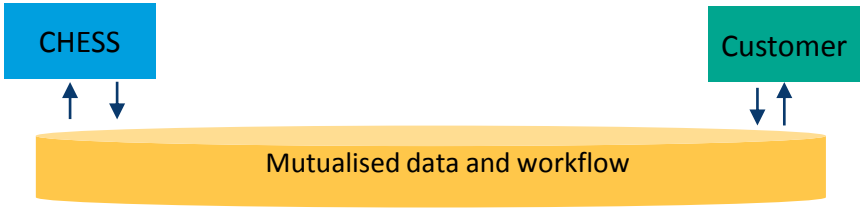
Messaging versus direct integration (node)

DLT is a technology that allows parties to a transaction to share a common mutualised view of the data

Messaging



Direct (node)



Transaction – example - DvP request

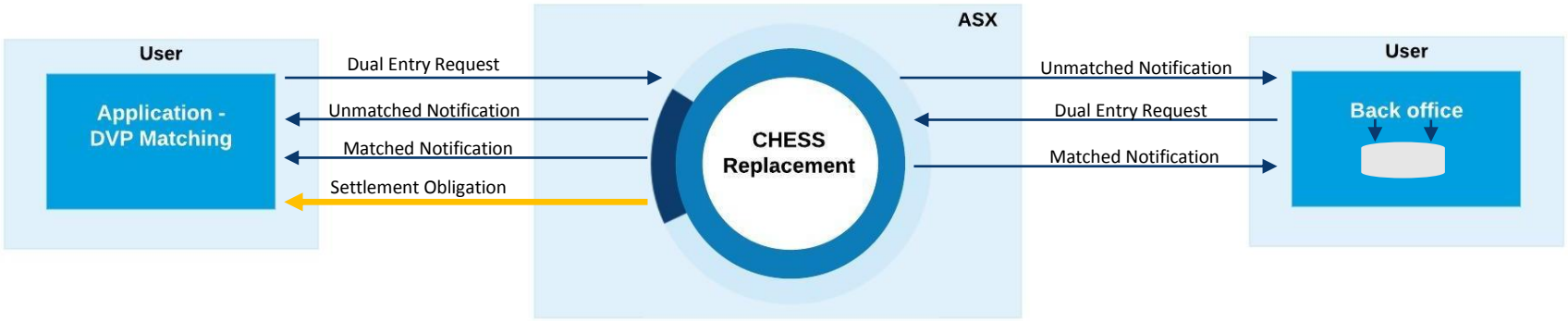
Comparison of node versus messaging based DvP request

Direct (node)

Party A

Messaging

Party B



Message Gateway: Ledger API
Transaction Format: DAML
State: Managed on ledger

Message Gateway: AMQP or SWIFT
Message Format: ISO 20022 XML
State: Managed off ledger

DAML Software Development Kit (SDK)

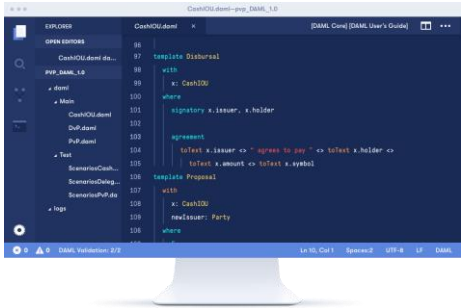
ASX

The DAML SDK

An integrated suite of tools designed to accelerate the development of DAML applications for the DA Platform.

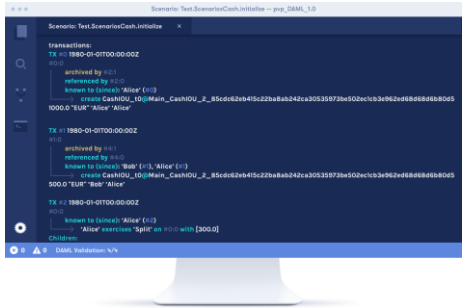
Develop

DAML Studio provides real-time feedback to support efficient development of correct smart contracts



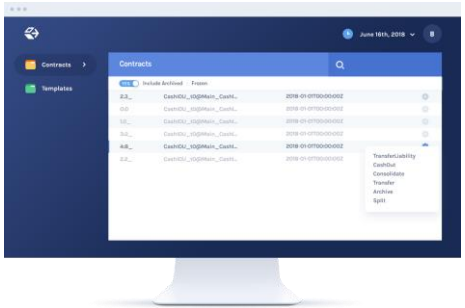
Test

Integrated scenario testing allows developers to see the impact of the agreement on the ledger immediately



Demonstrate

The DAML SDK includes a dynamic front-end that automatically generates simple GUIs for DAML models



Ledger API

The Ledger API uses gRPC (Google's Remote Procedure Call) which maintains services using Google's Protocol Buffers* as the Interface Definition Language (IDL).

The Ledger API has two layers of services

- **Ledger Services** make up the core functionality that is needed to interact with the ledger
  - Identity, Configuration, Packaging
  - Command submission/completion
- **Application Services** provide higher level components that aid developers in building robust applications
  - Command service
  - Active contract service

Protocol Buffers

*Protocol buffers are Google's language-neutral, platform-neutral, extensible mechanism for serializing structured data – think XML, but smaller, faster, and simpler.

Why gRPC?

- Open-source interoperability
- Vast adoption
- Vibrant community of contributors
- Multitude of language mapping
- Designed for scale and performance yet simplicity
- Secure connections (SSL/TLS) as well as pluggable authentication mechanisms

Ledger API - Services

> Ledger Services

Ledger Administration	
Ledger Identity Service	Retrieves the Ledger ID of the ledger the application is connected to.
Ledger Configuration Service	Retrieves some dynamic properties of the ledger, like minimum and maximum TTL for commands.
Ledger Metadata Exchange	
Package Service	Queries the DAML packages deployed to the ledger.
Ledger Data Exchange	
Command Submission Service	Submits commands to the ledger.
Command Completion Service	Tracks the status of submitted commands.
Transaction Service	Retrieves transactions of events from the ledger.

> Application Services

Ledger Data Exchange	
Command Service	Combines command submission and command completion into a single service.
Active Contract Service	Bootstraps an application with active contracts. It eliminates the necessity to read from the beginning of the ledger and to process create events for contracts that have already been archived.

DAML SDK – applications and application framework

ASX

DAML

A key element of CHESS Replacement is the use of the DA Platform and Digital Asset Modelling Language, called DAML. DAML is specifically configured to *track/map* rights and obligations of ASX participants and how they update over time on the ledger.

All modifications to the ledger happen via DAML commands. The ledger is updated by a participant upon submission of a valid transaction (DAML command). The rules as encoded in DAML dictate under which conditions contract instances are added/archived.

DAML Libraries

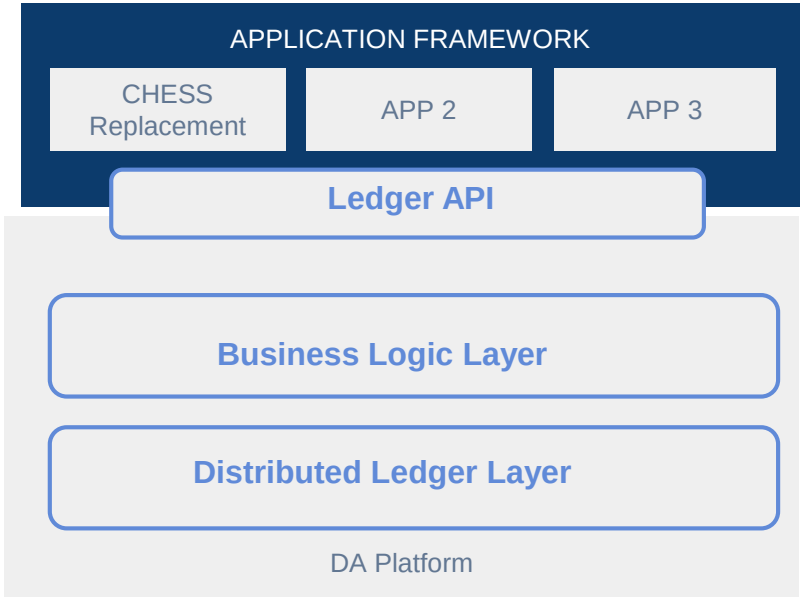
- ASX DAML contracts will be grouped into DAML Libraries (or modules). Tip: think Java .jar file
- DAML Libraries represent the application rules (i.e. ASX market rules)
- The structure of commands and events are defined by the DAML Libraries being used
- Node users will be provided with the CHESS Replacement DAML Library and SDK (Software Development Kit)

Application Framework

Application Framework is a component of the DAML SDK that enables developers to develop applications against a DA Ledger efficiently. DAML-based applications are centred around a DAML library that is running on the DA Platform.

Goals of the DA Application Framework

- Provide a generic and lightweight ledger subscription-and-command generation framework which can be used to develop automated decision logic
- Provide reusable elements and Microservice development patterns
- Provide fast restart capabilities
- Exploit the required determinism of the decision logic
- Facilitate naturally parallelizing independent components



Application Framework - Platform Extensibility

Applications can be developed using the DAML SDK to address current problems or design a new range of solutions.

Participant Specific

developed directly by participant or vendor to solve a specific in-house requirement

Sample App 1.

Short Cover Alert and Inter A/C Transfer or Recall

Role Based

developed by a vendor to solve a market wide need or problem

Sample App 2.

Independent real-time risk monitoring or Trade allocation flow

Inter Participant

developed to extend the platform for either specific participants or all participants

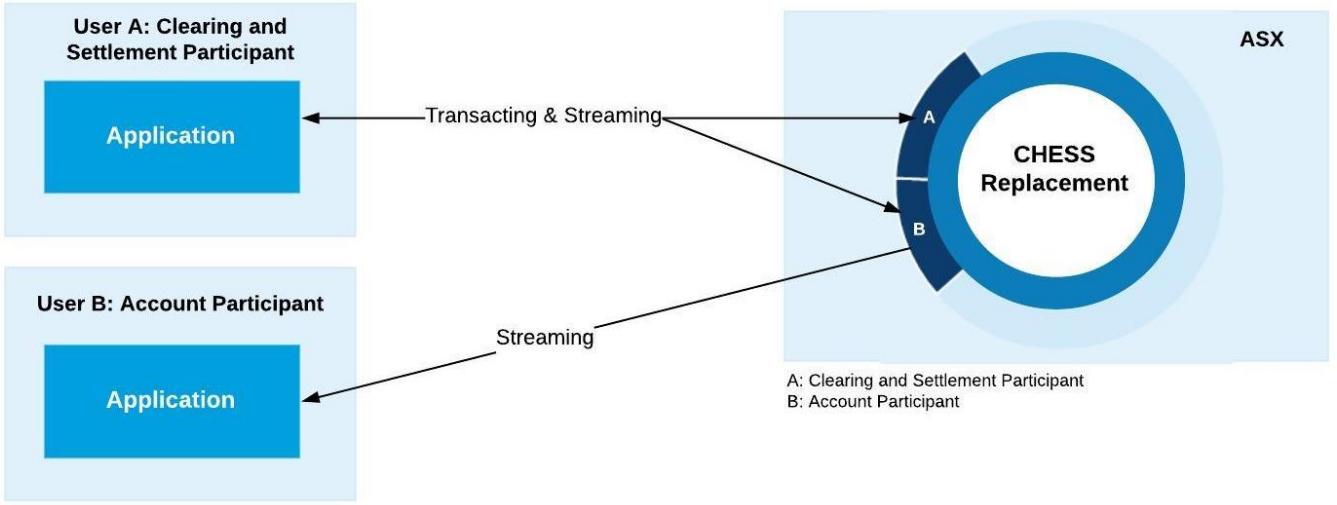
Sample App 3.

Collateral management

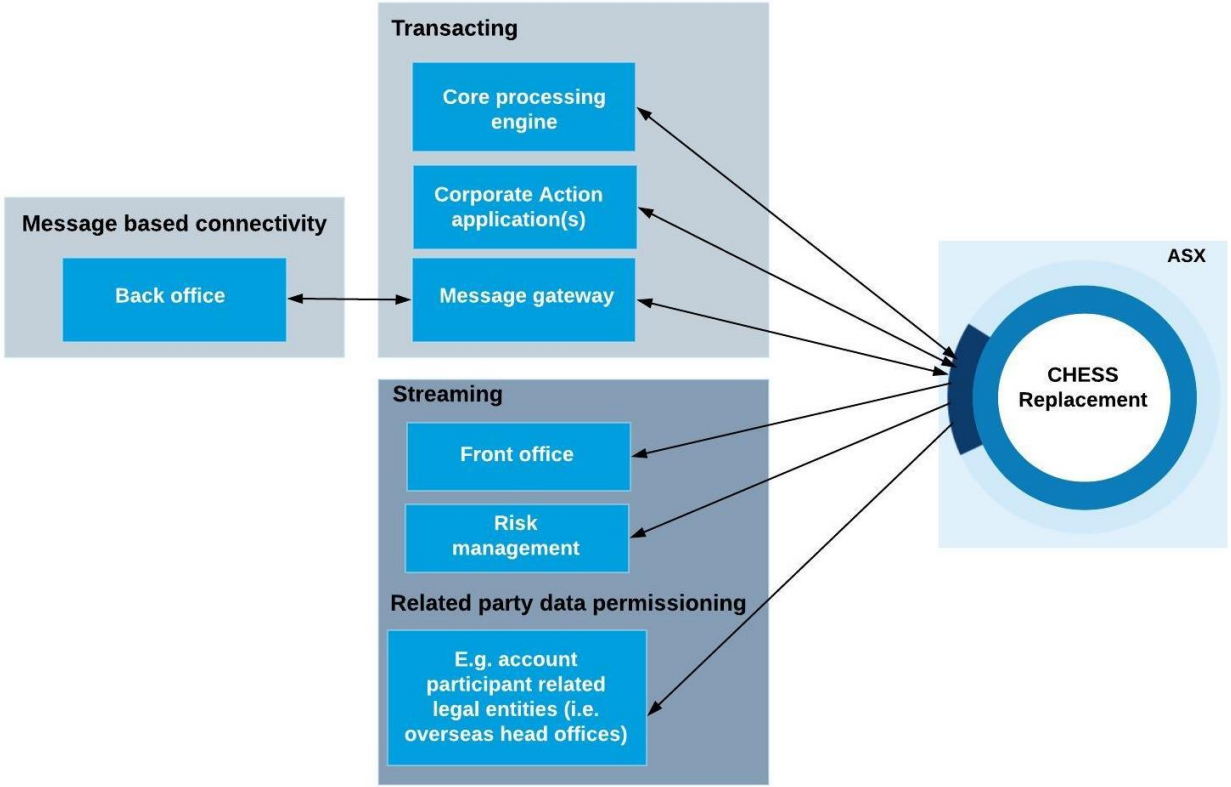
Example use cases

Data Permissioning

- Segregation of data from go-live will be the same as today, at the PID level
- Flexibility for other models and levels in the future



Bringing it all together



Benefits of taking a node

Benefits of taking a node

Golden source of truth

- Real-time ‘golden source shared data’
- Integrity and privacy via contract permissions
- Auditable data for risk, compliance and regulatory requirements
- Customise and permission access to data across multiple parties

Common Workflows

- DAML harmonises market rules and creates common business workflows
- Enforces strict parameters which eliminates interpretation risks
- Structured data to simplify operational processes

Innovation / Extensibility

- Rapid deployment of new applications to meet current and future needs
- Extend platform to replace existing tools, e.g. trade allocation
- Incorporate functionality to supplement existing infrastructure e.g. independent risk monitor

Q&A

DAML vs XML comparison

XML Form

<**NAME**>MR JOHN ROBERTS</**NAME**>
<**ADDR1**>13/117 SYDNEY PARK ROAD</**ADDR1**>
<**ADDR2**>ERSKINEVILLE</**ADDR2**>
<**PCODE**>2043</**PCODE**>

DAML Form

{ **name**: “MR JOHN ROBERTS”,
addr1: “13/117 SYDNEY PARK ROAD”,
addr2: “ERSKINEVILLE”,
pcode: 2043
}

Next Steps

- Connectivity and Integration Working Groups
- Focus Groups
- Sibos
- DLT Breakfast

Thank you.

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