CHESS Replacement: Assessment of Implementation Options for Cutover

Information Paper

July 2022

Contents

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Executive Summary

Overview

CHESS is the core system used by ASX to perform clearing, settlement and other post-trade services for the Australian equity market. While CHESS continues to be stable and to effectively deliver these services, ASX is replacing CHESS with distributed ledger technology (DLT), which will provide a broader range of benefits to a wider cross section of the market.

This paper explains the considerations and assessment by ASX to cutover from current CHESS to the CHESS replacement system, and to global standard message sets (including ISO 20022 and FIX, both from CHESS proprietary format message) using a risk-mitigated single cutover approach.

ASX acknowledges the interest from stakeholders to understand the rationale for a single cutover, including gaining a better understanding of the complexities and risks associated with the alternative options.

Using an evaluation criteria of operational risk, technical complexity, market impact and ASX impact, ASX assessed four implementation options:

1. ASX and CHESS user single cutover to CHESS replacement, and to ISO 20022 with new and enhanced processes (option 1, refer to section 4.1.1)
2. ASX single cutover to CHESS replacement and phased CHESS user migration to ISO 20022 like-for-like[1], followed by single cutover for new and enhanced processes (option 2, refer to section 4.2.1)
3. Phased ASX migration to CHESS replacement and CHESS user migration to ISO 20022 like-for-like aligned with ASX phasing, followed by single cutover for new and enhanced processes (option 3, refer to section 4.2.2). Potential variations include:
    - Phasing of which **issuers/securities** go-live on the new system over points in time
    - Phasing of which **holder identification numbers** (HINs) go-live on the new system over points in time
    - Phasing of which **message types/business processes** go-live on the new system over points in time
4. Phased CHESS user migration to ISO 20022 like-for-like with current CHESS, followed by ASX single cutover to CHESS replacement, followed by single cutover for new and enhanced processes (option 4, refer to section 4.2.3)

Based on the assessment undertaken, ASX has determined that the least complex and lowest risk option for the system migration is to cutover from the current CHESS system to the new CHESS replacement system, and to global standardised messaging (including ISO 20022 with new and enhanced processes and FIX), over a single weekend (i.e. option 1). The other options (options 2, 3 and 4, which all involve a phased implementation) were either assessed to be not feasible, or introduce added risk, complexity, time and cost for both the market and ASX to achieve the target end-state. Section 5 provides further information as to the complexities and risks of phased cutovers.

The implementation options for cutover, and the determination to proceed with a single cutover, is agnostic to the decision to replace CHESS using DLT.

A key consideration for the implementation approach is the messaging migration approach. ASX notes agreement with industry to move to the ISO 20022 global messaging standard when replacing CHESS, and not prior. This was agreed based on efficiency and cost/benefit for the market. Although this decision has already been made, this paper also examines implementation options if the move to ISO 20022 messaging were to be implemented in stages as this is a pre-requisite for all phased approaches. From a messaging migration perspective, any form of phased implementation requires like-for-like messaging compatibility to facilitate the transition. Importantly, the mapping of current in scope CHESS EIS (or proprietary format) messages to ISO 20022 messages is not one-for-one. Similarly, the adoption of ISO 20022 has for some messages necessitated a change in field format, size or the number of fields to support a business transaction. For this reason, backward messaging compatibility is not a straight-forward exercise. To enable backwards messaging compatibility, the project would need to:

[1] Like-for-like involves aligning proprietary message implementation to ISO 20022, and supporting centralised mapping translation between CHESS proprietary messaging and ISO 20022 messaging. This also applies to options 3 and 4.

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- Replicate all current workflow as-is in the new system and not initially activate any of the new or enhanced workflow, e.g. alignment to ISO 20022 account model, settlement scalability, settlement fails, settlement locking, corporate actions (DRP/BSP) etc
- An alternative to the above would be to first build, where possible, the enhanced workflows within current CHESS
- Release a version of current CHESS messaging to align it to ISO 20022 so that a like-for-like mapping is possible. This is referred to as Phase 0 and necessitates a release of current CHESS
- Build a centralised message translation capability to provide real-time mapping of at least 275 in-scope post Phase 0 EIS messages to 106 ISO 20022 messages[2]

This would add significant development, time, cost, and complexity to the project and not align with feedback from the market which indicated a preference to introduce global standards and functional enhancements as part of the project to replace CHESS. However, a single cutover is ultimately required to then migrate from ISO 20022 (constrained by current CHESS) to ISO 20022 target state with new business processes.

Another consideration for the implementation approach is data migration. The paper sets out the reasons why data migration from CHESS to CHESS replacement under single cutover is manageable.

ASX acknowledges that no implementation option for cutover is without risk. To mitigate the risks of a single cutover, ASX has developed a robust plan of activities phased over the customer and operational readiness stages of the project, including dress rehearsals. Specialist expertise, independent review and a cutover governance model are also in place to support the implementation approach.

[2] This excludes current CHESS EIS messages that were de-scoped following finalisation of the business requirements.

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1. Background

ASX and a broad stakeholder community have been working together since 2016 to successfully deliver the system to replace CHESS using distributed ledger technology (DLT) and global standard messaging. The cutover to the CHESS replacement system is planned to occur over a single weekend following a series of readiness activities to appropriately prepare for and manage the implementation risks.

The choice of cutover approach to the new CHESS replacement system is material to all impacted CHESS users, including clearing and settlement and settlement-only participants, approved market operators (AMOs), share registries, product issuer settlement participants (PISPs), payment providers and the Reserve Bank of Australia (RBA). Third party vendors providing technical and system services to CHESS users will also be impacted. All parties will have some implementation activities to execute over the cutover weekend, although the impact will vary for different stakeholders.

This information paper, which is supplementary to the Cutover and Migration Strategy paper published in December 2021, outlines ASX's assessment of the different cutover options and the rationale for a single cutover over a two-day weekend. It also provides an evaluation of operational risk, technical complexity, market impact and ASX impact for each of the implementation options considered.

The alternative to a single cutover is a phased approach. Phasing requires multiple releases including changes to current CHESS, and in some options support for centralised message translation and/or the need to run both current CHESS and CHESS replacement alongside each other and keep them synchronised.

In November 2021, ASX engaged EY to perform an independent high-level assessment of ASX's cutover approach and strategy, which resulted in a number of key findings and recommendations.[3]

ASX understands the concern expressed by stakeholders on the risks associated with a single cutover approach compared to an approach that allows the new system to be phased in over time. ASX also acknowledges the interest from stakeholders to understand the rationale for a single cutover, including gaining a better understanding of the complexities and risks associated with the alternative options. In addition to this information paper, ASX will present the key points in this information paper through its CHESS replacement stakeholder engagement working groups.

The following sections detail key tenets of the CHESS replacement project and provides further context on the assessment of implementation options.

1.1. Guiding principles for the CHESS replacement project

In 2016 ASX established guiding principles for the replacement of CHESS, in anticipation of the investment in a replacement system, including:

- Meeting and responding to changing local and global markets, and promoting further innovation through new levels of functionality, open and global standards, and flexible technology
- Ensuring capacity to integrate with upstream and downstream business systems, and embracing global standards and openness to competition through interoperability in a cost-efficient way
- Streamline functions and workflows, remove embedded paper-based processes, and mitigate manual errors, and be effective and cost-efficient to operate, support and enhance
- Providing users and regulators with confidence that the solution will be available to process transactions as and when expected
- Complying with relevant laws, regulations and licenses relating to the operating entities

The cutover approach has taken into consideration these guiding principles to accommodate global standards, new functionality and the streamlining functions and workflows from the initial go-live of the CHESS replacement system. This has in turn influenced the implementation decision for cutover.

[3] The scope of EY's assessment did not extend to providing assurance over the program.

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1.2. Code of Practice and decision to transition to ISO 20022 global standard

The Regulatory Expectations for Conduct in Operating Cash Equity Clearing and Settlement Services in Australia (Regulatory Expectations) provide a framework for ASX's conduct in operating its cash equities clearing and settlement services while it remains the sole provider of these services. This includes establishing governance processes that enable users to provide input on the setting of the investment strategy. Investments should ensure that, to the extent reasonably practicable, the performance, resilience, security, and functionality of the core clearing and settlement infrastructure meets the needs of users, recognising the diversity and differing needs of users.

ASX's Code of Practice sets out ASX's commitment to comply with the Regulatory Expectations. In 2014, the industry advisory forums established under ASX's Code of Practice – the Forum (CEO-industry advisory committee), the Business Committee, and the Technical Committee[4] – discussed the costs and benefits of transitioning from CHESS proprietary messaging format to the global messaging standard ISO 20022.

ISO 20022 has emerged as the leading global standard for new or modernised financial market settlement infrastructures. It allows for international integrations for CHESS users who use ISO 20022 messaging in other markets, thereby facilitating interoperability with global or regional systems. The adoption of ISO 20022 messaging also encourages new entrants into the market by lowering the barriers to entry with the removal of the CHESS proprietary messaging format embedded within CHESS users' back-office systems.

During 2014, the Technical Committee evaluated options for the implementation of ISO 20022. Based on industry input provided through the Technical Committee and Business Committee, the Forum made a recommendation to the Boards of ASX Clear and ASX Settlement that ISO 20022 messaging should be introduced in conjunction with the replacement of CHESS.

The industry position was that the introduction of ISO 20022 messaging prior to the replacement of CHESS would be inefficient and involve significant extra cost for industry participants without providing additional business benefits.

In response to the recommendation from the Forum, the Boards of ASX Clear and ASX Settlement committed to implement ISO 20022 messaging together with the system to replace CHESS.

Similarly, ASX is also implementing a standardised FIX based connectivity and messaging format for the Trade Acceptance Service (TAS) that will be used by all AMOs in CHESS replacement.

1.3. Recent market trends and user feedback influencing scope

The scope of CHESS replacement included input from CHESS users to review current functionality and introduce new functionality and features. This included adopting global standards and embracing openness to competition through interoperability in a cost-efficient and non-discriminatory manner, as well as new functionality for account information, pre-settlement, settlement, reporting and corporate actions.[5] These market-requested enhancements, and message standard changes, resulted in the CHESS replacement system not being a like-for-like system solution.

In addition, record trading volumes experienced in March 2020, and the continuing elevated volumes compared to historical volumes, led ASX to propose changes to the design of both the netting and settlement workflows to ensure these critical business processes could support significantly greater trading volumes. ASIC and the RBA also publicly set out their expectations that CHESS replacement achieve a significant uplift in intraday processing capacity and end-of-day processing performance.[6] In consultation with the market in 2021, changes to netting and settlement workflows were confirmed to discontinue the materialisation of the net broker obligation (NBO) and the sending of individual settlement confirmation messages for instructions that settle successfully. This resulted in important modifications to the solution design including changes to ISO 20022 messaging and the provision of additional information and reporting

[4] The Charter of the Business Committee states that in some circumstances, it may be appropriate for the Business Committee to appoint and convene technical committees to assist in the performance of its role. An ISO 20022 Technical Committee comprising ASX and industry representatives was convened to focus on CHESS messaging and the adoption of ISO 20022 messaging.
[5] See here for detailed information on Day 1 New Business Requirements, including functionality which will be implemented on Day 1, post Day 1 and separate to CHESS replacement.
[6] ASIC and RBA Joint Media Release 'ASIC and RBA announce expectations for CHESS replacement', 1 October 2020.

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to assist participants with their exception management processes to address operational risk concerns. Given these fundamental changes to the netting and settlement messaging outputs, like-for-like backwards compatibility messaging (necessary to support a phased migration) would only be viable if these changes were also made to current CHESS.

1.4. Interdependencies and interfaces with CHESS users

A co-ordinated level of preparation by CHESS users is required to support a successful system deployment.

Unlike some market infrastructures that specialise in a part of the post-trade life cycle, CHESS needs to cater to a diverse group of users, where some CHESS users act in multiple capacities which adds to the complexity.

User type	Number of users[7]
Clearing and settlement participants (including third party clearers)	32
Settlement only participants	24
Payment providers	11
AMOs using the TAS	3
Share registries	9
PISPs	11
Total	**90**

Software to support these CHESS users is provided by a combination of six third party vendors and in-house developers.

1.5. Functional and messaging complexity of current CHESS

CHESS has a higher-than-average business functionality and message complexity, and CHESS user diversity, when compared to global peers (central securities depositories) that have also undergone system and/or adoption of global messaging standards, including ISO 20022.

CHESS provides business functionality across 465 CHESS proprietary messages that equate to 13 ISO 20022 business areas:

- Securities trade
- Securities clearing
- Securities settlement
- Securities management
- Securities event
- Collateral management
- Account management
- Reference data
- Cash management
- Payments clearing and settlement
- Payments initiation
- Administration
- Authorities

Through a multi-year review and mapping stream of work, ASX and industry representatives have agreed a current list of CHESS proprietary format messages and business functions to carry forward, new functions, and descoped functions. As a result, 106 ISO 20022 base messages have been specified for CHESS replacement, where some base messages may have one or more ISO 20022 usage guidelines to cover a universe of use cases. Additionally, FIX messages have replaced the relevant CHESS proprietary format messages for the TAS. These changes have meant there is not a simple one-for-

[7] Statistics are current as at publication date.

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one mapping between current CHESS proprietary messages and ISO 20022 or FIX messages. In terms of comparable international market infrastructure migrations, CHESS replacement's 106 ISO 20022 base messages compares to ISO 20022 post-trade implementations for Singapore Exchange (SGX, 25 ISO 20022 base messages) and Japan Securities Depository Centre (JASDEC, 33 ISO 20022 base messages).[8]

1.6. ISO 20022 implementation strategies

ASX's analysis included a review of the ISO 20022 Implementation Strategies Information Paper by SWIFT, which outlines different approaches to transition to the ISO 20022 message format. The paper assessed that the best approach depends on the specific circumstances of the migration project; i.e. there is no one-size-fits-all solution. Of relevance, the paper also noted that:

- A single cutover may be required in certain scenarios e.g. when the exchange and market participants want to move directly to an ISO 20022 implementation that exceeds the current messaging standard.[9]
- A single cutover introduces more operational risk as "it requires the FMI [Financial Market Infrastructure] and all participants to be ready on the same day" and that "operators should plan for high levels of exceptions and investigations in the early days of operation, and ideally have in place contingency plans to fall-back to the legacy system in case of a major failure".[10]
- The inherent risk of a single cutover "can be mitigated by introducing a strong readiness testing regime and certification program, mandatory training and practicing implementation through dry-runs and exercises".[11]

Further information on ISO 20022 implementation is considered as part of Section 3.

[8] ISO 20022 Registration Authority 'The ISO 20022 Adoption Initiatives Report', 31 July 2018.
[9] SWIFT 'ISO 20022 Implementation Strategies Information Paper', July 2017, Page 8.
[10] SWIFT 'ISO 20022 Implementation Strategies Information Paper', July 2017, Page 8.
[11] SWIFT 'ISO 20022 Implementation Strategies Information Paper', July 2017, Page 8.

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2. Evaluation criteria

The evaluation criteria served as an important framework to assess the implementation options based on operational risk, technical complexity, market impact and ASX impact. This section outlines what is meant by each of these criteria.

2.1. Operational risk

Considerations for operational risk include:

Description	Points for consideration
Number of releases into production	How many distinct releases into production are required? > Each major release into a production environment brings with it a degree of operational risk. Systems become more stable over time as defects and issues are addressed. Whilst this can be mitigated through testing and rehearsals, there remains a residual risk. > Typically a production release is deployed once code complete and after user acceptance testing is completed and there are no blocking issues for go-live.
Cutover point clarity	Are the CHESS user cutover points from current CHESS to CHESS replacement clear, well defined and not likely to result in operational errors due to misalignment between ASX and CHESS users as to the timing and scope of each cutover? > All cutover events contemplate implementation on a weekend. Most options cutover the entirety of a CHESS users' experience in one event. However, some variations within option 3 will require CHESS users to cutover in tranches, which creates an opportunity for misalignment between what ASX has cutover and what the CHESS user has cutover.
Key process validation	Can batch settlement and end-of-day be pre-validated before go-live on Monday (i.e. validation over cutover weekend)? > Completion of batch settlement and end-of-day processing on the Monday following a cutover is critical to the successful operation of the system.
Public holidays and non-business days	Can the migration be achieved without relying on public holidays or declared non-business days? > A cutover approach that relies on long weekends would have significant constraints on when it could be executed. > A cutover approach over a long weekend is non-standard and results in additional volume and activity on the subsequent business day. > A cutover approach that assumes a two day weekend must allow sufficient time for validation checks and rollback if required.
CHESS user readiness	Can the cutover approach proceed if a single CHESS user is not ready? > A CHESS user that is not ready to cutover may impact the cutover for other stakeholders, depending on whether the cutover event is a single cutover or phased, and subject to consideration of all relevant circumstances.
Data synchronisation errors	Is there a risk that data can be out of synchronisation between current CHESS and CHESS replacement when running in parallel? > If the cutover option requires current CHESS and CHESS replacement to run in parallel during any phase, certain data must be synchronised from current CHESS to CHESS replacement and from CHESS replacement to current CHESS. This process would be subject to increased reconciliation between systems and open to failure or errors that would result in the data in the two systems being out of synchronisation, potentially causing an operational incident.

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Description	Points for consideration
ASX operation of two systems in production concurrently	Does the cutover approach require ASX to operate both current CHESS and CHESS replacement in production concurrently? > Operating two systems rather than one is likely to introduce operational and technical risk, especially if certain functions are undertaken in either system and users are having to connect to both systems to undertake clearing and settlement activities.
CHESS user operation of two systems in production concurrently	Does the cutover approach require the CHESS user to operate both current CHESS and CHESS replacement in production concurrently? > As above, needing to interact with both current CHESS and CHESS replacement concurrently will introduce operational and technical risk as there will be higher support requirements and more scope for implementation errors which can result in operational incidents (for both ASX and CHESS users).

2.2. Technical complexity

Considerations for technical complexity include:

Description	Points for consideration
Release to prepare current CHESS (Phase 0) - requirement	Does the cutover approach require a release (Phase 0) that prepares current CHESS to support a centralised message translation capability or data synchronisation between current CHESS and CHESS replacement? > This implies a potentially major release of current CHESS, and is likely to be complex. The same is likely to be true for CHESS users who are in some cases migrating to new platforms as part of CHESS replacement.
Messaging backwards compatibility - requirement	Does the cutover approach require a centralised message translation capability? > Refer to section 3.1.1. > Building a centralised message translation capability for CHESS replacement would be a complex undertaking, as it would need to: - Seamlessly integrate with the CHESS EIS messaging broker (a proprietary message transport protocol and message broker) and the CHESS replacement ISO 20022 XML message channels AMQP and SWIFT - Support two-way translation of at least 275 message types without loss of data or intent (implying potential need for state to be kept by the translation capability) - Support high performance, reliability, and disaster recovery without message loss
Messaging backwards compatibility - business rules complexity	If required, are complex business rules that require the translation layer to store temporary state necessary? > Complexity is significantly increased if there is not a one-to-one mapping between CHESS EIS and ISO 20022. Problematic cases that introduce complexity are: - Where multiple messages are translated into one - Where data must be generated and potentially stored for later use in order to meet the mapping requirements

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Description	Points for consideration
CHESS user messaging - concurrent support needed for CHESS EIS and ISO 20022	Does the cutover approach require CHESS users to support CHESS EIS to current CHESS, and ISO 20022 integration to CHESS replacement concurrently? > Both current CHESS and CHESS replacement need to be aware of what they should and should not do in order to avoid sending duplicate outputs to CHESS users. > Some CHESS user types would need to solve for concurrent connectivity to current CHESS and CHESS replacement, either by adding a message and protocol routing capability or by running multiple instances of their system.
Data synchronisation - requirement	Does the cutover approach require that data is updated synchronously between current CHESS and CHESS replacement? > If the cutover option requires current CHESS and CHESS replacement to run in parallel during any phase, this implies that certain data must be synchronised from current CHESS to CHESS replacement and from CHESS replacement to current CHESS. > In order to produce the expected results, such integration would need to be: - Performant - Transactional (in most cases) > To build a performant distributed transaction capability between current CHESS (a legacy platform) and CHESS replacement would be very complex.
Data synchronisation - reconciliation	If required, does the cutover approach need an ongoing data reconciliation capability to validate that CHESS and CHESS replacement are synchronised? > Reconciliation of data between current CHESS and CHESS replacement would be required in order to verify the ongoing integrity of underlying data in both systems. The reconciliation must be performant and provide a means of identifying where reconciliation breaks have occurred.
Interim system functionality during cutover	Does the approach require interim logic in the CHESS replacement system to facilitate the cutover? > Where current CHESS and CHESS replacement are running in parallel, care must be taken to identify processes that should only run in one system and not both. > For example: - To avoid multiple settlement batches, settlement obligations would be synchronised and settlement batch would only be run in the system nominated as the master at the point in the cutover for batch settlement. - For billing, care must be taken to not double bill where the data is in both systems. > Complex capabilities to not process or hide outputs (and possibly others, depending on the business process that needs to be remediated) would be required, noting these introduce operational risk.
Data migration - requirement	What is the approach to data migration from current CHESS to CHESS replacement? > Refer to section 3.2. > An approach where data is migrated holistically is less complex than an approach where data is migrated based on a selection criteria.
Data migration - reconciliation	What is the approach to data reconciliation post migration from current CHESS to CHESS replacement? > Data must be reconciled between CHESS replacement and current CHESS post migration to ensure that all data was successfully migrated. An approach where data is migrated holistically would result in reconciliation being less complex than an approach where data has to be reconciled for selection criteria.

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Description	Points for consideration
Data migration - market dress rehearsals	How will the data migrations be rehearsed? > An approach where data is migrated holistically is less complex than an approach where data is migrated based on a selection criteria.

2.3. Market impact

Considerations for market impact include:

Description	Points for consideration
CHESS user operation of two systems in production concurrently	Does the cutover approach require CHESS users to connect to, run and maintain two systems concurrently? > Operating two systems rather than one impacts the build required by CHESS users, increases the operational risk (refer to operational risk), and adds technical complexity for CHESS users.
Cutover event considerations - RBA	Are there any specific considerations for the RBA?
Cutover event considerations - payment providers	Are there any specific considerations for payment providers?
Cutover event considerations - AMOs	Are there any specific considerations for AMOs?
Cutover event considerations - clearing and settlement participants including PISPs	Are there any specific considerations for clearing and settlement participants including PISPs?
Cutover event considerations - share registries	Are there any specific considerations for share registries?
Settlement efficiency	Does the cutover approach result in two settlement batches (one for current CHESS, and one for CHESS replacement)? A requirement for a second settlement batch would be a significant process change for the market.
Connectivity channel	Is the cutover approach agnostic to CHESS users' choice of connectivity channel (Ledger API, AMQP, SWIFT or CHESS User Interface (UI))?
Number of phases and resultant project duration	Does the cutover approach require multiple phases? > Each phase introduces an additional time and effort element, including executing additional dress rehearsals to simulate each phase of the migration.

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2.4. ASX impact

Considerations for ASX impact include:

Description	Points for consideration
Build required	What ASX build is required? > Depending on the cutover approach, a subset of the below components is required to be built by ASX - CHESS replacement application - the DLT/DAML based transaction processing system that implements CHESS ISO 20022 workflows and processes - Internal integration and reporting - integration to ASX's internal systems such as billing, risk management, and reporting - Standard connectivity channels (Ledger API, FIX, ISO 20022 XML via AMQP and SWIFT) - implementation of SWIFT and AMQP message gateways to support ISO 20022 XML integration, a FIX 5 gateway to support FIX integration, and establishment of an ASX managed node service for Ledger API access - CHESS UI - browser based native Ledger API user interface for use by ASX Clearing and Settlement Operations and CHESS users alike - Migration extract, transform, load (ETL) - tooling to support data migration from current CHESS to CHESS replacement - Current CHESS release that aligns current CHESS to ISO 20022 in readiness for a like-for-like cutover where messaging backwards compatibility is possible - CHESS replacement enhanced application (release in CHESS replacement to introduce new and enhanced processes that were not part of earlier phases) - Centralised message translation – provides backwards compatibility (ISO 20022 and CHESS EIS messaging) during a transition phase - Real-time bi-directional data synchronisation between CHESS and CHESS replacement - Interim logic in CHESS and CHESS replacement to avoid duplicate outputs to CHESS users, support billing and other processes.
ASX operation of two systems in production concurrently	Does the cutover approach require ASX to operate both current CHESS and CHESS replacement in production concurrently? > Operating two systems rather than one impacts the build required (refer to build required above), increases the operational risk (refer to operational risk), has high technical complexity (refer to technical complexity).
Number of phases and resultant project duration	Does the cutover approach require multiple phases? > Each phase introduces an additional time and effort element, including executing additional dress rehearsals to simulate each phase of the migration.

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3. Considerations for the implementation approach

This section provides information on considerations for the implementation approach, including the message migration approach, data migration approach, and use of public holidays or declared non-business days during cutover.

3.1. ISO 20022 messaging migration approach

The migration approaches from CHESS proprietary messaging format to ISO 20022 are evaluated below. As stated in section 1.2, ASX notes that these approaches were explored from as early as 2014, and ASX and the market agreed from an efficiency and cost/benefit perspective to introduce ISO 20022 using the enhanced messaging approach.

3.1.1 Like-for-like

A 'like-for-like' messaging migration provides the flexibility for the current CHESS system to process ISO 20022 messages and/or the CHESS replacement system to process CHESS proprietary messages via a translator. It requires as a first step that the CHESS proprietary messages are mapped to ISO 20022 without the introduction of any new data elements, and without the introduction of any new or changed business processes, unless such changes are a pre-requisite to supporting a like-for-like mapping.

This approach facilitates backward compatibility between legacy and ISO 20022 messaging, since it is possible to build a complete message translation between the two different formats. This would also allow for the progressive adoption of ISO 20022 over a period of time.

However, due to the high message complexity (number of message types and business areas) of the existing CHESS proprietary messages, building a centralised translation service would be a large and potentially complex undertaking. Additionally, CHESS messaging is more than just a message format. It is a secure message transport protocol and message broker.[12] This would need to remain in place but be modified to route all incoming messages to the translation service which would act as a bridge between current CHESS messaging and the CHESS replacement system. Conversely, CHESS replacement would need to route output messages to customers still using legacy messaging via the translator.

The assumption with this approach is that all the data in the legacy format can be mapped to corresponding fields within the ISO 20022 format without resorting to overuse of the supplementary data capability (which is considered poor practice in standards adoption).

The initial 'as-is' mapping carried out by ASX and SWIFT consultants found occurrences where legacy messaging in its current form was fundamentally incompatible with the ISO 20022 standards.

One such example is the way CHESS models accounts compared to how ISO 20022 models accounts, due to restrictions on the maximum length of registration details. This includes the current limitation for CHESS messaging to correctly model joint accounts in some cases. To retain the CHESS messaging model would have resulted in implementing a non-ISO 20022 compliant model using ISO 20022 messaging. ASX received clear guidance from the market on avoiding non-compliance as it significantly undermines the value of migrating to the ISO 20022 standard in the first place.

The solution to the above incompatibility between legacy and ISO 20022 messaging can be solved by the adoption of a phased approach as follows:

- Phase 0 - modification of legacy messages and processes as required to support Phase 1
- Phase 1 - migration from legacy to like-for-like ISO 20022 messaging
- Phase 2 - introduction of new and enhanced services using ISO 20022 messaging

[12] A message broker lies at the heart of any message-based transaction processing system, such as CHESS. It ensures guaranteed delivery of messages to the intended destination.

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It is also noted that the CHESS message structure is fundamentally different from XML based ISO 20022. Concepts such as repeating fields that come native with XML are either not supported in legacy CHESS messaging, or would require significant development in current CHESS. It would be a substantial release in current CHESS to implement Phase 0 since there are use cases where extensive repeating groups are required in the ISO 20022 equivalent implementation (for example joint accounts that list up to four joint account holders). Each phase (Phase 0, 1 and 2) would be deployed separately, resulting in three upgrades into the production environment rather than one. Each phase introduces an additional time, effort and cost element.

Given that the whole market, comprising around 90 entities, need to be ready, timeframes to migrate from Phase 0 to Phase 1 may be elongated if CHESS users or ASX require extensions. This can result in delays to the introduction of new services, post Day 1 business requirements, or innovations to existing services.

It should also be noted that for the duration of the CHESS replacement project, ASX is maintaining a static version of the ISO 20022 standards. If the implementation timeline needs to include additional time for phased migration, the message version will become further removed from current versions used in financial markets. A key harmonisation principle for adopting ISO 20022 standards is for an FMI or market to upgrade its message usage to the latest versions. This supports interoperability for financial institutions operating in more than one market. Further delays will add to the depth and complexity of work needed to catch-up to the latest versions post CHESS replacement go-live (in its entirety).

3.1.2 Enhanced messaging

An enhanced messaging approach prioritises alignment to ISO 20022 message formats and processes, with the view to enabling new services or innovations to existing services unconstrained by the need to provide backwards compatibility to a legacy format.

This approach, as an example, allows ASX to adopt the ISO 20022 model for accounts which is a fundamental building block in many transactions.

Importantly, it only requires a single release and coordination of the market into the production environment that allows for Day 1 realisation of new business processes and capabilities.

This approach requires a single cutover from CHESS legacy messaging to ISO 20022 messaging for both ASX and CHESS users, as using the example of accounts, if one CHESS user makes use of the extended ISO 20022 account schemas, the data will not be compatible (it will not fit) into a CHESS proprietary message (EIS).

3.1.3 Conclusion

In the context of CHESS replacement, an enhanced message migration approach is optimal over a like-for-like message migration approach as it: delivers ISO 20022 message formats and processes from Day 1; allows implementation of new services and innovations to existing services; and does not require backwards compatibility to a legacy format.

A like-for-like message migration aims to ease the transition towards the required enhanced state but introduces extended timeline and additional cost.

A like-for-like messaging migration mandates message translation (or backward compatibility) between phases, as both CHESS proprietary messages and ISO 20022 messages need to co-exist. Once the enhanced state is reached, message translation can no longer be supported due to the incompatibility of business processes and data models.

The interim states (Phases 0 and 1) do not provide any significant business value as no new business processes or data models can be introduced and result in negligible risk reduction at high cost to the market. Improved business processes, data models and efficiency can only be achieved when messaging migration reaches the enhanced state.

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Phases	Objectives	Implications
Current state to Phase 0	- Align current CHESS EIS to ISO 20022 (like-for-like) - Modify legacy messages to support phase 1 (still in EIS)	- Requires legacy CHESS release for market - Complex and costly initiative with low business value project that would delay CHESS replacement
Phase 0 to Phase 1	- Migrate CHESS EIS to ISO 20022 XML (like-for-like) - EIS messages migrated to like-for-like XML messages	- Centralised message translation service required
Phase 1 to Enhanced	- Migrate ISO 20022 XML (like-for-like) to fully enhanced ISO 20022 XML - Enable realisation of new business processes and data model	- Requires single cutover due to change in business processes - Message translation is no longer possible for key workflows involving most CHESS users due to incompatibility of business processes and data models e.g. ISO 20022 account model and settlement scalability

As both the like-for like and enhanced messaging approaches ultimately result in a single cutover, migrating messaging to the enhanced ISO 20022 model in a single cutover is preferred.

3.2. Data migration – front running historical data prior to cutover and manageable data volumes

All data required to meet system, regulatory and legal requirements and obligations will be migrated. The majority of historical data will be migrated prior to the cutover weekend. As a result, the volume of data in scope over the cutover weekend is around 40 million data records, which allows for the end-to-end migration activities to be completed on the Saturday.

As part of ASX's migration activity, the number of fields that require any transformation is relatively low, with over 90% of the data in scope requiring no change. When data transformation is required, it is relatively simple. An example of where data is transformed is account details – in CHESS today, a HIN combines in a single field the names and addresses of holders, where the CHESS replacement system will split this into separate fields. KPMG has delivered to ASX a purpose-built data migration and reconciliation solution that will manage the data migration required for the CHESS replacement system, including any required transformation to data as well as automating many of the processes, where practical.

The number of ASX source systems for data migrations is also low with all data to be loaded into a single target system.

Furthermore, ASX will rehearse executing the full volume of current state data in several mock migrations.

The Cutover and Migration Strategy paper published in December 2021 contains further details on ASX's migration activities, and considerations and actions for CHESS users.

3.3. Use of public holidays or declared non-business days during cutover

ASX assessed whether anchoring the cutover around public holidays or declaring non-business days should form part of the cutover approach.

Anchoring cutover to public holidays introduces significant scheduling risk. In the first instance, it significantly restricts the ability to rehearse the cutover approach using internal and external dress rehearsals. These are much more readily rehearsed over multiple two day weekends. Additionally, if issues arise during MDRs and the cutover date does need to change, this will substantially limit the options for rescheduling the cutover date.

The term 'business day' means a day other than:

(a) Saturday, Sunday, New Year's Day, Good Friday, Easter Monday, Christmas Day, Boxing Day; and
(b) Any other day which ASX Settlement notifies Facility Users is not a Business Day.

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Non-business days align with non-trading days[13] and non-settlement days (as those terms are defined and used in each set of rules for a relevant AMO).

Declaring non-business days on the day prior to, or day after, cutover, was not considered feasible or practical for Australia's cash equities trading, clearing and settlement market. Any use of non-business days would also need to be included in rehearsals and comes with the additional operational risk of exception processing (given that a non-business day is a non-business as usual (BAU) activity).

[13] As declared or notified by each market operator.

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4. System implementation options for cutover

This section outlines the available system implementation approaches for CHESS replacement, which can be broadly categorised as 'single cutover' or 'phased' implementation approaches. Further complexities to layer onto this broad categorisation include:

- Whether a like-for-like or enhanced message migration occurs
- Whether ASX and CHESS users are using the same, or different, cutover approaches

4.1. Single cutover implementation

A single cutover implementation is characterised by one point in time, and all stakeholders moving from one system to another (referred to as option 1).

4.1.1 Option 1 - ASX and CHESS user single cutover to CHESS replacement, and to ISO 20022 with new and enhanced processes

The goal of this approach is to cutover the whole market in a single weekend, eliminating the need for a Phase 0 release in current CHESS, a centralised message translation service, and a subsequent release of CHESS replacement to introduce enhancements. ASX has published more comprehensive information related to this approach in its Cutover and Migration Strategy paper.

This approach consists of a single phase, as depicted on the diagram below:

Completion of BAU (Friday)

- No CHESS user messages to be sent to current CHESS post 7pm once CHESS end-of-day processing commences
- CHESS runs as usual on Friday evening and CHESS users can download Friday night's reports as normal (as well as all messages queued from CHESS end-of-day)
- The cutover to CHESS replacement commences once CHESS end-of-day fully completes (estimated to be 2am)

Migration to new system (Saturday)

- ASX undertakes migration activities from CHESS to CHESS replacement
- ASX will complete the data migration and ensure reconciliation outcomes are signed off prior to Sunday morning
- CHESS users to complete change activity to enable CHESS replacement capability (including AMOs switching to FIX interface)

Verification of new system (Sunday)

- CHESS users connect and perform verifications checks
- Final Go/No-Go decision

Operating on new system (Monday)

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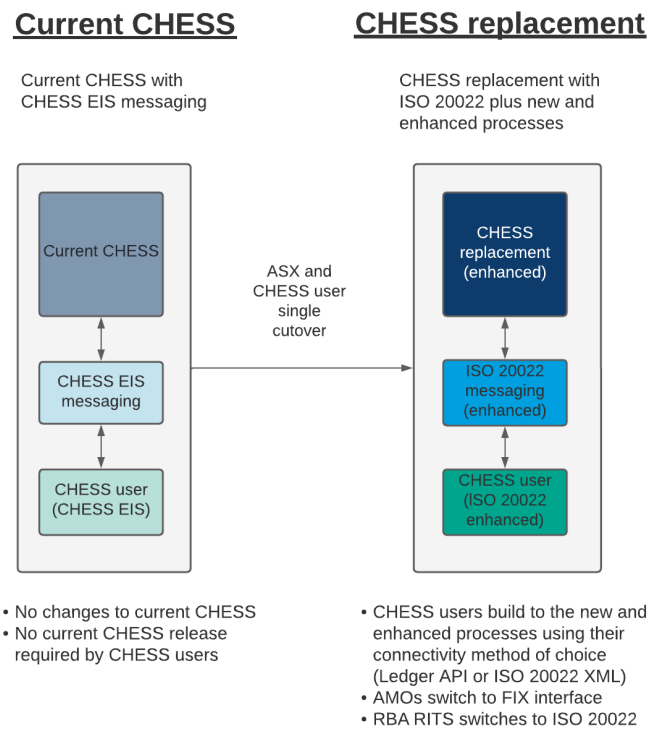
ASX and CHESS user single cutover to CHESS replacement and ISO 20022 with new and enhanced processes



4.2. Phased implementations

A phased implementation involves implementing CHESS replacement in multiple stages. A phased implementation could be done in a variety of ways, including:

- ASX single cutover to CHESS replacement and phased CHESS user migration to ISO 20022 like-for-like, followed by single cutover for new and enhanced processes (option 2)
- Phased ASX migration to CHESS replacement and CHESS user migration to ISO 20022 like-for-like aligned with ASX phasing, followed by single cutover for new and enhanced processes (option 3). Potential variations include:
    - Phasing of which **issuers/securities** go-live on the new system over points in time
    - Phasing of which **HINs** go-live on the new system over points in time
    - Phasing of which **message types/business processes** go-live on the new system over points in time
- Phased CHESS user migration to ISO 20022 like-for-like with current CHESS, followed by ASX single cutover to CHESS replacement, followed by single cutover for new and enhanced processes (option 4)

4.2.1 Option 2 - ASX single cutover to CHESS replacement and phased CHESS user migration to ISO 20022 like-for-like, followed by single cutover for new and enhanced processes

The goal of this approach is to allow CHESS users to cutover to ISO 20022 during a transition window that may span several months. However, this comes at the cost of needing a CHESS user release with current CHESS (a Phase 0 release) and two releases for CHESS replacement.

This approach consists of three phases, as depicted on the diagram below:

- Phase 0 is a release to align current CHESS to ISO 20022 data and processes. This involves changes to current CHESS to support Phase 1 like-for-like migration. A CHESS release would be required by CHESS users to support this.
- Phase 1 is a single cutover for ASX from CHESS to CHESS replacement, and phased CHESS user migration from CHESS EIS to like-for-like ISO 20022 messaging over a period of months

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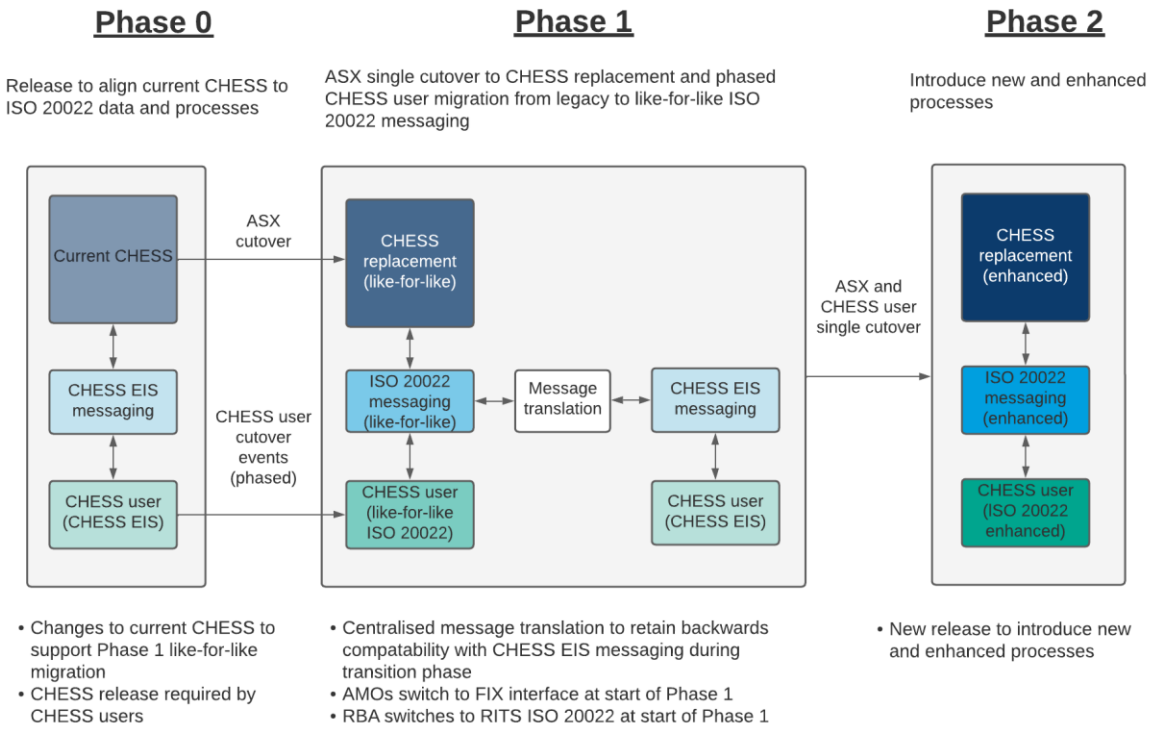
- During Phase 1 centralised message translation is required to retain backwards compatibility between ISO 20022 and CHESS proprietary messaging. CHESS users would be required to transition from CHESS EIS to ISO 20022 any weekend within the duration of Phase 1.
- Since there is no backwards compatibility for FIX, AMOs would be required to switch to the FIX interface at the start of Phase 1.
- Since there is no backwards compatibility for RBA RITS FIN messaging, RBA RITS would be required to switch to the RBA RITS ISO 20022 interface at the start of Phase 1.

> Phase 2 is a single cutover for ASX and CHESS users to a new release supporting new and enhanced business processes.

ASX single cutover to CHESS replacement and phased CHESS user migration to ISO 20022 like-for-like, followed by single cutover for new and enhanced processes



4.2.2 Option 3 - Phased ASX migration to CHESS replacement and CHESS user migration to ISO 20022 like-for-like aligned with ASX phasing, followed by single cutover for new and enhanced processes

This approach consists of three phases, as depicted in the diagram below.

> Phase 0 is a release to align current CHESS to ISO 20022 data and processes. This involves changes to current CHESS to support Phase 1 like-for-like migration. A CHESS release would be required by CHESS users to support this. For the avoidance of doubt, this Phase 0 is the same Phase 0 set out in options 2 and 4.

> Phase 1 is a phased ASX migration to CHESS replacement over a period of months, with the corresponding phased CHESS user migration from legacy to like-for-like ISO messaging. There are several potential ways to phase the migration within this option that are explored in this section:
  - By issuer/security code
  - By HIN
  - By message type/business process

Unlike options 2 and 4, centralised message translation is not supported in Phase 1. Rather, CHESS users must connect to either current CHESS or CHESS replacement according to the chosen phasing tranches. As a result, some phasing

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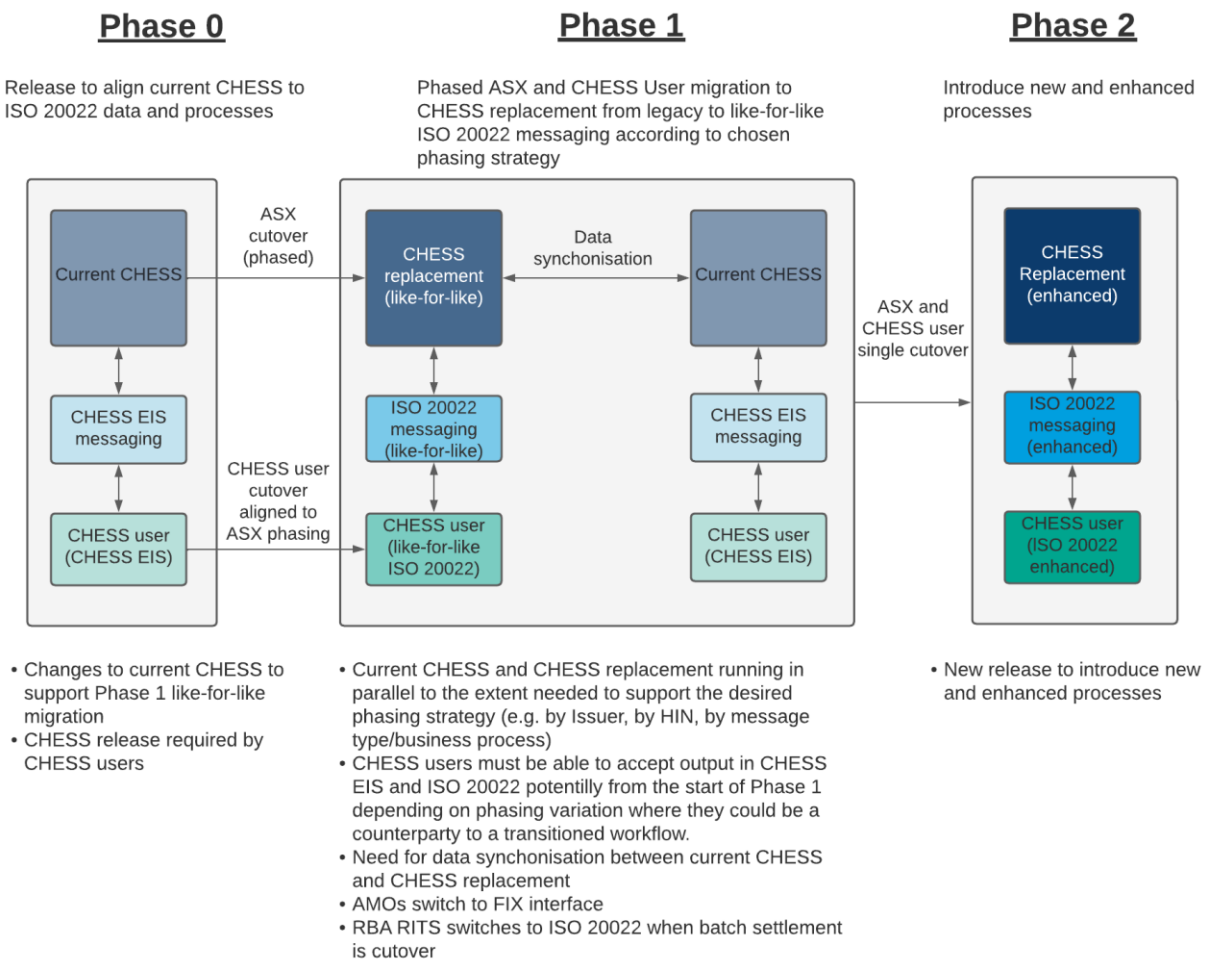
strategies would require CHESS users to connect to both systems during Phase 1. If centralised message translation was supported, then this option would be equivalent to option 2 from a CHESS user's perspective. However, from an ASX perspective, it would be much more complex to implement centralised message translation than in option 2 or option 4 since it would need to support evolving message level routing according to the chosen phasing tranches, plus translation between CHESS EIS and ISO 20022 into CHESS replacement, plus translation between ISO 20022 and CHESS EIS into current CHESS. This would introduce very high complexity and operational risk for ASX with no benefit to CHESS users that is not already offered by the simpler options 2 and 4. As such, this option is being evaluated without centralised message translation.

Phase 2 is a single cutover for ASX and CHESS users to a new release supporting new and enhanced business processes.

Phased ASX migration to CHESS replacement and CHESS user migration to ISO 20022 like-for-like aligned with ASX phasing, followed by single cutover for new and enhanced processes



- Changes to current CHESS to support Phase 1 like-for-like migration
- CHESS release required by CHESS users

- Current CHESS and CHESS replacement running in parallel to the extent needed to support the desired phasing strategy (e.g. by Issuer, by HIN, by message type/business process)
- CHESS users must be able to accept output in CHESS EIS and ISO 20022 potentilly from the start of Phase 1 depending on phasing variation where they could be a counterparty to a transitioned workflow.
- Need for data synchonisation between current CHESS and CHESS replacement
- AMOs switch to FIX interface
- RBA RITS switches to ISO 20022 when batch settlement is cutover

- New release to introduce new and enhanced processes

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The table below provides additional details on the phasing varieties within this option

Way to phase	Explanation
By issuer/security code	This approach phases migration based on issuer/security code. For example > Migrate with a handful of security codes initially and once stable migrate most traded or top 500 security codes. > Migrate in tranches such as A to C, D to F, etc. This approach somewhat echoes the original migration onto CHESS in the 1990s of securities in tranches. However, it must be noted that current CHESS went live in stages, with the first stage including sub-register only and minimal workflow in the system, e.g. settlement was implemented over 12 months later.
By HIN	This approach phases migration based on HIN. For example, a sponsoring broker would migrate a portion of their HINs at a time.
By message type/ business process	This approach migrates by CHESS message type or family of messages that create a business process. For example, migrate account management or holding movement messages.

4.2.3 Option 4 - Phased CHESS user migration to ISO 20022 like-for-like with current CHESS, followed by ASX single cutover to CHESS replacement, followed by single cutover for new and enhanced processes

The goal of this approach is to allow CHESS users to cutover to ISO 20022 with current CHESS during a transition window that may span several months. However, this comes at the cost of needing a CHESS user release with current CHESS (a Phase 0 release) and two releases for CHESS replacement. This approach is similar to option 2 from a CHESS user perspective, but it allows ASX to ensure that CHESS users are operating using ISO 20022 before introducing the new underlying technology stack on the ASX side.

This approach consists of three phases, as depicted on the diagram below:

> Phase 0 is a release to align current CHESS to ISO 20022 data and processes. This involves changes to current CHESS to support Phase 1 like-for-like migration. A CHESS release would be required by CHESS users to support this. For the avoidance of doubt, this Phase 0 is the same Phase 0 set out in options 2 and 3.
> Phase 1a is a phased CHESS user migration from legacy to like-for-like ISO 20022 messaging
  - During Phase 1a centralised message translation is required to retain backwards compatibility between ISO 20022 and CHESS proprietary messaging. CHESS users would be required to transition from CHESS EIS to ISO 20022 any weekend within the duration of Phase 1
> Phase 1b is ASX, AMO and RBA RITS single cutover to CHESS replacement
  - ASX would cutover to CHESS replacement like-for-like (i.e. no new and enhanced business processes)
  - Since there is no backwards compatibility for FIX, AMOs would be required to switch to the FIX interface at the start of Phase 1b
  - Since there is no backwards compatibility for RBA RITS FIN messaging, RBA RITS would be required to switch to the RBA RITS ISO 20022 interface at the start of Phase 1b
> Phase 2 is a single cutover for ASX and CHESS users to a new release supporting new and enhanced business processes. For the avoidance of doubt, this Phase 2 is the same Phase 2 set out in options 2 and 3.

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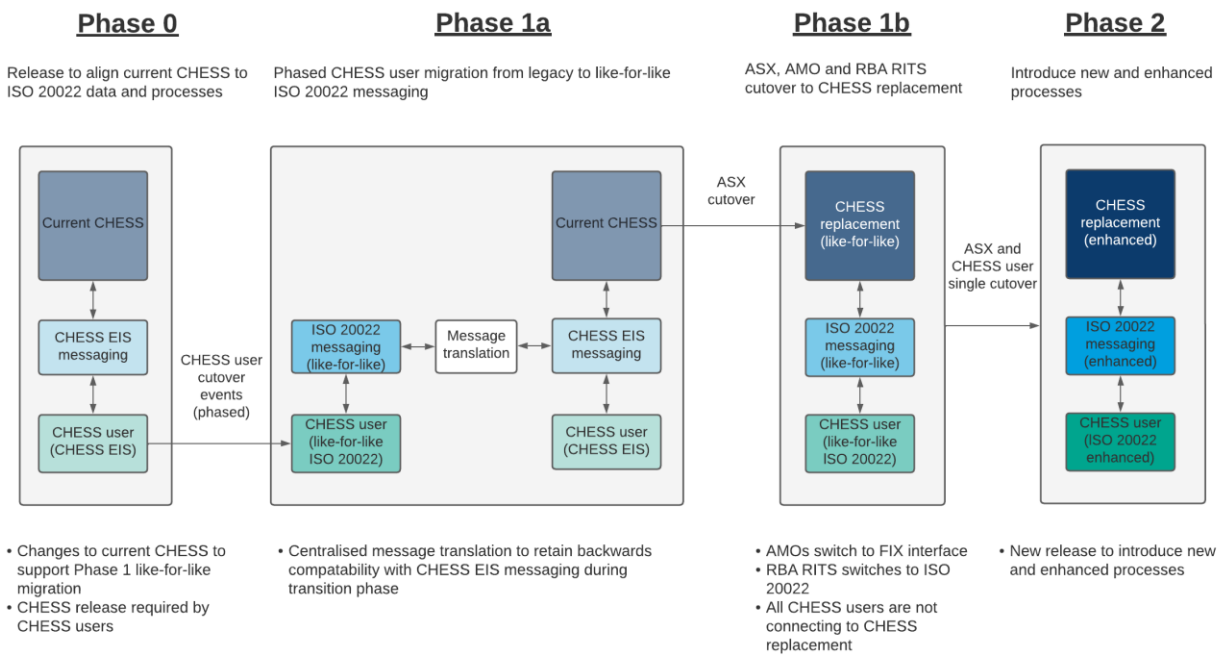
Phased CHESS user migration to ISO 20022 like-for-like with current CHESS, followed by ASX single cutover to CHESS replacement, followed by single cutover for new and enhanced processes



- Changes to current CHESS to support Phase 1 like-for-like migration
- CHESS release required by CHESS users

- Centralised message translation to retain backwards compatability with CHESS EIS messaging during transition phase

- AMOs switch to FIX interface
- RBA RITS switches to ISO 20022
- All CHESS users are not connecting to CHESS replacement

- New release to introduce new and enhanced processes

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5. Assessment of system implementation options for cutover

ASX conducted a comprehensive feasibility validation of the available system implementation options identified in section 4, using the evaluation criteria established in section 2. This includes the following assumptions:

- The cutover weekend is a two day weekend. Migration is not dependent on a three day public holiday weekend or a declared non-business day on the Friday or Monday pre or post cutover weekend (see section 3.3 for further details).
- It is not possible to prevent corporate actions from occurring on the day of, and around, the transition.

The considerations for each option have been assessed as low or no risk (yellow), medium risk (orange) and high risk (red) in the below tables, and represent a relative assessment of the four options.

5.1. Operational risk

Description	Points for consideration	Option 1	Option 2	Option 3	Option 4
Number of releases into production	How many distinct releases into production are required?	One	Three as follows: - Phase 0 - for current CHESS (ASX and market impacting) - Phase 1 - CHESS replacement release (market, including AMO and RBA, and ASX impacting) - Phase 2 - CHESS replacement release (ASX and market impacting)	Three as follows: - Phase 0 - for current CHESS (ASX and market impacting) - Phase 1 - CHESS replacement release (market, including AMO and RBA, and ASX impacting) - Phase 2 - CHESS replacement release (ASX and market impacting)	Four as follows: - Phase 0 - for current CHESS (ASX and market impacting) - Phase 1a - CHESS user transition to ISO 20022 (ASX and market impacting) - Phase 1b - CHESS replacement release (ASX, AMO and RBA impacting) - Phase 2 - CHESS replacement release (ASX and market impacting)
Cutover point clarity	Are the CHESS user cutover points from current CHESS to CHESS replacement clear, well defined and not likely to result in operational errors due to misalignment between ASX and CHESS users as to the timing and scope of each cutover?	Yes - single well defined market wide cutover point at post end-of-day (EOD) with opportunity for CHESS users to connect and carry out validations on Sunday	Yes - three well defined cutover points (one per phase at post EOD with opportunity for CHESS users to connect and carry out validations on Sunday)	No - multiple cutover points at post EOD with opportunity for CHESS users to connect and carry out validations on Sunday Cutover by security, HIN, or message type/business process introduce risk as CHESS users need to exactly align to the specific tranches being cutover	Yes - three well defined cutover points (one per phase at post EOD with opportunity for CHESS users to connect and carry out validations on Sunday)
Key process validation	Can batch settlement and end-of-day be pre-validated before go-live on Monday (i.e. validation over cutover weekend)?	No - these processes can be validated as part of post ASX dress rehearsal and market dress rehearsal checks but not on the actual migration weekend	No - these processes can be validated as part of post ASX dress rehearsal and market dress rehearsal checks but not on the actual migration weekend	No - these processes can be validated as part of post ASX dress rehearsal and market dress rehearsal checks but not on the actual migration weekends	No - these processes can be validated as part of post ASX dress rehearsal and market dress rehearsal checks but not on the actual migration weekend
Public holidays and non-business days	Can the migration be achieved without relying on public holidays or declared non-business days?	Yes - cutover occurs over a standard two day weekend	Yes - all cutovers occur over standard two day weekends	Yes - all cutovers occur over standard two day weekends	Yes - all cutovers occur over standard two day weekends
CHESS user readiness	Can the cutover approach proceed if a single CHESS user is not ready?	Potentially - subject to consideration of all relevant circumstances	Potentially – for cutover to Phase 0 and Phase 2, but not Phase 1 – subject to consideration of all relevant circumstances	Potentially - for cutover to Phase 0 and Phase 2, and also potentially Phase 1 depending on phasing variation – subject to consideration of all relevant circumstances	Potentially – for the cutover to Phase 0, Phase 1b and Phase 2, but not Phase 1a – subject to consideration of all relevant circumstances

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Description	Points for consideration	Option 1	Option 2	Option 3	Option 4
Data synchronisation errors	Is there a risk that data can be out of synchronisation between current CHESS and CHESS replacement when running in parallel?	N/A	N/A	Yes – during Phase 1 there is a risk of data synchronisation breaks as this option requires certain data to be synchronised (bi-directionally in some variations). A temporary outage of the synchronisation processes could result in either a system outage or data being out of synchronisation which can result in incorrect results being generated.	N/A
ASX operation of two systems in production concurrently	Does the cutover approach require ASX to operate both current CHESS and CHESS replacement in production concurrently?	No	No	Yes - operational risks are introduced from: > Complex data integration between current CHESS and CHESS replacement being a source of data synchronisation errors and/or performance degradation > Longer timeframes to troubleshoot underlying issues as investigation must span across two systems and the integration between them > Confusion between ASX and CHESS users as to which system they are interacting with	No
CHESS user operation of two systems in production concurrently	Does the cutover approach require the CHESS user to operate both current CHESS and CHESS replacement in production concurrently?	No	No	Yes - all variations will require most CHESS users to support dual connectivity concurrently potentially from the beginning of Phase 1 as some workloads will occur on both current CHESS and CHESS replacement. That is, this approach phases the ASX side but CHESS users will have to be ready to receive ISO 20022 messages from the start of Phase 1. For example, a holding transfer requires both counterparties to receive (and respond to) the messages from the system that the transaction occurred on. Where needed, CHESS users would be required to implement routing rules that are both synchronised with the phasing tranches and in the case of unsolicited requests be cognisant of which system they need to respond back to. CHESS users will need to either run two systems or implement message translation.	No

5.2. Technical complexity

Description	Points for consideration	Option 1	Option 2	Option 3	Option 4
Release to prepare CHESS (Phase 0) - requirement	Does the cutover approach require a release (Phase 0) that prepares current CHESS to support a centralised message translation capability or data synchronisation between current CHESS and CHESS replacement?	No - changes to current CHESS are not required	Yes - a Phase 0 release is required in current CHESS. The greater the alignment achieved in Phase 0 to the Phase 1 ISO workflows, the simpler the centralised message translation capability is to build.	Yes - a Phase 0 release is required in current CHESS. Alignment is required to ensure data synchronisation is possible between current CHESS and CHESS replacement	Yes - a Phase 0 release is required in current CHESS. The greater the alignment achieved in Phase 0 to the Phase 1a ISO workflows, the simpler the centralised message translation capability is to build.
Messaging backwards compatibility - requirement	Does the cutover approach require a centralised message translation capability?	No - centralised message translation is not required	Yes - centralised message translation is required for at least 275 messages in Phase 1	No - centralised message translation is not required	Yes - centralised message translation is required for at least 275 messages in Phase 1a

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Description	Points for consideration	Option 1	Option 2	Option 3	Option 4
Messaging backwards compatibility - business rules complexity	If required, are complex business rules that require the translation layer to store temporary state necessary?	N/A	Will depend on the degree of alignment achieved by Phase 0. If full alignment then mapping will be straight forward. However, if it is not practical to update current CHESS to fully align then the message translation may require complex mapping rules and need to store state. For example, CHESS transaction IDs are limited to 16 characters but ISO 20022 can be 35, implying the translation service would need to store a mapping.	N/A	Will depend on the degree of alignment achieved by Phase 0. If full alignment then mapping will be straight forward. However, if it is not practical to update current CHESS to fully align then the message translation may require complex mapping rules and may need to store state. For example, CHESS transaction IDs are limited to 16 characters but ISO 20022 can be 35, implying the translation service would need to store a mapping.
CHESS user messaging - concurrent support needed for CHESS EIS and ISO 20022	Does the cutover approach require CHESS users to support CHESS EIS to current CHESS and ISO 20022 integration to CHESS replacement concurrently?	No	No	Yes - all variations will require most CHESS users to support dual connectivity concurrently <u>potentially from the beginning of Phase 1</u> as some workloads will occur on both current CHESS and CHESS replacement. That is, this approach phases the ASX side but CHESS users will have to be ready to receive ISO 20022 messages from the start of Phase 1. For example, a holding transfer requires both counterparties to receive (and respond to) the messages from the system that the transaction occurred on. Where needed, CHESS users would be required to implement routing rules that were both synchronised with the phasing tranches and in the case of unsolicited requests cognisant of which system they need to respond to. This dual connectivity complexity essentially makes this option unviable. <u>By issuer/security:</u> > AMOs, participants and share registries would need to interact with both systems from the beginning of Phase 1 as CHESS users may be on either system. > RBA and payment providers may need to depending on the solution for batch settlement (refer to data synchronisation). <u>By HIN:</u> > Participants and share registries would need to interact with both systems from the beginning of Phase 1 as CHESS users may be on either system. <u>By message type/business process:</u> > AMOs, participants and share registries would need to interact with both systems. RBA and payment providers would be cutover when settlement batch is cutover.	No
Data synchronisation - requirement	Does the cutover approach require that data is updated synchronously between current CHESS and CHESS replacement?	No - a data synchronisation capability is not required	No - a data synchronisation capability is not required	Yes - all phasing variations rely on both CHESS and CHESS replacement being the source of truth for relevant transactions. However, that source of truth must often be in both systems simultaneously, and to avoid incorrect results must be updated synchronously as opposed to asynchronously. This would impose a significant performance degradation and introduce another potential point of failure. The requirement for data synchronisation during Phase 1 essentially makes this option	No - a data synchronisation capability is not required

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Description	Points for consideration	Option 1	Option 2	Option 3	Option 4
				unviable. By issuer/security: > Participant and security reference data must be synchronised > Account data must be synchronised. Reporting of holdings within a HIN would be split over two systems > Either obligations must be synchronised into one master system where settlement batch will run, or separate settlement batches must be run in both systems By HIN: > Participant and security reference data must be synchronised > Account and holding data must be synchronised in order to support HIN to HIN movements > Obligations must be synchronised into one master system where settlement batch will run By message type/business process: > Participant and security reference data must be synchronised > Account and holding data must be synchronised > Obligations must be synchronised into one master system where settlement batch will run	
Data synchronisation - reconciliation	If required, does the cutover approach need an ongoing data reconciliation capability to validate that CHESS and CHESS replacement are synchronised?	N/A	N/A	Yes - required for Phase 1 as all variations have some degree of data synchronisation between current CHESS and CHESS replacement.	N/A
Interim system functionality during cutover	Does the approach require interim logic in the CHESS replacement system to facilitate the cutover?	No	No	Participants and share registries will be required to connect to both systems. To avoid duplicate outputs being sent to CHESS users by ASX, certain functionality might need to be disabled in one system. For example, batch settlement should only run in one system, with the results synchronised to the other. This requires special logic in both CHESS and the CHESS replacement systems that will be removed on completion of the Phase 1 cutover.	No
Data migration - requirement	What is the approach to data migration from current CHESS to CHESS replacement?	Historical data is progressively migrated prior to the single cutover event. All current state data (including eligible inflight transactions) is migrated on the Saturday of the cutover weekend. The volume of current state data is around 40 million records which can be migrated within the required window.	Historical data is progressively migrated prior to the single ASX cutover event at the start of Phase 1. All current state data (including eligible inflight transactions) is migrated on the Saturday of the cutover weekend. The volume of current state data is around 40 million records which can be migrated within the required window.	Historical and current state migration must align with the phasing tranches for this variation, meaning that there will be multiple historical and current state migration events. This introduces complexity and scope for errors to be made in the migration of data (for example, accidentally not migrating the correct securities when implementing the by issuer/security variation).	Historical data is progressively migrated prior to the single ASX cutover event at the start of Phase 1b. All current state data (including eligible inflight transactions) is migrated on the Saturday of the cutover weekend. The volume of current state data is around 40 million records which can be migrated within the required window.

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Description	Points for consideration	Option 1	Option 2	Option 3	Option 4
Data migration - reconciliation	What is the approach to data reconciliation post migration from current CHESS to CHESS replacement?	ETL and exception reporting tools are used to reconcile migrated data to original CHESS data. For historical data, this is done progressively. For current state data, this is done after the current state migration completes on the single cutover event.	ETL and exception reporting tools are used to reconcile migrated data to original CHESS data. For historical data, this is done progressively. For current state data, this is done after the current state migration completes on the single ASX cutover event at the start of Phase 1.	ETL and exception reporting tools are used to reconcile migrated data to original CHESS data. Historical and current state reconciliation must align with the phasing tranches for the chosen variation, meaning that there will be multiple historical and current state reconciliation events), requiring more sophistication in the tooling.	ETL and exception reporting tools are used to reconcile migrated data to original CHESS data. For historical data, this is done progressively. For current state data, this is done after the current state migration completes on the single ASX cutover event at the start of Phase 1b.
Data migration - market dress rehearsals	How will the data migrations be rehearsed?	A series of ASX internal and market dress rehearsals in the lead up to the cutover event	A series of ASX internal and market dress rehearsals in the lead up to the cutover event	A series of ASX internal and market dress rehearsals in the lead up to each cutover event, which may need to be replicated in some form for each subsequent cutover event. Where cutover events are regular (e.g. weekly) it may not be possible to rehearse each specific cutover event to the same extent as the other options.	A series of ASX internal and market dress rehearsals in the lead up to the cutover event

5.3. Market impact

Description	Points for consideration	Option 1	Option 2	Option 3	Option 4
CHESS user operation of two systems in production concurrently	Does the cutover approach require CHESS users to connect to, run and maintain two systems concurrently?	No	No	Potentially - all variations will require most CHESS users to support dual connectivity concurrently <u>potentially from the beginning of Phase 1</u> as some workloads will occur on both current CHESS and CHESS replacement. That is, this approach phases for ASX but CHESS users will have to be ready to receive ISO 20022 messages from the start of Phase 1. For example, a holding transfer requires both counterparties to be listening (and responding) to the messages from the system that the transaction occurred on. Where needed, CHESS users would be required to implement routing rules that were both synchronised with the phasing tranches and in the case of unsolicited requests cognisant of which system they need to respond to. CHESS users can determine whether they deal with that by running two systems or by putting message translation at the front of their system.	No
Cutover event considerations - RBA	Are there any specific considerations for the RBA?	Single cutover event to ISO 20022 RITS interface, in unison with the rest of the market	Single cutover event to ISO 20022 RITS interface at start of Phase 1	Single cutover event to ISO 20022 RITS interface at the point CHESS batch settlement cuts over at some point during Phase 1 (assumes single batch)	Single cutover event to ISO 20022 RITS interface at start of Phase 1b
Cutover event considerations - payment providers	Are there any specific considerations for payment providers?	Single cutover event to ISO 20022, in unison with the rest of the market	Single cutover event to ISO 20022, at any point during Phase 1 window	Single cutover event to ISO 20022 interface at the point CHESS batch settlement cuts over at some point during Phase 1 (assumes single batch)	Single cutover event to ISO 20022, at any point during Phase 1a window
Cutover event considerations - AMOs	Are there any specific considerations for AMOs?	Single cutover event to FIX, in unison with the rest of the market cutover to ISO 20022	Single cutover event to FIX at the start of Phase 1	Potential variations, some of which require dual connectivity. <u>By issuer/security:</u> > Phased cutover to FIX during Phase 1 according to security tranches	Single cutover event to FIX at the start of Phase 1b (a FIX interface will not be available in current CHESS)

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Description	Points for consideration	Option 1	Option 2	Option 3	Option 4
				By HIN: > Single cutover event to FIX at the start of Phase 1 By message type/business process: > Single cutover event to FIX aligned to the cut-over of trade registration workflow	
Cutover event considerations - clearing and settlement participants including PISPs	Are there any specific considerations for clearing and settlement participants including PISPs?	Single cutover event to ISO 20022, in unison with the rest of the market. Potential impact for software vendors providing support for multiple customers concurrently.	Single cutover event to ISO 20022, at any point during phase 1 window	Potential variations, all of which require dual connectivity. Note that participants may receive ISO 20022 from the start of Phase 1 where they are a counterparty to a cutover workflow. By issuer/security: > Phased cutover to ISO 20022 during Phase 1 according to security tranches By HIN: > Phased cutover to ISO 20022 during Phase 1 according to HIN tranches By message type/business process: > Phased cutover to ISO 20022 during Phase 1 according to message type/business process tranches	Single cutover event to ISO 20022, at any point during phase 1a window
Cutover event considerations - share registries	Are there any specific considerations for share registries?	Single cutover event to ISO 20022, in unison with the rest of the market.	Single cutover event to ISO 20022, at any point during Phase 1 window	Potential variations, all of which require dual connectivity. Note that share registries may receive ISO 20022 from the start of Phase 1 where they are a counterparty to a cutover workflow. By issuer/security: > Phased cutover to ISO 20022 during Phase 1 according to security tranches By HIN: > Phased cutover to ISO 20022 during Phase 1 according to HIN tranches By message type/business process: > Phased cutover to ISO 20022 during Phase 1 according to message type/business process tranches	Single cutover event to ISO 20022, at any point during phase 1a window
Settlement efficiency	Does the cutover approach result in two settlement batches (one for current CHESS, and one of CHESS replacement)?	No	No	Potentially, but can be avoided With the 'by issuer/security' variation, one potential option is to run separate settlement batches in each system. This would have implications for ASX, RBA, payment providers and settlement participants. However, this can be avoided by synchronising obligations to the system that is running batch (refer to data synchronisation in the technical complexity assessment)	No
Connectivity channel	Is the cutover approach agnostic to CHESS users' choice of connectivity channel (Ledger API, AMQP, SWIFT or CHESS UI)?	Yes	Yes	Yes	No - Ledger API users would need to implement ISO 20022 XML as an interim step during the phase 1a transition window, or cutover with Ledger API at the start of Phase 1b (this also impacts CHESS UI as it is a native Ledger API application - refer to ASX Impact - build required section)
Number of phases and resultant project duration	Does the cutover approach require multiple phases?	No - 1 phase	CHESS users need to manage 3 releases	CHESS users need to manage 3 releases and align to the ASX phasing tranches in Phase 1	CHESS users need to manage 3 releases

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5.4. ASX impact

Description	Points for consideration	Option 1	Option 2	Option 3	Option 4
Build required	What ASX build is required?	> CHESS replacement application > Internal integration and reporting > Standard connectivity channels (Ledger API, FIX, ISO 20022 XML via AMQP and SWIFT) > CHESS UI > Migration ETL	> CHESS replacement like-for-like application (Phase 1) > Internal integration and reporting > Standard connectivity channels (Ledger API, FIX, ISO 20022 XML via AMQP and SWIFT) > CHESS UI > Migration ETL > Current CHESS release (Phase 0) > CHESS replacement enhanced application (Phase 2) > Centralised message translation	> CHESS replacement like-for-like application (Phase 1) > Internal integration and reporting > Standard connectivity channels (Ledger API, FIX, ISO 20022 XML via AMQP and SWIFT) > CHESS UI > Migration ETL (higher complexity) > Current CHESS release (Phase 0) > CHESS replacement enhanced application (Phase 2) > Real-time bi-directional data synchronisation between CHESS and CHESS replacement > Interim logic in CHESS and CHESS replacement during Phase 1 to avoid duplicate outputs to CHESS users, support billing and other processes	> CHESS replacement like-for-like application (Phase 1b) > Internal integration and reporting > Standard connectivity channels (Ledger API, FIX, ISO 20022 XML via AMQP and SWIFT) > CHESS UI - would need to be redesigned to not require a Ledger API connection > Migration ETL > Current CHESS release (Phase 0) > Current CHESS release (Phase 1a) > CHESS replacement enhanced application (Phase 2) > Centralised message translation
ASX operation of two systems in production concurrently	Does the cutover approach require ASX to operate both current CHESS and CHESS replacement in production concurrently?	No	No	Yes	No
Number of phases and resultant project duration	Does the cutover approach require multiple phases?	No - 1 phase	Yes - 3 phases	Yes - 3 phases	Yes - 4 phases

5.5. Conclusion

ASX determined that the least complex, lowest risk option is option 1; to cutover from the current to the new system over a single weekend. Option 3 is assessed as not feasible, given the high risk and complexity involved. Options 2 and 4 introduce added risk, complexity, time and cost to both the market and ASX to achieve the target end-state. None of the phasing options (options 2, 3 and 4) are more risk reducing than a single cutover. Section 6 sets out risk mitigations for the single cutover approach.

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6. Risk mitigations

ASX acknowledges that no implementation option for cutover is without risk. The project has focused on the development of a detailed and robust plan to mitigate the risks associated with the single cutover from an operational risk, technical complexity, market impact and ASX impact perspective. The plan phases the steps for risk mitigation across many activities, as set out below. ASX will continuously monitor and iteratively refine these activities to ensure their effectiveness.

6.1. Risk mitigations for operational risk

6.1.1 Documentation

In 2018 ASX established a dedicated documentation portal for the CHESS replacement project. Information has been published at a regular cadence including business and technical specifications. Operational readiness scenarios have also been published allowing CHESS users to prepare for their operational readiness assessment. In December 2021 ASX published a Cutover and Migration Strategy paper. ASX continues to share documentation via the dedicated documentation portal with stakeholders.

6.1.2 Dress rehearsals (ASX internal and external)

Dress rehearsals will execute the scope of the cutover weekend including migration, reconciliation, integration configuration and business sign-off with all internal and external users (clearing and settlement participants, share registries, PISPs, payment providers and AMOs). There are three market dress rehearsals planned that are preceded by six internal dress rehearsals. The purpose of each cutover dress rehearsal is to ensure that the full migration, cutover, verification, and rollback can be carried out safely within a go-live weekend. All dress rehearsals will be conducted in the ASX 'to be' production environment.

The different phases of dress rehearsals include:

- ASX Technical Dress Rehearsals (TDR) - ASX internal cutover dress rehearsals that focus on ensuring technical related ASX cutover tasks are proven to be stable. CHESS user activity is not in scope.
- ASX Dress Rehearsals (ADR) - ASX internal cutover dress rehearsals that focus on ensuring the full scope of ASX cutover activity can be executed within the cutover window successfully. A business verification test will be performed with all relevant internal ASX stakeholders. CHESS user activity is not in scope.
- Market Dress Rehearsals (MDR) - rehearsal of the full scope of the go-live cutover including tracking CHESS user activity against the full Go/No-Go criteria. CHESS user participation is mandatory. Having all CHESS users participating in successful MDRs will demonstrate confidence that as an industry group, we are ready to move into the go-live weekend. A key entry criteria into go-live is a successful final MDR (MDR3) across all CHESS users.

Risks are mitigated by:

- Executing production data migration, reconciliation and identifying any data misalignment ahead of go-live, which is to be rectified prior to the next cycle of rehearsals. CHESS users will receive customer migration reports from ASX's data migration for internal use and review in all MDRs as well as on the go-live cutover weekend. Further information on customer migration reports is published on ASX's documentation portal.
- Allowing for an opportunity to practice exception handling processes to enable data migration and reconciliation if any small number of data exceptions are identified.
- Ensuring the time required to successfully cutover is proven, including activity associated with the technical migration, reconciliation sign off, data remediation where required, and process to confirm a Go decision is effective.
- Demonstrating the right level of communication, tracking, and support structures are in place to ensure the weekend activity is efficiently executed.
- Ensuring success criteria is clearly defined and rehearsed so that all users are aware of what is required to confirm a Go, or determine a No-Go.

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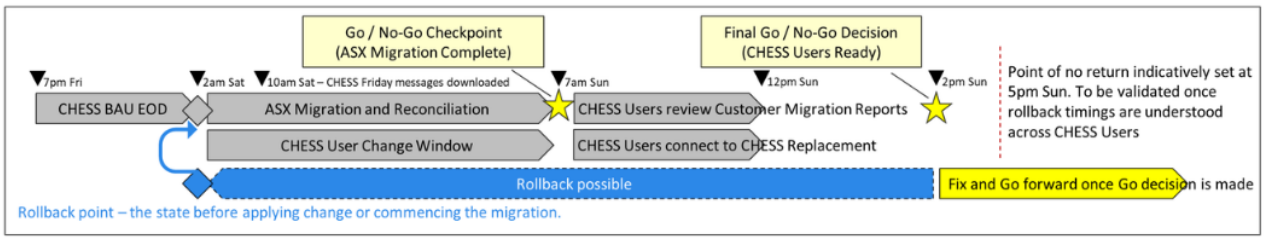
6.1.3 Rollback as part of dress rehearsals

It is only feasible to rollback to existing CHESS up until the final Go/No-Go Decision point on Sunday of the implementation weekend. If a final Go decision has been made, it is not feasible to rollback to the old CHESS system once live business transactions are sent.

The high level approach to rollback will be to reverse any change made to live production integrations and systems as part of the go-live weekend.

Key points relating to rollback as part of an MDR are that:

- ASX will execute the ASX rollback plan as part of internal rehearsal events
- CHESS users will be required to develop and execute their individual rollback plans
- Execution of CHESS user rollback plans will be requested as part of selected MDR event(s) – ASX will seek to understand the duration of each CHESS user's rollback plan to ensure the final Go/No-Go and point of no return takes all rollback plans into consideration
- CHESS users will be required to ensure their rollback plans are validated internally prior to the MDR phase



Further information on rollback as part of market dress rehearsals is published in section 5.5 of the Cutover and Migration Strategy paper.

6.1.4 Fallback strategy

Why fallback[14] is not feasible after the final Go/No-Go decision

After the final Go/No-Go Decision point, and if a Go decision is confirmed, ASX has assessed that the only feasible option after this point is to fix and go-forward. Initiating a fallback once business transactions have begun being sent in the CHESS replacement system would require users to unwind their system changes, while also resetting their systems having sent transactions, while also needing to replay business transactions up to the point of needing to fallback. This approach is deemed not feasible.

6.1.5 Early stakeholder engagement

ASX has also engaged with stakeholders via working groups and dedicated Focus Groups (November 2021) regarding its migration strategy and has sought stakeholder input regarding messaging and business specifications.

Specific to data migration, ASX's engagement via working groups occurred from November 2019 to February 2022.

6.2. Risk mitigations for technical complexity

6.2.1 Migration of historical data prior to cutover weekend

ASX will migrate the majority of the historical data required to facilitate historical customer reporting and internal operations support in advance. Only current state data will be migrated on the cutover weekend, significantly reducing the volume of data to be migrated over the implementation weekend. This alleviates the workload on the production system, minimises the window for migration and avoids resource contention.

[14] In the context of this project, the term 'rollback' is used to describe the process of rolling back to the previous state on the existing CHESS system; this is feasible up to the final Go/No-Go decision point. The term 'fallback' is used to describe the process after a final Go decision has been made if critical issues in the CHESS replacement system are experienced.

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6.2.2 Mock migrations (ASX internal)

ASX has been running monthly mock migrations with full volume production data. These mock migrations include extracting all datasets required from current CHESS and other source systems to then migrate into the target CHESS replacement system in a dedicated environment. This will prove the end-to-end data migration and reconciliation process, progressively achieving desired reconciliation targets. ASX plans to continue running mock migrations with the latest cut of production data up until go-live. A successful mock migration is a key entry criteria before executing any dress rehearsal.

Risks are mitigated by:

- Proving automation and performance in the underlying data migration process. The actual ASX migration process including reconciliation is targeted to complete by early Sunday morning of the cutover weekend thus enabling a significant window of time for the subsequent market activities to complete, ready for the start of trading on Monday
- Completing the required level of testing and the maturity of the migration process reaching the target to commence ASX internal dress rehearsal as planned
- Validating the ability to migrate and reconcile full volume production data
- Enabling frequent data profiling and validation cycles to run identifying data quality exceptions to be remediated further and allowing validation of past remediation. This significantly minimises the risk of data quality issues for cutover
- Ensuring critical points in the migration process have component redundancy identified and tested

6.2.3 Market dress rehearsal testing connectivity

During the MDRs, as part of performing connectivity and application verification, ASX will co-ordinate network interface failovers so that users can validate that their connectivity to ASX's secondary site is also functioning correctly. CHESS users will also be strongly encouraged to validate connectivity from their disaster recovery sites to both ASX sites.

Risk is mitigated by:

- Ensuring CHESS users validate production connectivity to both ASX's primary and secondary sites
- Allowing CHESS users to validate connectivity from both their own primary and secondary sites

6.2.4 Migration dry run prior to cutover weekend (ASX internal)

In addition to running a number of MDRs in the ASX 'to be' production environment, ASX will perform dry runs approximately one week prior to the go-live cutover weekend to further mitigate risks. A dry run in this instance will include migrating a subset of data into the CHESS replacement system validating all migration activities including reconciliation and business verification can be performed as planned during the actual cutover weekend. Further to the regular data profiling and validation run by ASX's Data Quality Working group, these dry runs may enable identification and remediation of any data quality exceptions at source and significantly minimise the risk of encountering exceptions on the actual go-live weekend by monitoring production more frequently in the days ahead of the actual go-live weekend.

6.3. Risk mitigations for market impact

6.3.1 Tools to manage data exceptions

To ease the transition for users, ASX has made available a registration details tool that provides CHESS users and their software vendors the ability to convert CHESS registration details from the current CHESS proprietary messaging format to one that aligns with ISO 20022 messaging standards. The tool may also assist with the remediation of accounts prior to the cutover weekend by identifying those accounts with registration details not aligned with ISO 20022 messaging standard and/or business rules in the CHESS replacement system. For further information, see here.

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6.3.2 Data remediation

In November 2019, ASX notified CHESS users that it would waive fees associated with bulk cancellations of dormant or inactive accounts. This initiative has resulted in more than 1 million HINs cancelled in CHESS. Subsequently ASX also established an internal Data Quality working group in early 2021 with a purpose to ensure legacy data in scope for migration is in a 'clean' state to allow for successful migration to the CHESS replacement system. To de-risk and facilitate the migration of accounts on the cutover weekend from current CHESS to the CHESS replacement system, ASX has been working with CHESS users to remediate exceptions in their own internal CHESS-facing systems. This includes the correction of invalid or outdated country codes and the removal of references to invalid terms or characters in account designations.

A regular data quality validation and profiling process has been running and will continue to run until the cutover weekend. This process identifies data quality issues and allows for reporting to the relevant CHESS user for remediation. ASX and controlling participants have reduced the number of exceptions significantly since the start of this exercise. ASX will continue to review and test the exception handling process through mock migrations and dress rehearsals, such that should any exception be identified during the cutover weekend, those exceptions are appropriately managed and tested to enable a successful migration of customer data.

6.3.3 Inflight migration testing (external)

This optional test phase for software providers in ITE-M will test the completion of inflight transactions that started in CHESS and are migrated into the CHESS replacement system.

Risk is mitigated by:

- Allowing software providers to enter their own data in a CHESS BAU test system, which will then be migrated to a CHESS replacement test system allowing users to update and complete workflows
- Facilitating technical verification, identifying any misalignment and allowing for any issues to be rectified before the next cycle
- Testing of inflight transactions by CHESS users in the post MDR Day 1 test phase

6.3.4 Dress rehearsals (ASX internal and external)

See section 6.1.2 above.

6.3.5 AMO trade registration and pricing parallel test (AMO only)

In the context of this section, an AMO trade registration and pricing parallel test refers to running production trades into a to-be production copy of CHESS, which allows ASX (for the avoidance of doubt, the ASX CHESS replacement team, not AMOs) to reconcile trades and end-of-day prices between CHESS and the to-be production copy of CHESS.

This will provide an opportunity to ensure trade registration and price reporting from AMOs reconciles to what is received by current CHESS.

Risk is mitigated by:

- Validating new AMO and ASX FIX infrastructure is working correctly
- Providing the opportunity to monitor and gain experience with the new system ahead of the go-live weekend

AMOs will participate in the MDRs and will be provided with a specific suite of customer migration reports following migration.

6.3.6 Post MDR Day 1 testing on migrated data (ASX internal and external)

Post MDR Day 1 testing will provide ASX (and CHESS users) the opportunity to run targeted scenarios that would benefit from either needing an unmasked cut of production data or require the production 'to be' infrastructure.

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Risk is mitigated by:

- Proving functionality following a cutover dress rehearsal where functionality is not exercised as part of the weekend event
- Building confidence by validating functional scenarios with production data

ASX has published detailed information about Post MDR Day 1 testing as part of the Cutover and Migration Strategy here.

6.3.7 CHESS user testing

CHESS users will test both functional and non-functional aspects of the system across four distinct test phases – CHESS user testing; operational readiness assessment; market dress rehearsals including the opportunity to test into the first business day post migration (referred to as post MDR Day 1 testing); and industry wide testing (IWT).

On the commencement of CHESS user testing, CHESS users will start testing their organisation's functional flows. This will be the first time CHESS users will be able to test the development of their software (in-house or third party), and ensure the software development is fit for their purpose. CHESS user testing also provides for testing bilaterally across the market to ensure CHESS users can successfully interact with their peers and other cohorts e.g. clearing and settlement participant testing with a share registry. This is an important pre-cursor to the more scripted IWT phase to provide confidence that CHESS users can interact with other CHESS users in advance of IWT commencing.

ASX will then provide the opportunity to integrate with AMOs for the first time, allowing CHESS users the ability to test trade execution through to clearing and settlement.

Operational readiness is the first time ASX will be assessing each CHESS user and their functional flows. This is a key phase in evidencing the market's readiness and ability to operate their business.

Three market dress rehearsals will allow CHESS users to test all required activities to successfully cutover to the CHESS replacement system within the required timeframe.

The last phase will be mandatory industry wide testing (IWT), designed to ensure CHESS users can interact with other CHESS users is a simulated production-like environment.

Risk is mitigated for a single cutover through a culmination of these four distinct test phases that allows for CHESS users to progressively test all relevant workflows needed to support their businesses and interactions across the market, leading to an attestation on their readiness for go-live.

6.4. Risk mitigations for ASX impact

6.4.1 Migration of historical data prior to cutover weekend

See section 6.2.1 above.

6.4.2 Migration dry run prior to cutover weekend (ASX internal)

See section 6.2.4 above.

6.4.3 Testing on migrated data (ASX internal)

The purpose of ASX internal testing on migrated data is to test the data flow between various ASX systems to the CHESS replacement system using migrated data including testing of inflight transactions.

Risk is mitigated by:

- Validating business processes are functioning as expected in the target platform with migrated data. This allows for any issues to be identified with the migration processes and the data that has been migrated
- Proving inflight migration and continuity of workflows using migrated data
- Proving critical processes can be executed as expected

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6.4.4 Mock migrations (ASX internal)

See section 6.2.2 above.

6.4.5 Dress rehearsals (ASX internal and external)

See section 6.1.2 above.

6.4.6 Post MDR Day 1 testing on migrated data (External)

See section 6.3.6 above.

6.4.7 Internal ASX parallel test

As part of ASX's internal test strategy, ASX will run a phase of parallel testing for critical business processes. This involves executing processes in the CHESS replacement system and comparing results to CHESS.

Risk is mitigated by:

- Where expected, ensuring business process outcomes match. For business process outcomes that are not expected to match, differences are reviewed and accepted e.g. batch settlement
- Verifying outcomes with production data

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7. Specialist expertise and governance

7.1.1 Specialist expertise and independent review

In 2019, an industry tender process was undertaken to select a partner to support ASX with internal migration activities. KPMG was selected based on its specialist data migration expertise and its track record in capital markets and financial services industry migrations. KPMG will be providing a data 'migration platform' which will perform the data extraction, transformation and reconciliation activities to migrate data from current CHESS to the CHESS replacement system.

ASX engaged EY to provide an independent external assessment of its cutover approach and cutover and migration strategy from CHESS to CHESS replacement. This review was completed in January 2022 and EY have provided a number of recommendations which ASX is implementing. ASX is currently working with EY to define the scope of future independent reviews.

7.1.2 Cutover governance model and communication

ASX has established an ASX CHESS Replacement Cutover Governance Model, which will be in place across each of the rehearsal phases. The model consists of multiple layers, representing different levels of accountability and responsibility. An Implementation Governance Group (IGG) will keep ASX's regulatory agencies informed on the status at key milestones during the event, including any decisions made. A communication plan will be defined leading into the MDRs outlining critical milestones and key contacts. The IGG will be the escalation and decision authority, as the final decision makers, the Go/No-Go approvers and the critical escalation point.

The event communication plan will be provided as part of the MDR overview document planned to be published at least three months prior to the start of MDR1.

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