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Investit Research

Investment Book of Record

Doug Neill

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About Investit

Investit will help you increase profitability by developing better products, winning and keeping clients and improving your operating platform.

Located in London, Boston, Dubai and Sydney, Investit is a global management consultancy that leverages Investit's deep industry research and benchmarking practices to support the asset management industry. Since 1998, Investit has been guiding the growth and profitability of firms to create industry leading investment products and implement effective operating structures. Our proven methodology has a three point process that has successfully helped transform our client's business to meet both today's and tomorrow's challenges.

Investigate.

Research industry trends, challenges, and solutions

Assess.

Evaluate firm structure and processing to identify barriers to success

Achieve.

Guide firms on their journey to meet defined objectives through

About the Author

Doug Neill

Principal, Investit

Doug Neill heads our Australian office which opened in 2008 supporting both existing clients who are working globally and new clients based in Australia. Doug formed the Chief Operating Officers' forum in Australia to facilitate the collective discussion about local and global issues affecting the industry as a whole. He has also been responsible for developing a deep reaching operational assessment and alignment methodology allowing firms to truly assess the value of their IT and operational investment.

As a contributor to Investit's Intelligence research Doug has authored a number of research papers including 'The Future FX' which looked at the role of investment firms in the FX markets and 'The future of Investment Operations in Australia' which considered the role of software vendors and outsource providers in the local market.

Prior to joining Investit Doug held senior positions at both investment management and asset servicing firms.

For further information on this research paper please contact Doug Neill at doug.neill@investit.com

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1 Executive summary

As the investment management process becomes more complex with emerging instruments, shifting and increasingly complex investment strategies, greater regulation, increased globalisation, and increased pressure on fees, investment firms have to ensure that their decision makers have the most accurate, complete and up-to-date data on which to base their investment decisions. Providing accurate, timely, consistent and complete position data is one of the most important operational competencies and is critical to ensuring the firm's investment assets are appropriately leveraged and allocated to contribute value to the investment process. Without it, firms will fall short of achieving their potential as available assets are left out of the investment mix and undermine the full potential of the investment strategy.

Since the advent of commercially available investment management systems, supplying this Investment Book of Record has been a consistent challenge for investment firms where the data timeliness versus accuracy requirements do not naturally fit into the traditional accounting based structures prevalent across the industry. Most firms have adopted highly flexible strategies enabling them modify how they manage position data to deal with shifting business and investment strategies, globalisation, regulatory demands and shifting distribution channels.

Although firms use a variety of different systems all of these construct an investment position based on an accounting foundation. As complexity increases investment firms need to contend with multiple sources of accounting data supplying multiple investment systems at multiple times which exposes the limitations in the end-of and start-of day batch processing that dominates today's market. Consequently, it is probable that the market will move to on-demand models where it will be possible to refresh the investment position as and when required. The notion that the industry will ultimately move to a real-time model is not well supported by the investment firms who see controlling the investment position update as highly important. Outside of Australia there are some who believe that models need to evolve that go beyond removing the dependency on start-of-day batch processing and need to create a fully independent IBOR that is used to feed investment systems and provide enterprise level reporting.

There is an industry wide collective agreement that investment position data is a key pillar of the operational and technology foundation of any investment firm. The major software providers of accounting systems, investment order management systems and database solutions are positioning their products as the modern IBOR solution with the view that the investment firms need to invest more.

The pace of change is likely to be slow because there are no burning platforms and most of the improvements make things work better rather than improving the top-line revenue. With most investment firms confident that their current systems and processes adequately support the investment data needs it is difficult to consider a business case outside of the normal investment cycle. The dominant strategy firms are adopting is to select the most appropriate core solution and the right partner to continually improve and adapt the model to new business requirements.

Investit's observations

Current state is batch with single update.

Typically investment firms are tackling a highly distributed systems architecture with many discrete systems sharing accounting and operational information through a network of complex integrated systems. Although the processing activities may differ between firms these processes are focused on achieving the same result which is to populate the investment systems with the most accurate up-to-date data supporting investment decision making.

- The processes are predominantly batch in nature, are unidirectional, updated only once every day and are based on the previous days close of business accounting data.
- Once investment systems are updated and populated they become semi-isolated from any upstream accounting data and tend to rely on maintaining positions based on trading activity and data directly loaded into these investment systems.

This start-of-day batch processing performs a key role in ensuring everything in the prior period is captured correctly and that the starting position is as accurate and complete as possible. Generally, the industry relies on an investment position that is created by enhancing an accounting end-of-day position. This dependency is viewed as a strength because it provides a true reference point to verify the position data but also a weakness because it increases the pressure on the accounting teams to complete the end-of-day processing.

The many-to-many systems architecture is unlikely to disappear in the near term for two main reasons

- There is no market momentum to move away from componentised investment systems architectures, and;
- Diversification into broader investment, products, markets and asset classes causes firms to use multiple providers or accounting/administration systems.

This has caused a number of investment firms to become fragmented with processes aligned to providers/accounting platforms and to asset classes and, although most firms are very confident that the quality of what is delivered to the investment teams is very good, it is a limitation on the ability of these firms to manage position data at the enterprise level.

Most investment firms believe what they are providing is adequate albeit with imperfect processes and although most believe there are always efficiency improvements to be gained whether this happens through incremental improvements or a significant investment must be carefully balanced against the costs, improvement in risk management and business benefits. This is the crux of the software vendors' dilemma. Most of the benefits being proposed support the cost and risk aspects of their business case with little emphasis on revenue gains for the investment firms. Most investment firms already commit a significant proportion of their operational budgets to managing investment position data which is included in their normal budget and investment cycle. To invest significantly outside of this cycle is unlikely unless there are external drivers like regulation, a very quantifiable business benefit or as part of other initiatives.

Vendors struggle to gain traction.

The recent increase in discussion about the need for IBOR solutions has not resulted in the software vendors producing new standalone IBOR solutions. The reasons for this are quite simple, investment firms are unlikely to commit to large IBOR projects in isolation and are far more likely to look for direct business benefits provided by business applications and functionality – simply the IBOR provides a great foundation but not enough business functionality to justify significant investment.

Software vendors have started to clearly show how and where their solutions benefit firms when managing investment position data. The various solutions have either tended towards a database or an application approach.

- **Database centric:** Many investment firms consider that the best approach is to collect, verify, cleanse and normalise data and store this in a centralised database. This data can then be used to feed other business systems or be used directly by applications referencing this data store. Some of these solutions, such as Eagle Data Management and DST Global Solutions Anova IBOR, have roots in performance systems which have always needed to capture detailed position data which provides the basis to support data intensive business applications.

  Others, such as Eze Software Group have significantly extended their product offering, including a centralised data management system, to provide a spectrum of modules that can be configured to address individual investment firm's specific IBOR needs.

- **Application centric:** Some investment firms believe that it is more effective to manage the IBOR within the applications that use the data. For firms with an end-to-end accounting system like SimCorp Dimension it makes logical sense to base their IBOR strategy on this platform. Other firms that have a more componentised architecture can use specialised systems like Markit Enterprise Data Management to provide data to the downstream investment systems. There are also a number of emerging initiatives from the providers of investment order management systems to enhance the data management coverage to provide improved data integrations

Is the future emerging?

Common across all of these approaches is the reliance on an accounting foundation and the requirement to complete the accounting end-of-day. Although for many firms this reliance represents the weakest link in the whole process it is also a significant restriction on what alternative approaches can be considered. Whether in the long-term this leads to a change in approach where the accounting data dependency is removed remains to be seen. This is essentially what a group of influential investment management firms in Europe have recognised and are proposing an event driven IBOR solution that would remove these direct accounting data dependencies.

2 About this research

The information included in this report has been derived from a number of different sources including interviews, survey results, trade journals and on-line research. Investit would like to thank all those that took part in the research for their contribution and in particular the following vendors:

- DST Global Solutions
- Eagle Investment Systems
- Eze Software Group
- Markit
- SimCorp

The following information describes the process used by Investit to complete our research.

- Interviewed six custodians, investment operations outsource providers and seven software vendors to gain insights on industry issues and trends.
- Researched industry specific trade journals as well as non-industry specific articles and books that provided detailed insight into usage, application, challenges and risks.
- Interviewed 16 investment firms in Australia to understand the current market practices, the challenges these firms face and their views on future improvements and change.

The Australian investment management market is concentrated with over three-quarters of the assets under management spread across the top-30 firms. The firms are segmented into two groups:

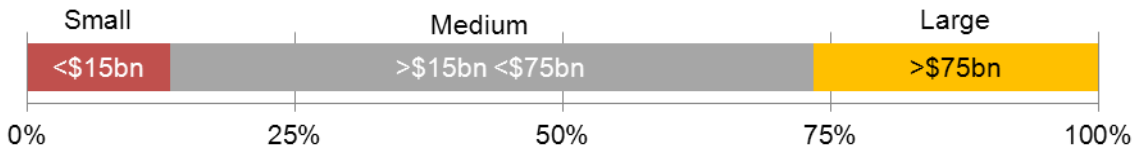
- **Australian investment firms:** who are headquartered in Australia and make technology and operations decisions locally. These make up about 60% of the top-30 investment firms.
- **Non-Australian investment firms:** with a presence that included investment management product manufacturing capability in Australia but with an offshore headquarters where operations and technology decisions are made. These make up about 40% of the top-30 investment firms.

This research is concentrated on Australian domiciled and headquartered investment firms as shown in Graph 1.

Graph 1 - Type of research participants based on location of decision making for IT and Operational spend

The combined AUM of these firms is estimated to represent approximately 65% of the total assets managed in Australia and is distributed in small medium and large firms as shown in Graph 2 below.

Graph 2 - Size of investment firms in AUM who participated in the research



The investment firms that participated in this research include:

- Aberdeen Asset Management
- AMP Capital Investors
- BT Investment Management
- Challenger
- Colonial First State GAM
- Magellan Asset Management
- Maple-Brown Abbott
- NABInvest
- Perennial Investments
- Perpetual Investments
- Principal Global Investors
- QBE Investments
- QIC Limited
- TCorp NSW
- The Future Fund
- UBS GAM (Australia)

The software vendors that participated in this research include:

- Charles River Development
- DST Global Solutions
- Eagle Investment Systems
- Eze Software Group
- Markit
- SimCorp
- Sungard

The outsource providers that contributed to this research are:

- BNP Paribas Securities Services
- HSBC securities services
- The Northern Trust Company
- RBC Investor & Treasury Services
- State Street Global Services
- White Outsourcing

About this research

This research was sponsored by the following software providers and we have included details of their systems in section 6 and details of the providers in section 8.

- **DST Global Solutions**
- **Eagle Investment Systems**
- **Eze Software Group**
- **Markit**
- **SimCorp**

3 Defining IBOR

From the firms participating in this research, there was no consistent definition of what IBOR is or what it includes. Some firms believe it refers to the data in their order management systems, some use it to refer to their start-of-day position data and other firms have a broader view and should refer to all the data used in the investment process. It is also clear that there is not industry-wide consensus on what IBOR covers. This lack of definition and scope has increased industry confusion and to a certain extent has made some of the firms consider the term as simply marketing hype.

"A source of position/transaction data that is or can be adjusted for orders, cash flows, executions and corporate actions, and trusted by the investment businesses for the purpose of managing and constructing investment portfolios."

In reality, the lack of an industry definition or clear definitions from the key vendors has allowed the IBOR term to be used to describe a number of different scenarios, models and options. It is likely the term has become popular to distinguish the importance and challenges of IBOR from all the other data management discussions and generalist topics like 'big data'. Clearly, the industry needs an agreed definition to enable consistent discussion.

Additionally, other books-of-record (BORs). such as ABOR (Accounting Book of Record), CBOR (Custody Book of Record), OBOR (Overnight Book of Record), RBOR (Reporting Book of Record), SBOR (Settled Book or Record), and TBOR (Trading Book of Record), have entered the industry lexicon. The majority of these BORs also lack clear and concise definitions.

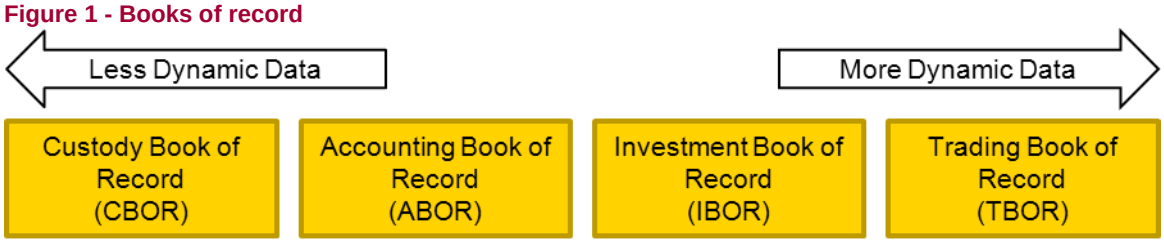
Other than IBOR, the important references in this research are:

Name	Description
ABOR	**Accounting Book of Record** Fairly well defined and is driven by accounting standards and market practices. Simplistically, this refers to a position firms knew they had at a point in time
TBOR	**Trading Book of Record** Loosely understood as the records used by portfolio managers and dealing teams to manage their investment positions in the market. Generally, this is based on security and cash position data loaded into order management systems at the start of the business day which is updated to reflect market activity.

When considering IBOR, it is important to acknowledge a requirement to satisfy varying types of data from highly dynamic data driven by market and trading activity through to data held in accounting platforms that changes less frequently and in a very controlled manner, i.e. is less dynamic. This is represented in Figure 1 below.

Defining IBOR

Figure 1 - Books of record



If ABOR represents what a firm knew it had at a point in time then the IBOR could loosely describe what a firm thinks it has now.

Collectively investment management firms believe IBOR must have the following characteristics:

- Cover all positional and transactional data;
- Supports the whole investment business (not just portfolio managers);
- Updated continuously for market and investment events and;
- Acts as a reliable source to reference historical positions.

Although there isn't complete consensus there are some who view that a true IBOR must be capable of reflecting and reporting the impact of all investment related events including uncertain, estimated, or predicted events, across all positions.

Effectively, IBOR is the positional data used to support the investment processes. This includes, but goes beyond, the start-of-day data used by the investment teams for order management. IBOR includes data used for the following:

- Investment decision support
- Investment risk
- Investment performance and analytics used in the investment process
- Exposure reporting
- Enterprise compliance

Across the majority of investment firms who took part in this research the consensus definition is:

"A source of position/transaction data that is or can be adjusted for orders, cash flows, executions and corporate actions, and trusted by the investment businesses for the purpose of managing and constructing investment portfolios."

In discussing this definition there was reasonable debate on the extent that IBOR needs to be fully dynamic, that is, whether the definition should say:

*"A source of position/transaction data that is **continuously** adjusted for orders …"*

or

*"A source of position/transaction data that **is or can be** adjusted for orders …."*

Although positional data is dynamic with the potential to be constantly adjusted for changes caused by cash flows, market trading and corporate actions, the general consensus amongst the investment firms is to be able to control the updates flowing into the investment systems.

Primarily being able to control these update is seen as an important control that ensures:

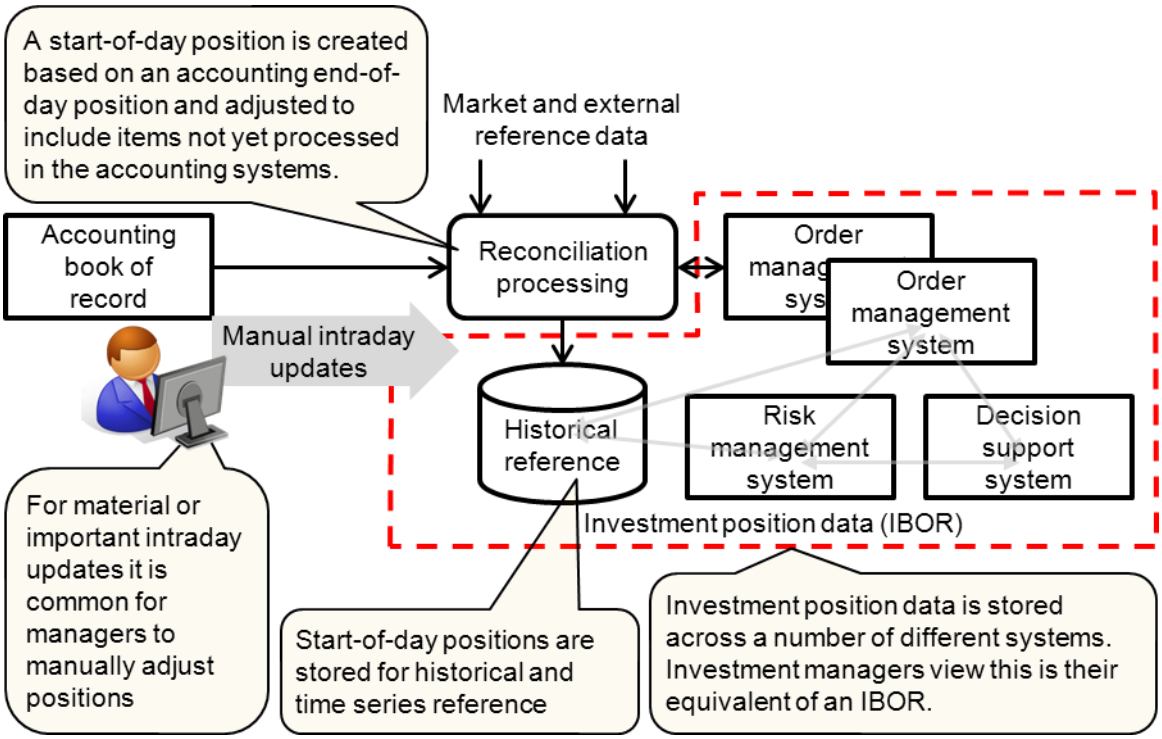
- The investment teams understand the starting positions and those positions can be subsequently updated under controls specific to the needs of the investment teams.
- Any changes made in the upstream accounting systems do not present unwanted distractions. To a large extent this makes sense with portfolio managers already having to deal with substantial volumes of data with a large portion being dynamic anyway – the last thing they need is for the position that their portfolios are based on to be constantly changing.

The main caveat that investment firms include in the above model is their ability and need to cater for intraday adjustments which have a material impact on their investment process.

Physically the architecture can be quite varied across different investment firms; however, logically it generally looks quite similar as shown in Figure 2 below which illustrates a logical IBOR spread across a number of physical systems.

All firms regard IBOR as a logical element in the business and expect it to exist across multiple physical systems.

Figure 2 - Logical illustration of a typical investment management IBOR



As important as what is included in IBOR, is what is not included; IBOR is not:

- **A book of record to provide client reporting or formal updates.** Several investment firms indicated they would use the same data their investment teams use to satisfy some ad-hoc client queries but, this was always agreed to be on an 'as-is' basis.
- **An alternative accounting position.** All the firms who had a view said that the source of truth would always be with their accounting teams or outsource providers and that the positional investment data was quite transient.
- **Just security prices.** For some firms their overall data checking processes were biased towards checking security prices, clearly this is an important component but nowhere near everything that is included in an IBOR.

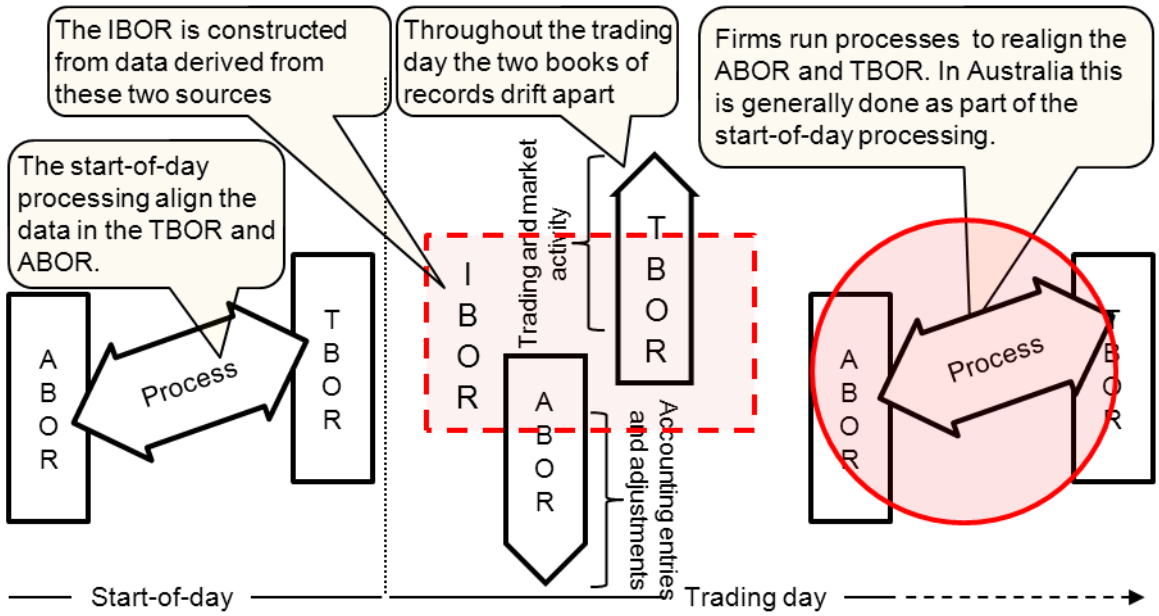
4 Current market practice

It is common practice for firms to construct the investment position by combining data derived from the ABOR and TBOR. Typically, at the beginning of the trading day operational processes align the TBOR and ABOR – effectively creating a set of shadow records. This might be repeated as different markets open in different time zones. These processes either create a set of files which are loaded into the investment systems or populate a set of tables referenced by the investment systems. For many firms the process is a very important control because it reaffirms that the data in the previous period was correct as well as verifying the completeness and accuracy of positional data going forward. Regardless of the technology or operating model the start-of-day processes generally consist of the following:

- **Portfolio valuations:** These are normally received and included as part of the start-of-day position. Most firms perform reasonableness checks to ensure that the valuations are within the expected tolerances. This may include comparisons of the total portfolio valuation against the movement of the portfolios index as well as absolute checks.
- **Event reconciliations:** Most firms maintain a list of market events, such as pending corporate actions, in their order management systems. The start-of-day process ensures that the details of these events are correct and that all events are accounted for across all platforms – a front-to-back as well as back-to-front alignment.
- **Position reconciliation:** The position reconciliation ensures the investment position includes all market executions that have been confirmed with counterparties as well as any outstanding orders that have yet to reach the operations teams.
- **Cash reconciliation:**
  - **Cash forecast:** this represents the accounting projection of the future cash flows by portfolio, currency and generally by type of cash. These are derived from the operational view of pending settlement cash, accrued income and fees.
  - **Collateral:** The known effects of collateral are included as soon as these are known. For some firms this may only be included well after the start-of-day has been completed.
  - **Client cash:** Depending on the investment mandates cash is either invested on notification or on receipt. The process ensures that the start-of-day position includes any notifications received by the fund administration functions/provider as well as any notifications that have been received directly by the investment teams.
- **Instructions:** For some firms the start-of-day process includes instructions relating to portfolio maintenance where there are non-discretionary changes made to investment positions.
- **Market data scrubbing:** Market data and analytics not relevant to the accounting records are generally loaded from external sources; however, some investment firms do receive this indirectly through the accounting position data feeds.

Typically, a shadow ABOR is created at the start-of-day which is combined with the TBOR to create an ‘IBOR’. Throughout the trading day updates in the accounting systems and the investment systems are made independently which causes the ABOR and TBOR to drift apart. A logical representation of this is shown in Figure 3.

Figure 3 - Common approach to data consistency (logical view)

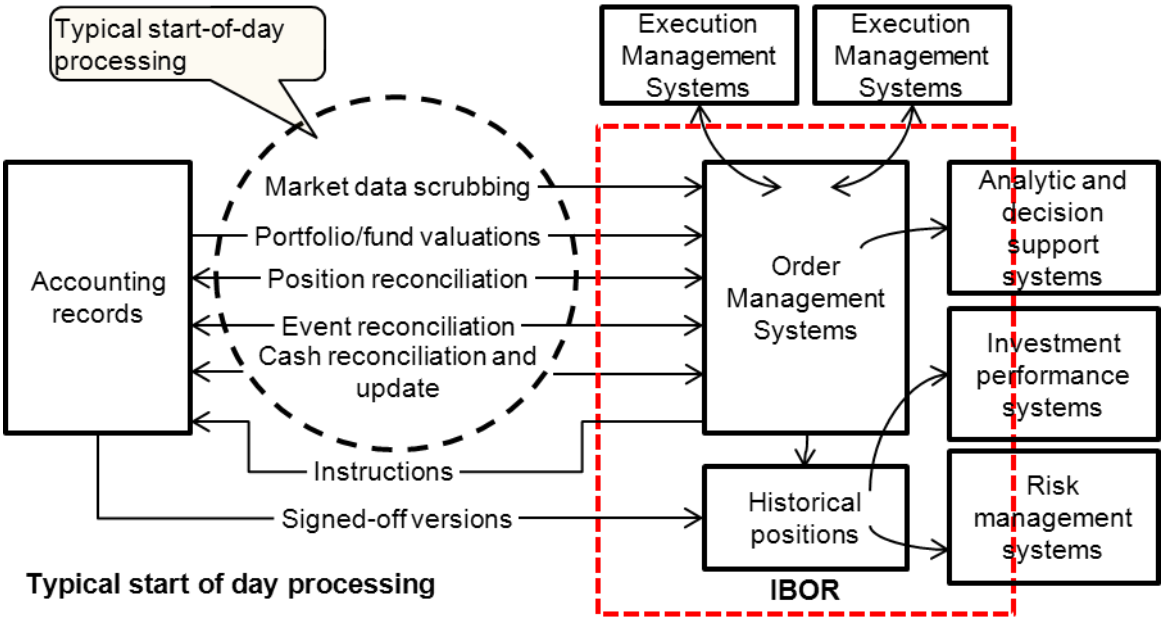


Once the start-of-day data position and cash reconciliations are complete these are processed by the order management systems. Depending on the design of the order management systems this can be a flush and refresh where the current positions in the order management systems are completely replaced with new data or through adjustments made as a result of differences identified in the start-of-day process.

The start-of-day position is usually kept in an historical data store or time stamped database tables to enable historical references. The typical process of constructing the start-of-day position is represented in Figure 4. Some firms will also store the signed-off accounting version alongside the investment position.

Note that there are no investment firms who participated in this research that create an investment position that is not based on a known accounting position.

Figure 4 - Logical representation of the typical start-of-day processing



Physical Models Constructed from a Shadow ABOR

Four physical models were identified and vary only because of the underlying database and application architectures and all share the common approach of constructing the IBOR from a shadow of the ABOR.

The four main approaches that shadow ABOR are the following:

1. Integrated front-to-back systems.
2. Shadow database.
3. Data management systems.
4. Expanded Investment or OMS systems.

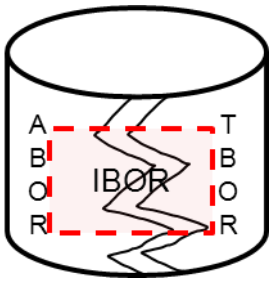
There is an alternative method where the IBOR is independently derived with no direct dependency on the TBOR or ABOR. This approach does not currently exist in any commercial software packages and is only believed to be in use by some of the very largest investment firms as a customised build.

These models represent the end-state and all of these can be implemented incrementally.

Integrated Front-to-Back Systems

All the data resides in a one integrated system with the TBOR and ABOR sharing common or linked database tables.

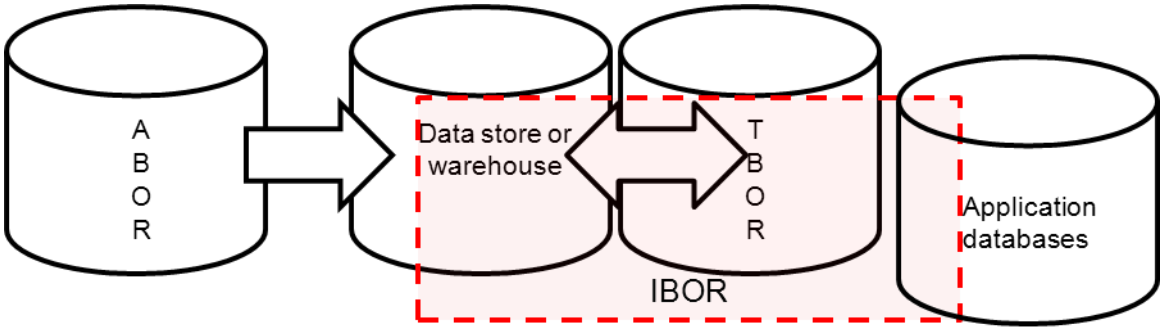
Figure 5 - Integrated front-to-back systems



Shadow Database

A shadow copy of the ABOR is created as part of the start-of-day processing and exists as a separate database sitting between the accounting systems/providers and the investment systems. Updates are propagated into this database from the accounting systems and the investment systems.

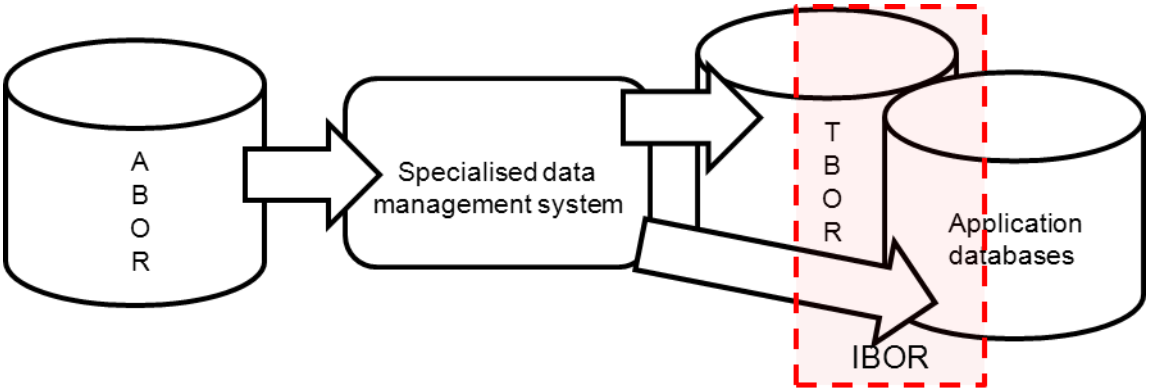
Figure 6 - Shadow database



Data Management Systems

All the data is managed by specialised data management systems fed from the ABOR and TBOR and verified before being passed onto the investment application databases. This approach assumes that any IBOR requirements are dealt with by the application databases.

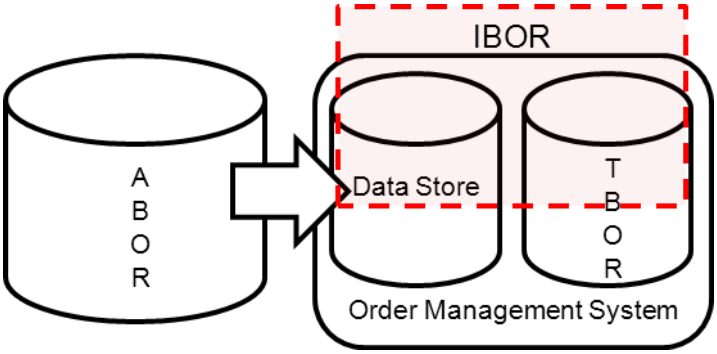
Figure 7 - Data management system



Expanded Investment or Order management systems

The order management systems are expanded to hold other positional and investment data that is not required for order management purposes.

Figure 8 - Extended capabilities in an order management systems



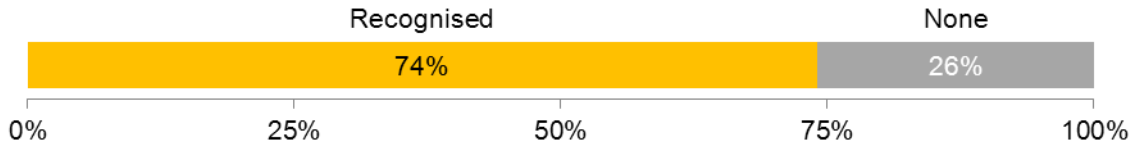
Vendors Adapting Existing Solutions

None of the software vendors we interviewed are developing IBOR only solutions but are concentrating on adapting their existing systems to improve investment position data capabilities in line with the accepted IBOR principles. This represents an improvement in capability but not a change in fundamental models with the dependency on the accounting position. Indeed, a number of vendors believe future trends will dictate a need for deeper integration with accounting systems and providers.

As reflected in Graph 3 below around a quarter of investment firms have not reached the level of complexity that requires them to invest separately in specific technical architecture to manage their investment positions. Instead, they rely on a combination of management processes and end-user developed tools to fulfil IBOR requirements. Although none of these firms assess themselves poorly in terms or quality of data provided to the investment teams around 50% are

now considering introducing a data management platform in the next 12-18 months to support IBOR requirements

Graph 3 - Investment management firms with a recognised data management platform



5 The business case for greater investment

Throughout this research three groups were interviewed:

- Software vendors;
- Investment management firms and;
- Outsource service providers.

All three groups agreed that investment position data is highly important and core to supporting the investment process and is something that needs continual investment.

Firms tend to evolve their application solutions to keep pace with their business strategy which means forward planning enterprise level data strategies is immensely challenging. No-one who started the IBOR journey 15 years ago would have imagined the level of investment complexity and the consequential data requirements required today. Simply the lack of clarity of long term business requirements makes it very difficult to plan the data strategies at the enterprise level.

The predominant strategy adopted by the investment firms is to choose flexible solutions that can cope with evolving business requirements provided by vendors who are able and prepared to adapt their solutions accordingly.

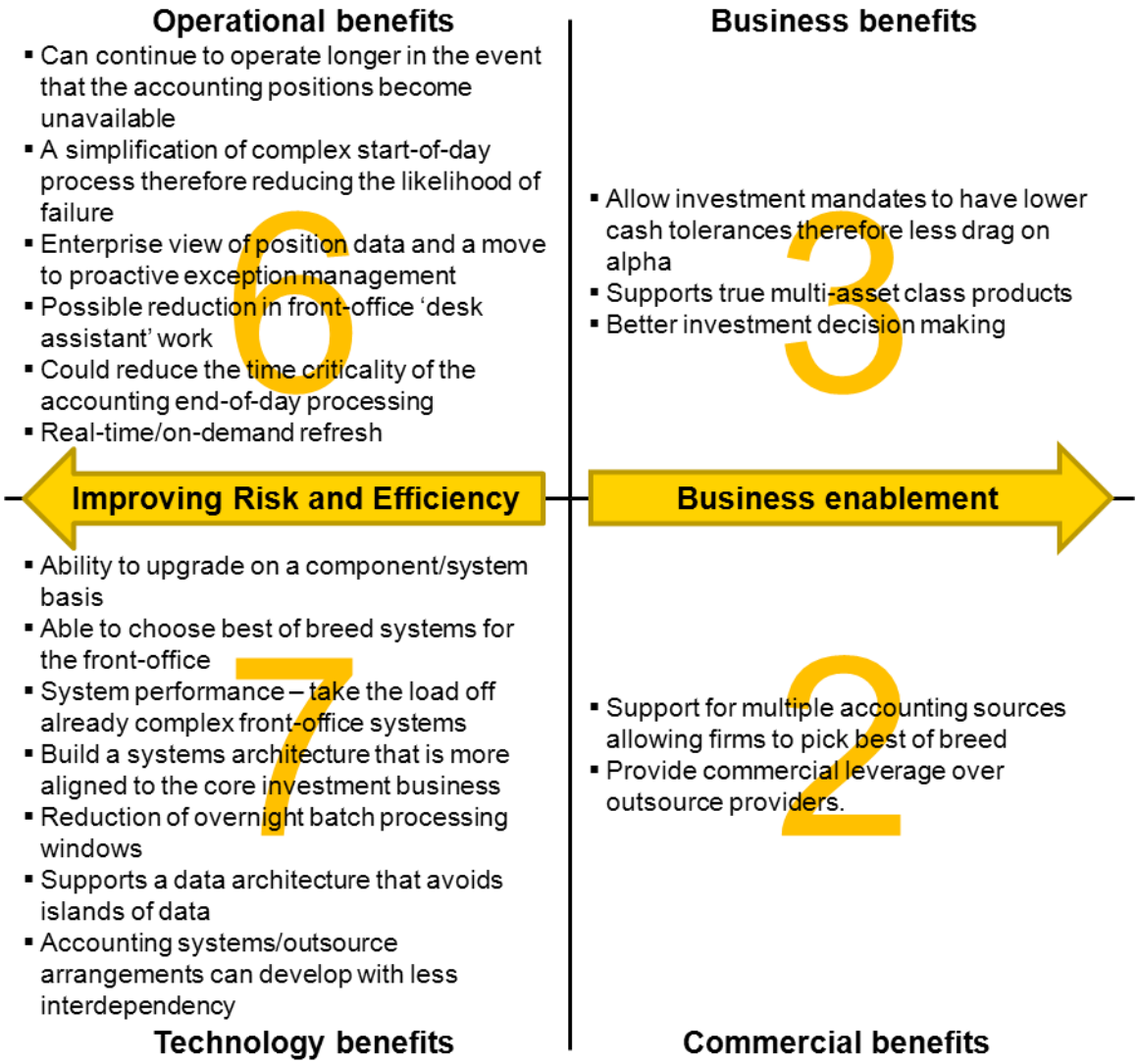
Whether the level of investment is sufficient is an area of debate. Whereas most of the investment firms are reasonably comfortable with their level of investment - which is generally part of the ongoing systems and operations capital and BAU budgets - the software vendors, not surprisingly, believe more can and needs to be done.

In this section, we discuss the various opinions about the business case for increased investment in IBOR.

Figure 9 summarises the main benefits identified in this research and categorises these in four main benefit sections:

Benefit	Description
Business	Improve a firm's profitability by adding value to the top-line revenue.
Operational	Improve efficiency and have the same outcome for less cost or a reduction in operational risk.
Commercial	Enables firms to adopt different commercial models to support their business strategy.
Technology	Enables firms to manage their technology more easily and more effectively.

Figure 9 – Benefits matrix



While it is relatively easy to identify better risk and efficiency outcomes through a combination of operational and technology benefits identifying improved revenue benefits through improved commercial and business benefits is challenging. No investment firms disagreed about the importance of providing the best quality data to their investment teams. With the majority of investment firms believing they have or are investing appropriately in their operational processes and systems supporting IBOR it is difficult for them to justify further investment outside of the normal investment cycle unless there are quantifiable top-line benefits or they need to because of an external requirement such as regulation.

"The core purpose of the firm is investments so we need to set them [investment teams] up for success as best as possible" – COO comment

To quantify the level of need from the investment firms:

- We asked 43 targeted questions about the quality, timeliness and completeness of the investment position data they provide their investment teams;
- Discussed their current processes and to identify their main areas of difficulty and concern;

- Discussed the potential benefits of investing more or adopting different approaches to supporting investment position data.

A considerable number of operational challenges were discussed but the main challenges and opportunities were seen as:

- Relying on the accounting systems/providers as the basis for the investment position data and;
- Dealing with the many-to-many relationships where data is received, processed and stored in multiple data stores and applications.

There was general consensus that further investment in technology would provide benefits but there was a division between those who believed the best approach is to build a loosely coupled systems architecture to support a componentised model and those who believed a tightly coupled architecture drives higher data consistency.

The discussion around business and commercial benefits was less compelling and it proved difficult to identify genuine top-line value improvements.

The following table summarises various business benefits suggested throughout this research and compares these with the investment firms' own view of their current capability.

Table 1 - Benefits

Benefits	Risk and Efficiency	Business enablement
A Reliance on an accounting base	✓	✓
Working with a distributed architecture	✓	
Better client management		✓
Improved business agility	✓	✓
Better investment decisions	✓	✓
Technology benefits	✓	

Operational issues

Although a significant range of different issues and challenges were identified and discussed the main effort is directed to resolving the following two issues:

1. **A Reliance on an accounting base:** All firms rely on an accounting base where there are processes that build a start-of-day position derived from an end-of-day accounting position. These processes are complex, tend to be:
   - One-shot
   - Time constrained
   - Susceptible to failure in upstream processes or systems

   The processes are also asynchronous and unidirectional resulting in position data that becomes isolated from its source.

2. **Working with a distributed architecture:** The investment position data is sourced from multiple sources and then distributed and stored across multiple platforms and/or databases which leads to consistency issues and challenges in reporting at an enterprise level.

A Reliance on an accounting base

Firms create their initial position data through complex batch processes effectively creating a shadow accounting position that is enhanced with investment data and enriched with market data. This is what Figure 4 on page 11 depicts. For firms with offices in multiple time zones there are specific batch processes run at the start-of-day for each office location.

Once the start-of-day batch processes are complete the positions are kept current by including the positional changes resulting from any trading activity and any material changes firms decide to include from the accounting and client systems. This is Figure 3 on page 11.shows.

Highlights

- The start-of-day batch processes are complex and not uniform across geographical locations but are well understood across the industry.
- Having a known starting point is viewed as an advantage but having a high dependency on the completion of accounting processes is seen as an inherent weakness with most firms challenged to run a full investment function much beyond 24 hours without an accounting refresh.
- Order management systems architecture has a strong bearing on the resilience of the processes where firms believe that a reconciliation and adjustment approach is superior to the flush and refresh method. This highlights the operational benefits of decoupling the investment process from the accounting functions.
- There are two main time zones issues for Australian investment firms:
  - US markets still open across the start of day process and;
  - European markets completely closed making it difficult to deal with queries.
- It is not uncommon for investment firms to work off contingent positions until data from other regions is available.

#1 : Data integrity - The process can create a competing source of truth

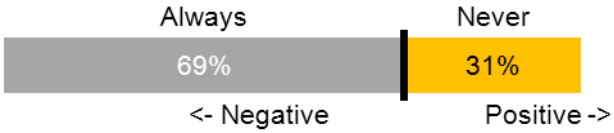
Graph 4 below shows that over a third of investment firms believe that their IBOR creates a competing source of truth. With the majority of these firms outsourcing their accounting functions it is likely this is necessary to compensate timing issues from their administrators.

Graph 4 – Percentage of firms who consider their IBOR creates a competing source of truth

#2: Resilience - End-of-day batch needs to complete

As can be seen in Graph 5 nearly two-thirds of firms have a start-of-day process that is dependent on the full completion of the end-of-day processing in their accounting systems. All the firms that do not have this full dependency run internal accounting systems.

Graph 5 – Percentage of firms dependent on the completion of the accounting end-of-day batch

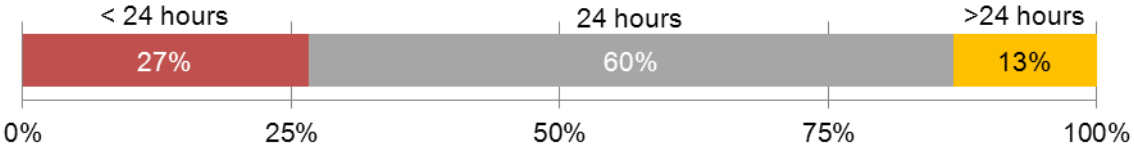


The third who do not have a full dependency on end-of-day processes still base their IBOR on the accounting records but because their investment systems are capable of supporting a contingent position they are able to continue to use this until the refresh is completed.

"Even after a substantial investment in [database] we are still not isolated from accounting system problems" – Head of Data Management comment

This critical dependency on the end-of-day process is a real issue for some investment firms who have concerns over the resilience of the whole process. Nearly 90% of firms believe their investment process cannot continue to operate without a refresh beyond a 24 hour period mainly because of difficulties in tracking cash.

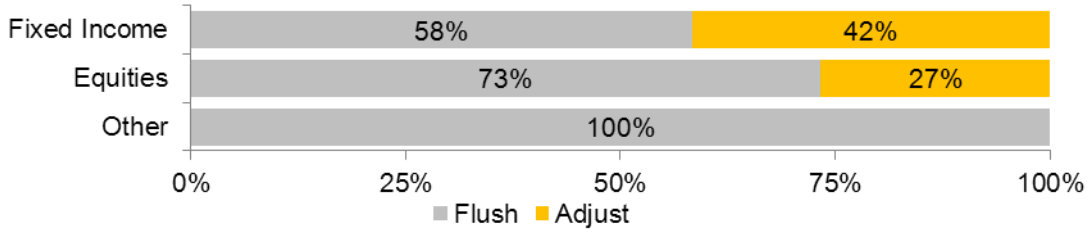
Graph 6 – How long can firms can run a full investment process refresh the investment positions



There is a strong correlation between the way the investment systems, primarily the order management systems, are refreshed and the level of resilience. Typically, there are two approaches to refreshing the investment systems:

- The reconciliation, flush and refresh method where the investment order management systems are aligned with the accounting position by flushing the previous position and loading a newly created position. As can be seen in Graph 7 this is currently the predominant approach.
- The reconciliation and adjustment method where the investment order management system position is checked against the accounting position and adjustments are made to the existing records without a refresh.

Graph 7 – Approach to updating investment systems



It is recognised that systems operating the 'reconcile and adjust' model tend to have improved capabilities to maintain positions longer between refreshes over systems operating the flush and refresh model. This is because these systems tend to be more capable of sourcing and processing data independently of the accounting systems/providers. For example, the systems running the 'flush and refresh' model usually source corporate actions from the accounting or investment

"Constructing our start-of-day positions on a batch basis once a day is a weakness but also a strength because we know exactly where our starting point is" – COO Comment

operations systems whereas the systems based on the 'reconcile and adjust' model are more likely to load corporate actions directly. Firms with a mixture of approaches to cope with different asset classes, geographies or investment styles are quite keen to point out the operational benefits of removing the firm dependency on the accounting refresh. This gives weight to the need to consider operational models that decouple the completion of the accounting end-of-day process from the investment processes.

#3: Complexity – more and more needs to get done at start-of-day

Most firms do not view the size of the start-of-day processing as the main concern but are more concerned over the increasing number of events that are time dependent, for example:

- Allocation of matched trades in other markets.
- Getting collateral obligations recorded correctly in the investment position when these are not available in time for the start-of-day cross-load.

Although there are operational challenges a number of investment firms point out that the whole process is well accepted across the industry and has a number of advantages:

- Everything is derived from a known source of well-maintained records. An approach that didn't derive the investment position from these accounting records would most likely require other processes to reconcile (or at least 'true-up') this data with the accounting records.
- Having a known starting position based on the accounting records increases the level of confidence in the validity and completeness of the data.
- Accounting teams are resourced with staff who are 'passionate' about data accuracy and completeness.

#4: Complexity –Dealing with end-of day batches in other time zones

Australia is fortunate to be time zone located at the start-of-day for much the rest of the world (except New Zealand). However, this does present some challenges where firms invest in markets in other jurisdictions. The two primary challenges are:

- **US markets may still be open:** At certain times of the year the US end-of-day processing overlaps the Australian start-of-day possibly delaying the investment teams as they wait for the trade positions to be confirmed and orders filled. Most firms deal with this by relying on their investment systems to maintain contingent positions.
- **European markets are completely closed:** There are no times in the year where the European end-of-day is very close to the Australian start-of-day. When things are working correctly and all trades that may have been executed in European markets by Australian investment firms are matched and correct there are no issues. However, if there are issues it can be difficult for Australian investment firms to resolve when the counterparties or colleagues have finished their working day.

These issues highlight some of the challenges of having the investment position data reliant on upstream accounting processes and data.

When there are upstream issues it is not uncommon for firms to start their investment day from a contingent position built from a mixture of the previous day's position, verified data from the accounting systems and estimates.

Benefits of reducing the dependency on an accounting base

There are benefits of removing or reducing the high dependency on the completion of the accounting end-of-day as follows:

- Firms can potentially continue to operate longer in the event the accounting base positions are unavailable or delayed.
- Reduce the complexity of the start-of-day operational process.
- Relieve the pressure on the accounting teams and providers to complete end-of-day processing.

Working with a distributed architecture

A substantial portion of the start-of-day operational processes and supporting systems have been implemented to manage a many-to-many environment; typically this is caused by:

- Extending the geographical reach into jurisdictions that cannot be supported by the existing accounting or operational systems or providers. Some firms have found that their outsource providers have lacked the complete global coverage and therefore have needed to find alternative/supplemental providers.
- Firms launching new lines of business requiring very different operational support platforms.
- Including new investment styles and asset classes forcing firms to diversify their investment systems.

Highlights

- All firms have to deal with many-to-many relationships which can happen in three ways:
  - Across the different 'siloed' investment systems
  - Across different accounting systems and/or providers
  - Between the accounting and investment systems/providers.

  Despite this most firms believe they achieve a very high level of consistency
- Multi-asset class investing is made harder firms with a distributed systems strategy because of the difficulty in constructing a consolidated position.
- Once positions are loaded there is a very pragmatic approach to capturing and monitoring events and firms are highly confident they capture all the material events.
- Managing cash positions is the most challenging area.
- Most firms are confident they provide accurate data to their investment teams
- Relying on data that must be completely processed by an external provider is seen as painful
- Although the process of populating the investment systems is asynchronous and unidirectional it is backed up with pragmatic controls to include material events, meaning investment firms are highly confident that their position data is accurate, consistent and complete.

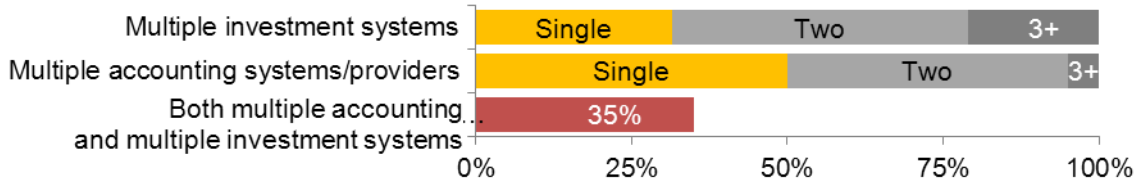
#1: Complexity –Dealing with many-to-many relationships

Only 15% of the firms have a single source of accounting data supplying a single investment system. It is not unusual for an investment firm to have:

- **Many investment systems:** Typically investment firms will have multiple investment systems either split by asset class or asset geography which are more than likely supported by specific asset class or product analysis and risk systems. The common practice of creating an IBOR across the accounting and investment systems means this ends up being dispersed across multiple investment platforms all of which are likely to manage this data independently leading to potential inconsistencies.
- **Many accounting providers/systems:** Differences in tax standards, operational practices, asset type coverage typically mean investment firms will end up with multiple accounting systems or providers.
- **Start-of-day processing across many time zones:** Firms with product manufacturing in multiple geographies are highly likely to need to cope with multiple 'sunrises'. We found no firms running identical start-of-day batches across different time zones meaning that they had to maintain and manage multiple processes.

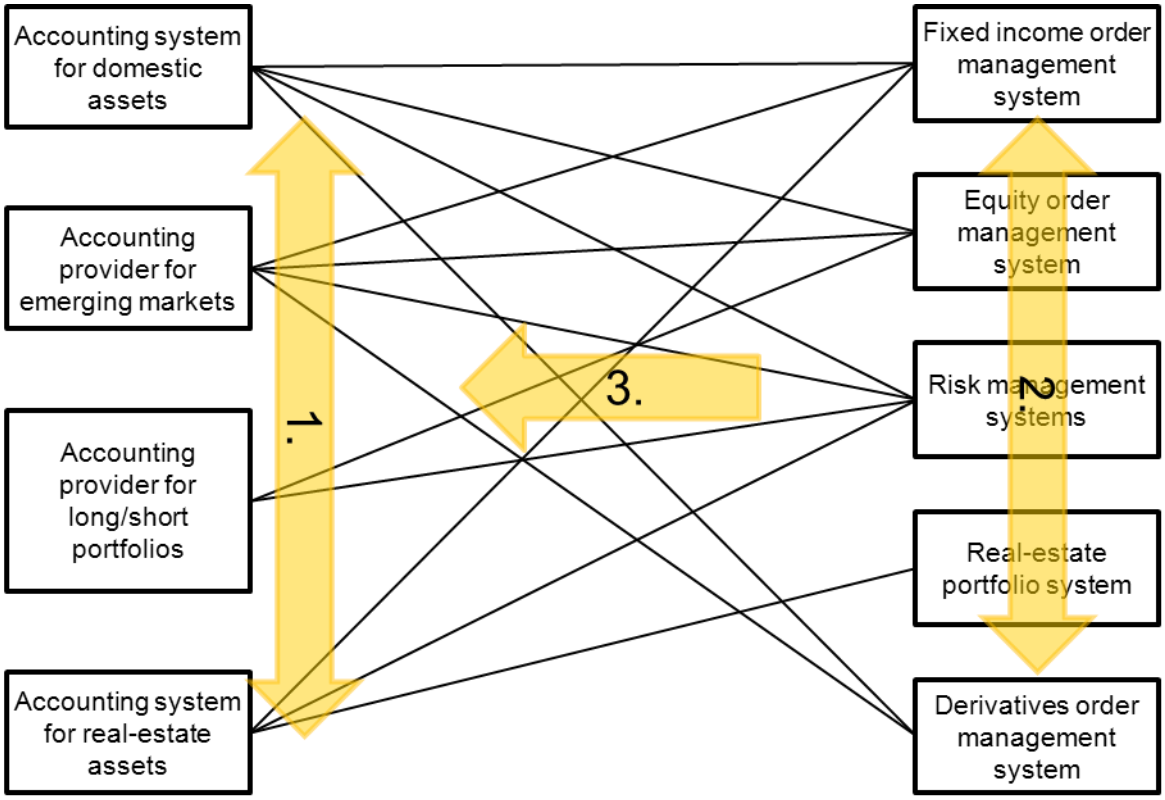
Graph 8 shows the extent of this many-to-many situation with two-thirds of firms having multiple investment systems and half the firms having multiple accounting systems/providers with over a third of firms having more than one accounting source and more than one investment system.

Graph 8 - Multiple investment and accounting systems



This can result in taking multiple accounting positions into a single investment system or single accounting positions into multiple investment systems or both as depicted Figure 10.

Figure 10 – The many-to-many data relationship



This presents a number of distinct data management issues:

1. Collecting data from multiple sources and ensuring these are consistent in terms of content, granularity and timing. Generally, this forms part of an internal start-of-day process using technology solutions that sits at the boundary between the investment solutions and the accounting systems and providers. This is the area shown as 1. in Figure 10 above.

   A less common approach is to appoint one of a number of accounting and operations outsource providers as the primary source of accounting data with the responsibility of collecting and verifying the data from other outsource providers. This can be a holistic arrangement where the primary provider sits across all other providers or a point solution where the primary provider sits across a few of the more specialist providers. In every case, this is an expensive solution to ensure that the position data is consistent.

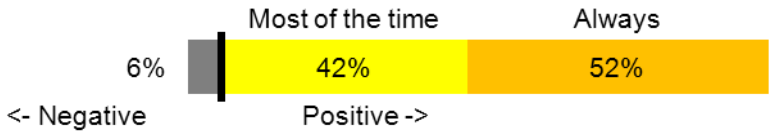
   "[start-of-day] should we automate it, yes, will we, no - there are too many higher priorities" – COO Comment

2. Significant processing overhead in reconciling between internal systems that calculate store or process data on different using different methods. This is the area shown as 2 in Figure 10 above.
3. Although not so common some firms will calculate or acquire data in the investment systems and pass it back to the operations or accounting teams. For example, effective exposure might be stored in the investment systems and passed back to the operations teams to be included in post-trade compliance. This is the area shown as 3 in Figure 10 above.

Although this represents a significant challenge most firms believe they achieve a very high level of consistency across their position data. As one COO remarked – *"It isn't that we get it wrong often, we are actually quite good but it's a lot of effort in a short period of time by some very dedicated staff – should we automate it, yes, will we, no - there are too many higher priorities".*

This is confirmed by nearly all firms believing they achieve high levels of data consistency as shown in Graph 9.

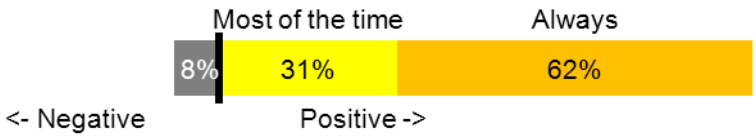
Graph 9 – Level of data consistency achieved by firms



To gain greater support for a diverse range of instruments many firms have favoured an investment systems architecture which effectively aligns asset classes to systems. This is done to take advantage of the strengths in certain systems supporting certain asset classes but this is also likely to include differences in the way specific instrument data is handled. As Graph 10 indicates most investment firms are confident that at an individual systems level the assets are completely and authentically represented.

"if there was anything more than minor issues with our investment position data our business would be in significant trouble." – COO comment

Graph 10 - All assets in the position data are complete and authentic in all systems



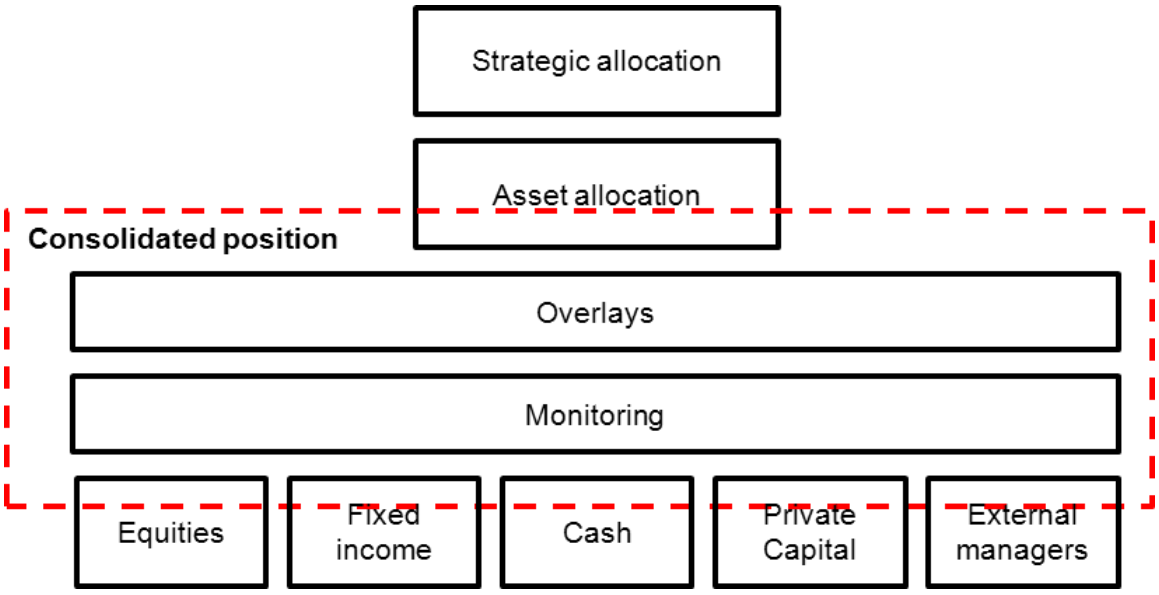
However, because this model is rarely pure, with firms ultimately representing the same instruments in different systems, issues start to surface when these are then brought back to be included in a consolidated position.

For example, supporting multi-asset class investment where investment exposure to multiple asset classes is provided through a single investment product. Typically this will mean a product will combine asset allocation with a number of discrete investment strategies in different asset classes. These asset classes could consist of fixed income, equities, cash, direct private capital, investments in other funds through a multi-manager strategy as well as having derivative exposures and overlays. Historically where firms have needed to support products made up of multiple asset classes, such as balanced funds, it has been possible to split these up into asset aligned portfolios and manage these asset pools in specialised systems. However, multi-asset class investing requires proactive management at a consolidated level and this quickly becomes difficult when the assets are dispersed across different systems. Simply a technology strategy built to support balanced funds where the asset allocation was fairly static is unlikely to adequately to support a more dynamic multi-asset investment strategy.

Firms who have or are launching these kinds of products are running the process across multiple platforms. Typically the main components are:

- A system to perform the top level strategic allocation to various risk profiles.
- An asset allocation system used to allocate and mix the risks across asset classes.
- Systems used to calculate and monitor exposures.
- Systems used to apply risk adjustment overlays.
- Systems used to manage the individual portfolios.

Figure 11 – Consolidated view for multi-asset class products



Typical issues firms face are:

- Getting consistency of positions across all systems is challenging and is more critical for these products because of the need to manage the risk overlays across all the asset classes as depicted in Figure 11.

- Some of the data requirements are especially difficult to source in a timely manner, for instance where firms have allocated to other managers it can be difficult to see the complete underlying asset exposure, that is, it is difficult to create the look through.

#2: Consistency – Improving management information reporting

Managing and reporting on distributed data is far more difficult than managing data in a central location. However, for many investment firms centralising the data is simply not currently possible which means there needs to be careful management and monitoring of position data.

Position data is made up of two major data components:

- **Security position data:** this is only affected by the investment teams own trading activity or from corporate actions.
- **Cash position data:** This is affected by a number of different events such as income from coupons and corporate actions; fees (management/administration) and client flows. Additionally, derivatives have initial and on-going margin variations which are harder and often need processing before being stored.

There are four main states in the position lifecycle:

- **Estimated:** where the positional data has been adjusted for an event or driver but the exact details are not yet known and there may be some uncertainty over the certainty, timing and effect of the event or driver. For example, positions may be updated to reflect the inclusion of a stock dividend but the exact amount is yet to be declared.
- **Committed:** where there is a level of certainty (and commitment) to a position change but this has yet to become contractually binding. For example, a corporate action may have been announced but will not become a contractual commitment until ex-date.
- **Contractual:** where the change in position data is certain with terms agreed. This is analogous with a matched trade.
- **Physical:** represents the records from the relevant custody and bank accounts – the settled position.

Our estimate of the state of the Australian market is in Table 2

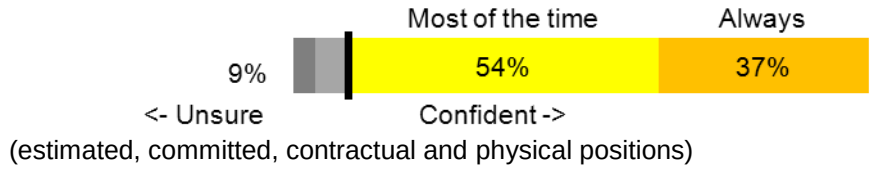
Table 2 - Position lifecycle

	Physical	Contractual	Committed	Estimated
Security Positions	✓	✓	✓	✘
Cash Positions	✓	✓	-	✘

All investment firms store positions across multiple platforms with supporting processes to ensure that actions and events are consistently applied. Broadly the industry practice it to have a core set of processes used to construct the bulk of the initial investment position and have supporting (sometimes manual) processes to complete the IBOR. None of the investment firms saw the need to track every item through every event and preferred the approach of reconciling the various positions and relying on the investment system to track changes throughout the trading day with other events dealt with on a materiality or business importance basis. Over 90% of investment firms are confident they capture and manage the material events through the lifecycle.

This is shown in Graph 11.

Graph 11 – Level of full position lifecycle correctly represented and reported



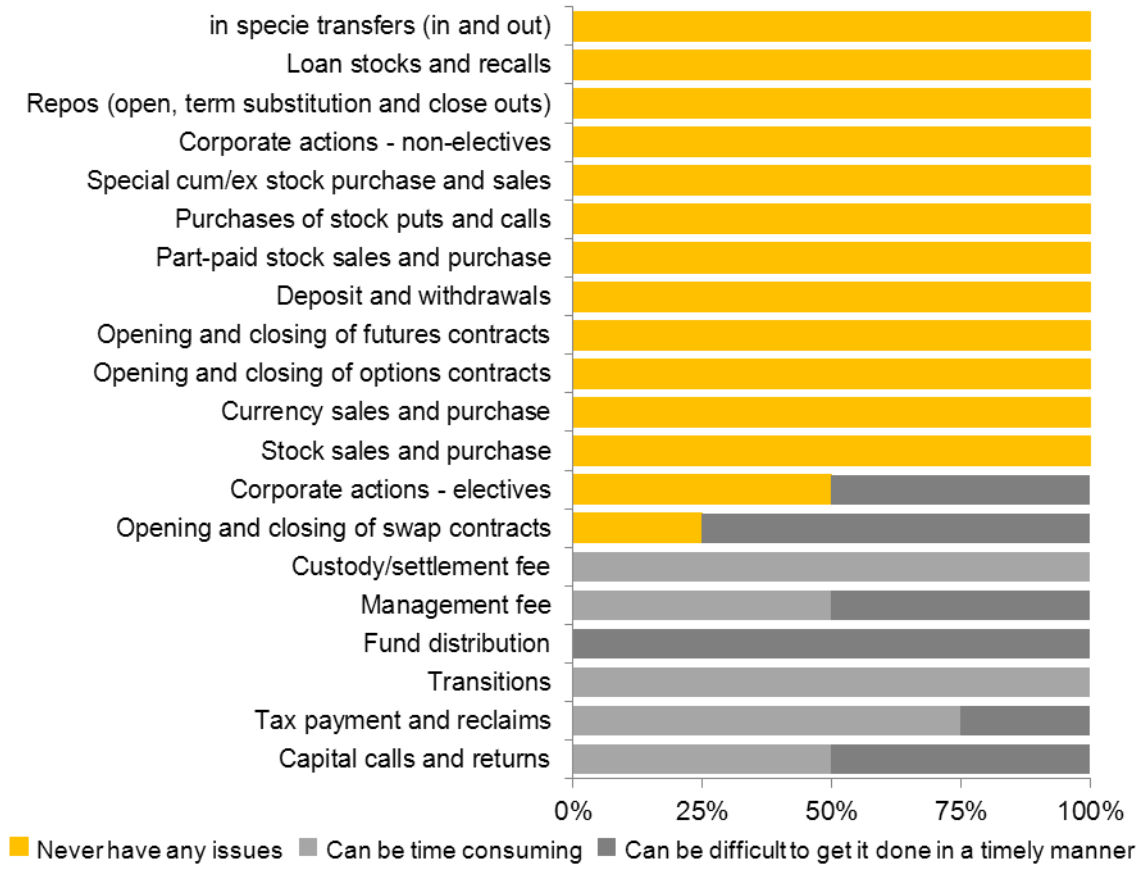
However, not all drivers are fully captured particularly where these relate to isolated or less certain events, such as:

- Ensuring the expected future effect of corporate actions on the IBOR often involves manual updates by making direct changes to positions in the investment systems. Challenges exist in ensuring these updates are consistently reflected in all the investment systems and are reflected appropriately in the accounting records.
- Material intraday events made in upstream systems need to propagate into the investment systems. The way firms approach this varies with some automation but many firms rely on manual process driven by materiality and business importance.

#3: Complexity – dealing with position drivers outside of a firms direct control

Generally firms are comfortable with the way most security positions are managed as can be seen in Graph 12 – the yellow bars. The issues highlighted are mainly where an external party is involved in the process – the grey bars - with many investment firms not being convinced that these would benefit from any further technology or operations investment.

Graph 12 – Pain points



#4: Complexity – dealing with Cash

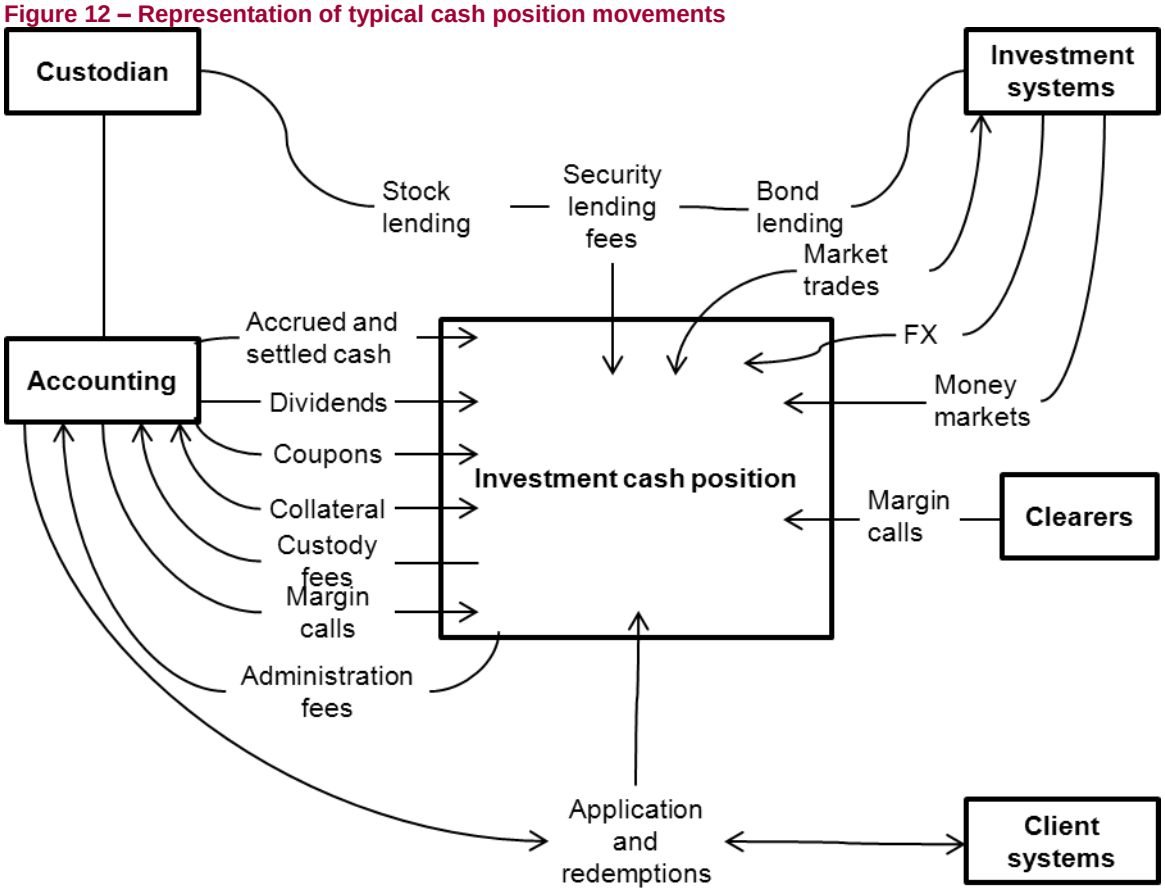
The main areas causing difficulties is the management of cash positions. Investment teams need to know their liquidity requirements and cash positions at the start of the day and these must be kept as accurate as possible throughout the trading day. Typically, as part of the start-of-day process cash will be separated into different pools and organised into the ladders and forecasts. Firms then rely on the order management systems to adjust cash for market transactions throughout the trading day as well as discretionary processes to load any material cash changes that might come from the accounting or client functions.

Unlike security positions which are affected only by the market executions and corporate actions, cash is affected by many different factors and can originate from multiple systems, providers and sources through multiple routes into the firm. Examples are:

- **Dividends and coupons:** although these tend to originate from the accounting systems a number of firms will load an independent feed into their investment systems. To ensure these are consistent the start-of-day processing reconciles data across all the investment systems.
- **Income from securities lending:** firms can outsource the stock lending to their custodians and may also run an internal bond lending program. The income and offsetting collateral from these arrangements creates cash flows in both directions.
- **Margin and collateral calls:** derivatives contracts will have an initial margin and then ongoing variation margins. These may come from the clearers directly or through the accounting systems and providers. For some firms including the effect of collateral is proving extremely difficult to do on a timely basis because the counterparties are slow in providing the data.
- **Client cash flows**: applications and redemptions may come directly to the investment teams, through the client management and sales function and even through the accounting/operations teams. There are timing and certainty considerations too: firms that have an internal distribution function, for instance a wealth management business, are likely to invest cash once it has been committed but only invest cash from other external sources once it is receipted.
- **Trading activity:** this will generate cash flows that need to be tracked. Typically firms will rely on their investment order management systems to track cash balances affected by orders placed in the market. Until these are filled and matched, these represent an estimated position.
- **Accounting cash**: the start-of-day position will include the cash from the previous day's settlement and accrued cash positions. This process tends to be batch in nature and firms will only usually make any intraday loads from the accounting book of record if they deem this to be of high business importance or if it has a material effect.

This means tracking cash positions that is typically distributed across multiple systems, sources and providers is challenging even for the most unsophisticated firms. This is one of the reasons firms favour using database technology to physically corral all these different sources of cash. The complexity of this is depicted in Figure 12 below.

Figure 12 – Representation of typical cash position movements



A number of investment firms highlighted they needed to maintain a certain level of cash tolerances to safeguard against levels of cash uncertainty. Clearly, this is not an overt strategy and for most funds is quite small; however, some firms believed if they were more precise and certain about their cash positions there could perhaps be benefits in reducing the cash allocation in the new product design.

Benefits of change

Simply, the many-to-many challenge is not going to cease and is most likely to become greater. Many of the software solutions are built to improve the way firms can manage this many-to-many challenge and fall into three main categories:

- Database approach where multiple sources of data are brought together verified, normalised and then distributed to downstream systems.
- Single end-to-end solutions with all the data in a single data schema with processes to control the flow of data between different functional areas of the system.
- Investment systems that are enhanced to hold all position data.

All of these approaches provide data management capabilities to help firms manage multiple sources and multiple consumers of position data.

Business benefits

All the firms that had a view about a business case for more investment in IBOR required benefits that would go beyond operational improvements and could contribute to the top line. Most agree position data is highly important but it is also seen as one step removed from providing the direct business benefit. This means it is quite challenging to identify direct business benefits.

Highlights

- IBOR is not seen as a basis to deal with formal client queries and reporting but can play an important role in ad-hoc reporting.
- By providing an independent IBOR firms can have:
  - Better commercial leverage over their outsource providers
  - A best-of-breed approach helping firms expand into different geographies and investment products;
  - The ability to improve time to market
- All investment firms recognise the importance of providing accurate position data to their investment teams and there is a correlation between providing accurate position data and investment outcomes insofar as the more accurate the data is the less time investment managers need to spend checking data and more time making investment decisions which ultimately should lead to better investment outcomes.
- Over half the investment firms believe that accurate investment position data will help other business areas outside of the investment teams.

Better client management

Client management can have a number of distinct disciplines:

- Client relationship management
- Investment consultant relationship management
- Instruction management and execution
- Formal monthly, quarterly and annual reporting
- Query management

No firms believed that they would support any formal client reporting from data that was not suitably certified; generally meaning it must be derived from custody based records. However, it is quite common for investment firms to use the data stored in the investment systems to answer queries and as part of the general relationship management processes. In every instance, there are controls to ensure this data is only used as a guide with appropriate disclaimers.

There is certainly more industry interest in understanding more about the investment positions between reporting periods particularly at the institutional level where it is now common for investment firms to provide raw unprocessed data. The current ad-hoc approach may benefit from a formalisation to avoid embarrassing errors in providing clients incomplete data on an intraday basis.

Improved business agility

Business agility can be thought of as the ability to adapt to business changes and business opportunities in an efficient manner by reducing or removing the barriers to change. Agile firms are able to adapt without having to completely redesign and reorder their business models.

"Not having [outsource provider] in our workflow definitely increases our flexibility" - Head of Investment Operations comments

In the context of IBOR benefits, the investment management firms highlight two distinct agility benefits:

- For firms that have outsourced their investment operations and accounting capabilities a well-designed IBOR solution providing a level of independence could allow firms to have choice of provider. This has two primary commercial benefits:
  - Choice is a strong commercial lever;
  - Choice allows firms to have more than one provider, perhaps in a region, asset class or product type that the existing providers are not particularly strong potentially improving time to market.
- For all firms, having the right data architecture that allows firms to get the data they need to support the introduction of new products or capabilities is key.

Better investment decisions

There is a considerable amount of industry commentary proposing that providing more complete and timely investment position data will directly lead to better investment decisions. All agree that investment position data is one of the most important operational foundations of an investment firm and without it being of sufficient quality the investment managers will be less effective.

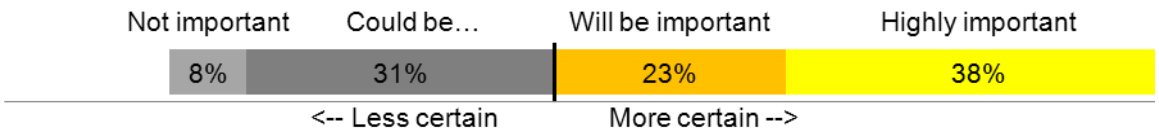
However, in reality the situation is less compelling. Investment teams will not make investment decisions based on uncertain data and are more likely to spend time checking and correcting data if they suspect it to be incorrect. By providing more trustworthy data on a consistent basis is more likely to reduce the amount of time investment teams spend checking data and therefore more time concentrating on investing. This is essentially the argument that improved position data leads to improved investment decisions.

"They'll check it anyway"- Head of data management comments

The investment firms generally concur with this view but also add that it is very difficult to convince investment teams to completely trust the data without any checks. However, there could be benefits in improving the way IBOR data is managed so confidence improves.

Over half the investment firms also believed that improved position data would help other parts of their business more than the investment teams directly. This is shown in Graph 13.

Graph 13 – Improved position data will help other business areas outside of the investment teams



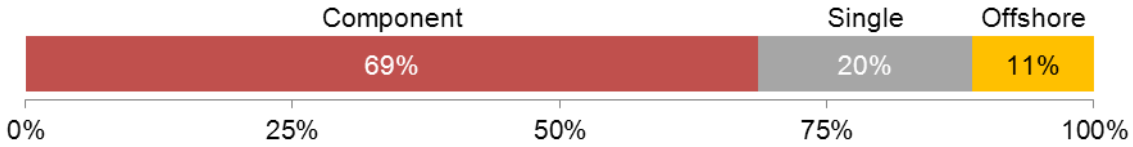
Technology benefits – Architectural improvements

Investment firms in Australia have one of three types of systems architecture:

- A componentised architecture that is built around a specific application supporting specific business functions.
- A single system architecture where the business functionality is largely supported by a single system.
- An offshore model where the systems functionality is provided from another region and the Australian systems footprint is very small.

The types of architecture for firms who participated in this research is shown in Graph 14 with the predominant architectures being componentised.

Graph 14 – Approach to systems architecture



Highlights

- Single system architectures are most likely to include an IBOR; however, a large proportion of the industry use componentised architectures with the IBOR spread across multiple systems. This creates challenges with integration and upgrades.
- There are differing views on whether loosely or tightly coupled architectures are better.

Single systems architectures will most likely include the IBOR; however, in a componentised architecture, the IBOR is found across multiple systems. This means changes made at the component level can impact the investment position data and affects:

- Agility in upgrades – with a distributed IBOR a change in one component requires complete testing across all other connected systems.
- The way new system components are added as this requires a level of integration work.

One approach is to have a separate identifiable IBOR that serves all the other business applications. This provides technology benefits by loosening the application architecture allowing different parts of the business to operate and manage their specific technology platforms. Any upgrades are then either limited to the IBOR or an individual components. The benefits in loosening the application architecture are:

- Able to choose best of breed systems for the investment teams.
- Improve system performance by taking the load off already complex front-office systems.
- Build a systems architecture that is more aligned to the core investment business rather than one based on accounting practices.
- Accounting systems/outsource arrangements can develop with less interdependency.
- Time criticality of the overnight batch can be reduced.

Some believe the best approach is to tighten the application architecture and not have separate systems and build everything into a single end-to-end platform. From an IBOR perspective this

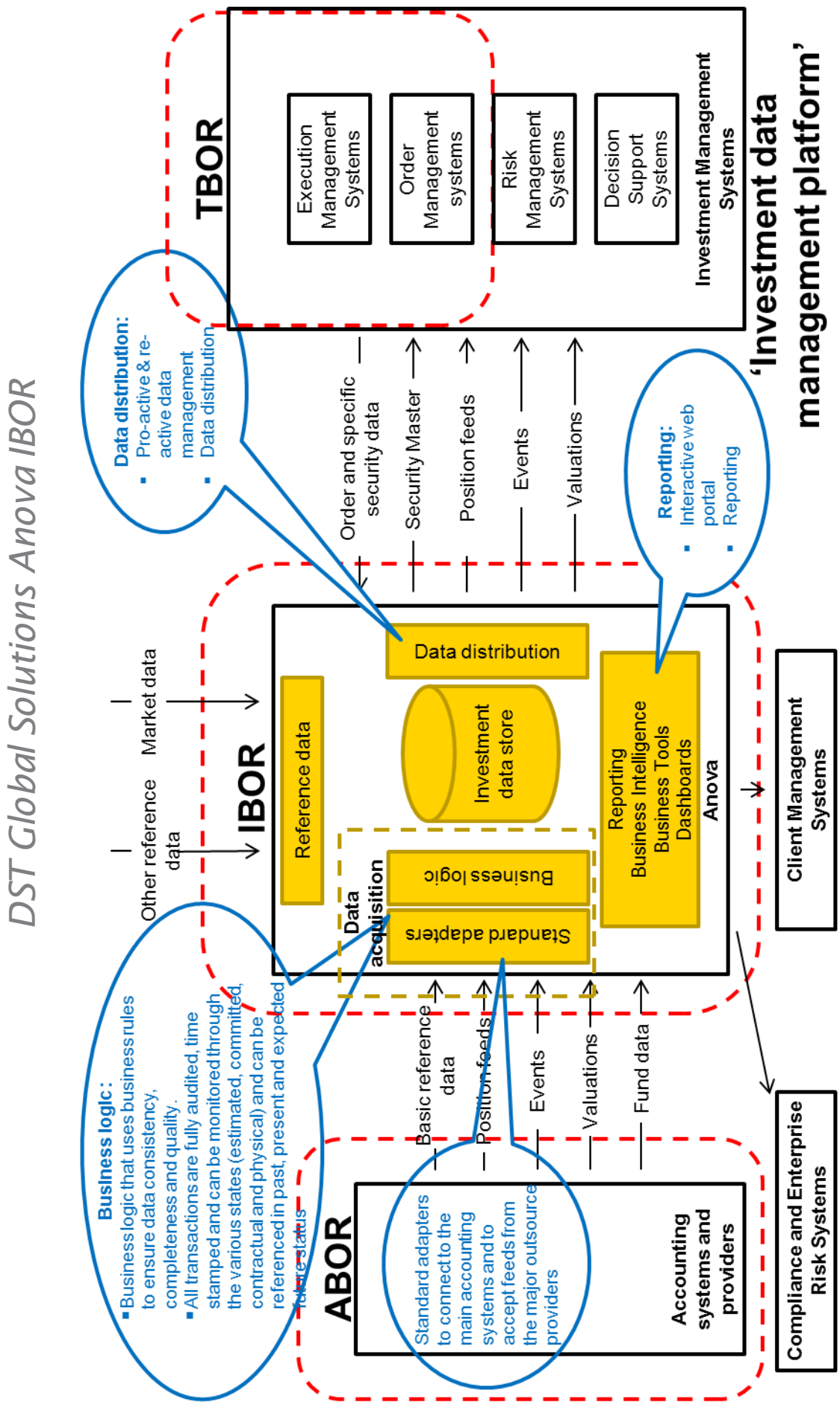
- Supports a data architecture that avoids islands of data.
- Removing the inconsistencies in the way systems treat and process instruments.

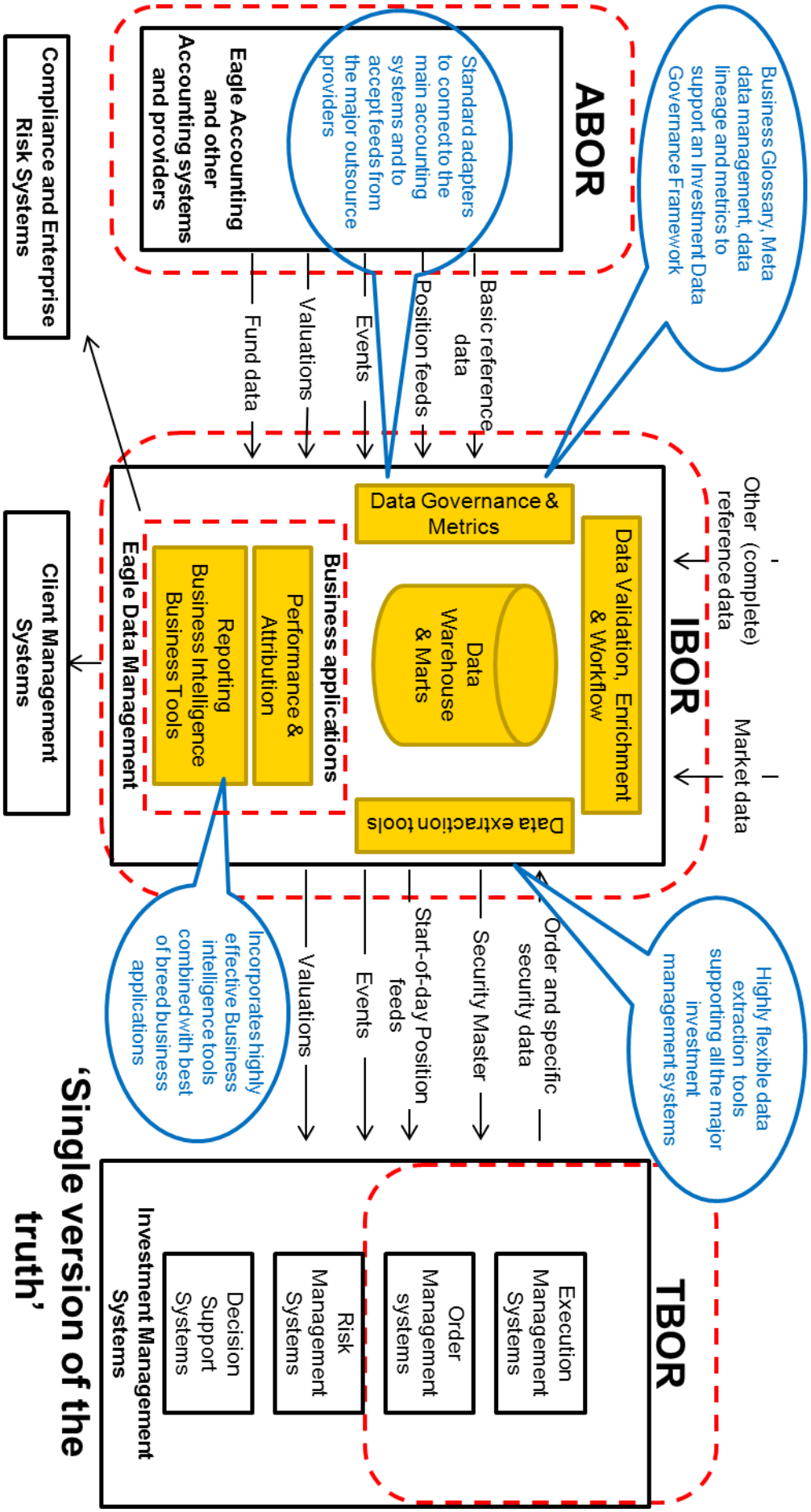
6 The solutions

This section provides a brief overview of the main software solutions as follows:

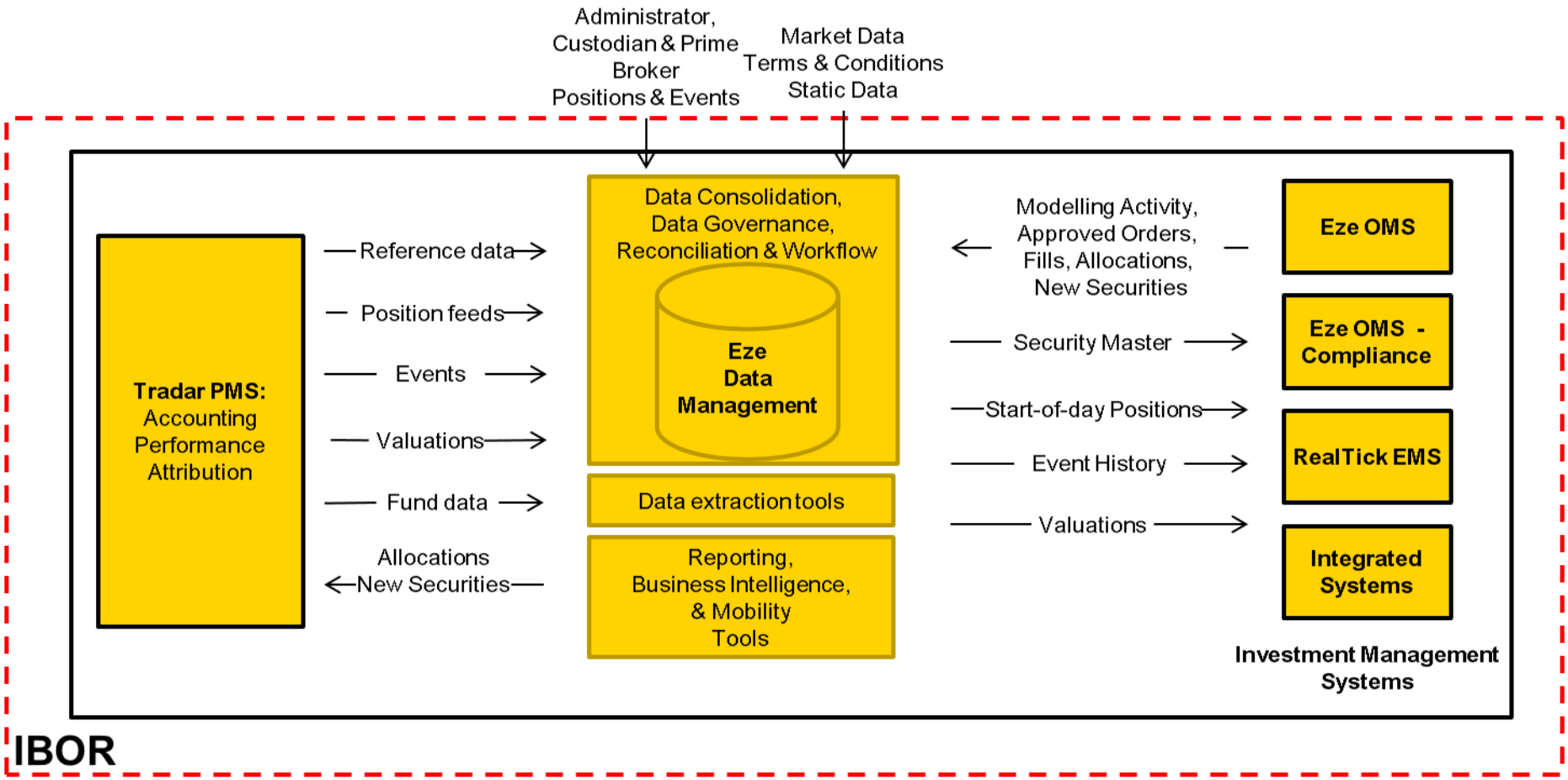
- DST Global Solutions Anova IBOR
- Eagle Investment Systems
- Eze Software Group
- Markit EDM
- SimCorp Dimension

We also briefly consider the role of the Third Party Administrators in providing investment firms with IBOR solutions.

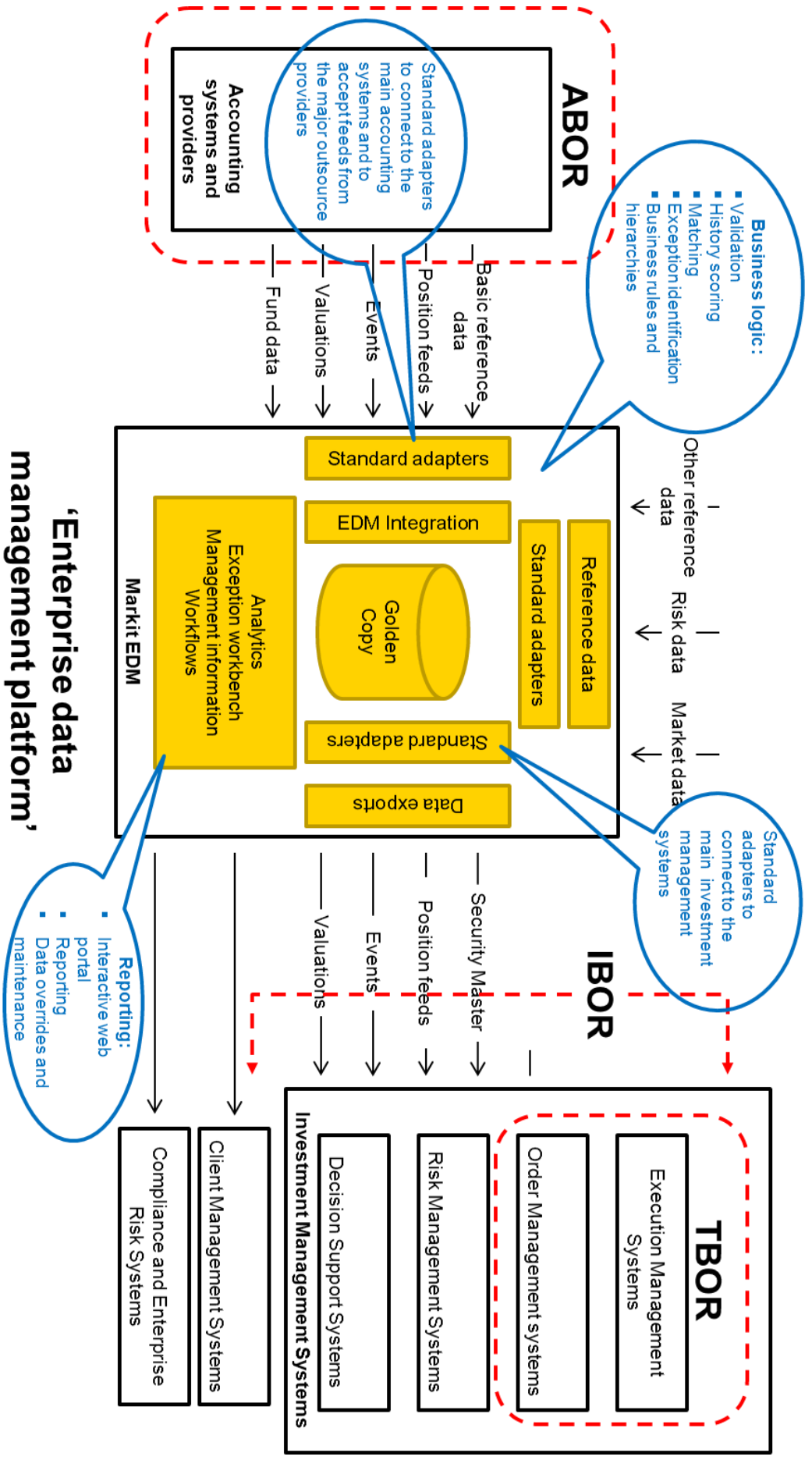




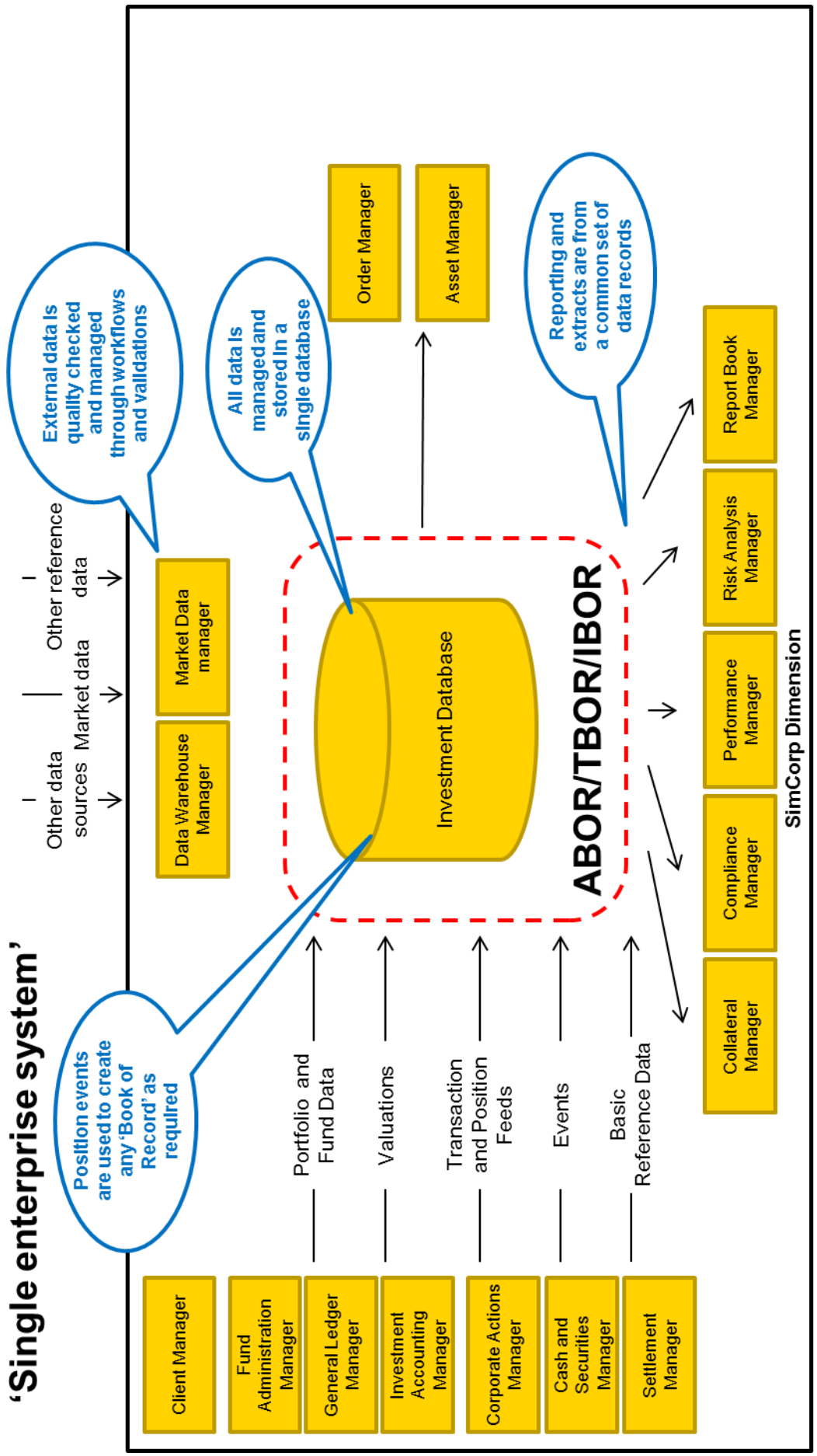
Eze Software Group IBOR Solutions



'Configured According To Client Requirements'



SimCorp Dimension

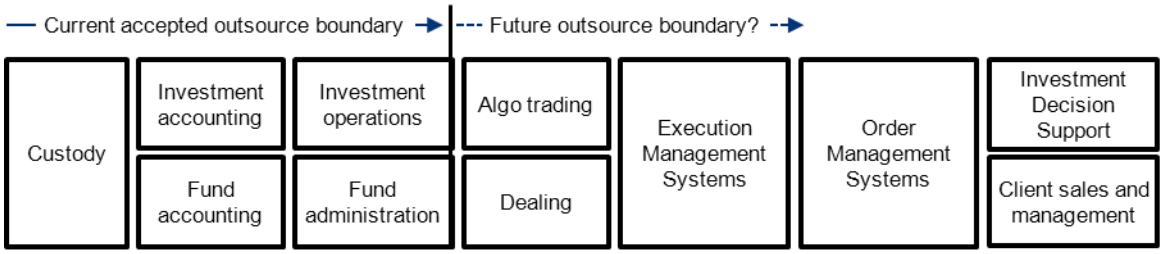


Third Party Administrators

Custodians and other providers of administration services, typically referred to as middle-office services, have significant investment in position keeping systems and supporting messaging and reconciliation systems. Logically, these providers could be seen as an alternative choice to provide investment position data for investment firms.

Most providers are able to provide 'signed-off' accounting, transaction and cash positions within the constraints of their service level agreements. This boundary is fairly consistent across all providers and is depicted in Figure 13 below.

Figure 13 – Outsource provider boundary



The majority of the providers believed that revenue and client 'stickiness' benefits of moving the boundary to provide investment position data outside of the end-of-day accounting feeds did not outweigh the increase in liability. Even if the direct liability could somehow be mitigated the reputational and relationship risks are quite high with no tangible upside.

Some providers would and can providing deal execution services. None provide order or execution management systems directly to their clients and although some thought it is possible most did not believe it would be a something they could justify. The difficulty for the provider in providing the order management systems is that they then have the IBOR challenges – something they are not commercially interested in supporting.

One challenge for the providers is the gradual increase in ad-hoc intraday data requirements coming from their investment management clients. The way most providers are dealing with this is to provide on-line access, typically through a web portal, so that their clients can self-serve. None of the providers are planning to supply anything else significant nor are they being asked.

7 The future

History

Historically, the investment management industry has grown quite dynamically:

- The first investment operations systems were developed in the late 80s to early 90s and were primarily concerned with tracking the physical certificates investment firms held in their fire, bomb and waterproof safes. Over a relatively short period (less than ten years) these developed into complex accounting and record keeping systems and became a dependent source of accounting truth for all investment firms.
- A similar growth in front-office systems evolved from blotters that tracked the orders that had been telephoned through to brokers into complex order management, modelling and in some instances decision support systems.
- There was an explosion in investment complexity through the early to mid-2000s where the diversification in asset classes, use of derivatives and more complex investment processes became widespread.

Throughout this period, the supporting operations and technology teams were expected to keep up with the increasing data demands of the investment teams who became more geographically spread, with firms that could be corporately expanding through acquisition and therefore adding more disparate systems/providers and more demanding clients.

Few firms, if any, had an operations and data plan to support this growth from day one and developed incremental capability resulting in a mixture of different systems and operational processes. The predominant model is based around the accounting end-of-day position and everything currently being proposed is still based on this approach.

The likely roadmap

The evolution of IBOR solutions is most likely going to take a path of continual improvement as depicted in Figure 14 below.

Figure 14 – IBOR evolution

- **Batch:** The market is dominated by the use of a batch operating model where the IBOR is constructed in a series of batch processes typically dependent on the accounting processes to be complete. Firms may run different batches processes for different offices in different geographies. These processes tend to be:
  - Inconsistent across geographies;
  - One-shot in nature
- **On-demand:** A solution that is still reliant on the ABOR for the foundation but is more capable of tracking intraday events and has the ability to refresh the investment systems on-

demand without having to wait for a complex and potentially time consuming batch process to complete. This is an investment systems pull model.

- **Real-time position keeping**: A solution where positional updates are triggered through actions and events rather than relying on batch process. Although this approach is similar to the on-demand solutions it differs because the position updates are triggered through events and are not batched. This model potentially pushes updates to the investment systems.
- **The independent IBOR:** A solution that removes all need to shadow positions in other systems and relies on the ability to track events and triggers to produce an independent IBOR that can be used to feed downstream requirements and provides the ability to view and access a complete enterprise wide view of all positions.

It is difficult to see what will create the momentum to move beyond the ability to provide on-demand positions. Although the step from batch based to on-demand appears to be logical, there are significant technical and operational challenges to overcome. It isn't just the systems providing the data to downstream systems that form part of the batch that need to change but the downstream systems also need to be fundamentally changed .

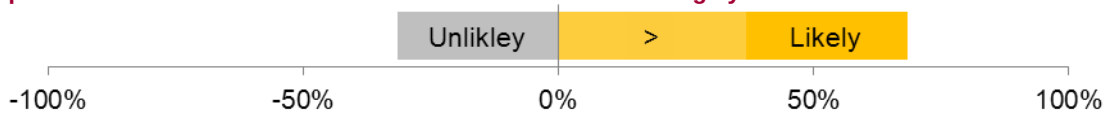
The investment firms' view

There is some market commentary suggesting that the time has come for IBOR to be accepted as a core function similar to investment operations or accounting. This suggests that there will be a significant switch to a standards based environment. There is even a consortium of large investment management firms based in Europe who are developing a set of IBOR standards.

For the Australian investment firms there is still a lack of future predictability and they are not in a stronger position in terms of understanding what the future position data requirements are likely to be now than they were ten years ago. The advantage is the experience gained over that period of time.

Most investment firms believe the best strategy is to choose the most appropriate foundation solution and supplier and continue to adjust and improve the solution in step with the business growth. No firms believed that they need to look for a completely new approach. This is confirmed in Graph 15 where over two-thirds of firms believed that the future IBOR solutions would evolve from their existing architectures with the other third believing it would evolve from solutions already supported in the market.

Graph 15 – Will the future IBOR solutions come from the existing systems architecture?



There are a number of possible future solutions and direction as follows:

- **Data warehouse:** Collating data from multiple sources into a single data warehouse. These systems provide the functionality to collect, verify, normalise and then report and disseminate data.
- **Multiple rolling balances:** Represents specific functionality in the accounting systems that allow journal entries posted into the accounting ledgers to be included in a specific position. This is normally done by time stamping the posting and having the capability to read/extract/use this data based on the posting rule. Therefore, it is possible to take a 'snapshot' of the position at any point in time.

- **Real-time trading platform:** where the IBOR is maintained within the front office trading system with real-time updates from market and trading events as well as feeds from accounting and client systems. This approach is not without challenges especially in systems architectures where there are multiple trading platforms are aligned to asset classes.

  There are two alternative approaches evolving:

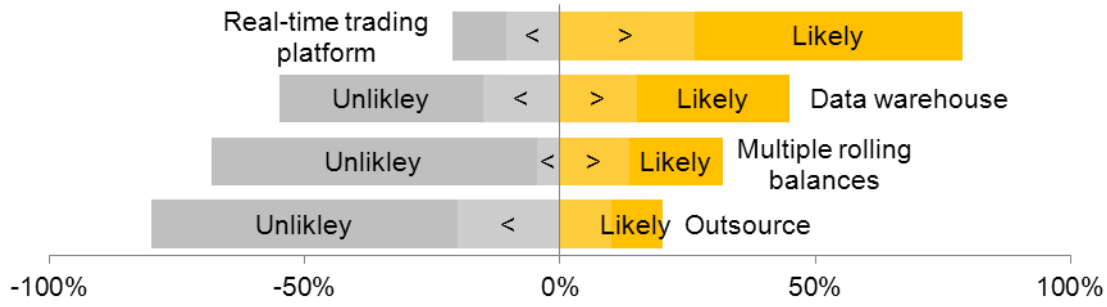
  - **Master-slave:** where one trading system is the primary position keeping system and this receives updates from the upstream accounting systems, tracks events and feeds other trading systems.
  - **Persistence:** where the trading system no longer depends on an accounting refresh and maintains a position independent of the accounting system.

  It is the persistent model that a number of investment firms are expecting to provide future capability.

- **Event driven:** a system that constructs the IBOR based on position event drivers detected and received from other sources. This is a very complex and data intensive approach and to be effective needs to be a full solution, that is, it would be difficult to apply partially. The likelihood is that only very large investment firms (bigger than those in Australia) may contemplate this approach.
- **Outsource:** third party administrators providing an IBOR solution.

Few investment firms believe the future solution will be provided by the outsource providers which is probably good as the outsource providers are not interested in providing this service either. Investment firms believe that the most likely solutions will either be based on a data warehouse or a real-time trading platform as can be seen in Graph 16.

Graph 16 – Where do the investment management firms think the future IBOR will evolve from?



The independent IBOR

Most of the solutions in place today are based on enhancing and enriching an end-of-day accounting position to create a start-of-day position which is maintained throughout the trading to reflect the trading activity and any material events that the firms sees fit to include. This potentially creates data integrity issues with competing sources of truth and data gaps.

None of the Australian investment firms acknowledged this as a significant issue for their firms. However, there is a group of large and influential investment firms in Europe who believe that there needs to be a radical rethink in the way position data is managed within investment firms by creating an IBOR that removes the hard dependency on the accounting book of record. Effectively the proposal is to create an independent IBOR driven from events in other systems and from other sources.

The obvious benefits are the ability to create and maintain an investment position without a hard dependency on upstream and downstream sources and the ability to provide an alternative source of truth to reconcile data against.

The obvious disadvantage is that there are currently no commercial solution available in the market.

Real-time position keeping

There is a lot of industry discussion about the requirement to provide real-time position data. In this research there was nothing to suggest that the investment firms were seeking to introduce real-time position keeping data, certainly many firms were not interested and some actually thought it would be an unwelcome distraction.

The likelihood is that the industry will start to move from a high dependency on fixed batch processes typically run at the start-of-day to an on-demand capability allowing investment firms to refresh the investment systems as required.

The benefits are to allow investment firms to:

- Increase flexibility to allow better for support for more geographic locations
- Increase resilience by being able to run the start-of-day processes multiple times to incrementally construct the positions if there are issues with the accounting systems/data.
- More discretion to allow an intraday update when there are material events.

The important differentiator is the removal of the need to wait until long batch processes complete which is theoretically possible in all the IBOR models with varying degrees of change needed in the upstream and downstream systems. Some believe this could be achieved in the order management systems as an extension to the way these systems currently manage real-time market data and maintain the TBOR. However, there are questions whether building a complete IBOR in the investment systems that is insulated from the ABOR is really feasible.

Despite all the market commentary few investment firms are demanding real-time position data preferring to have the control to update systems as required. Even firms who have technical architectures already capable of real-time updates choose to keep the discretion to refresh their investment systems.

A few investment firms believed that real-time data would actually be a distraction expressing the view that there is already enough information changes that the investment teams need to track without adding more. Some firms believe it is more important for their investment teams to spend their valuable time analysing markets and fundamentals and do not welcome the distraction of frequently changing data.

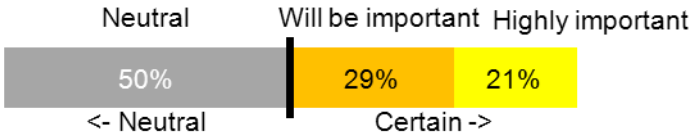
Supporting increased regulatory reporting requirements

Regulatory reporting

With a regulatory environment frequently changing and evolving it is difficult to predict future reporting requirements. This is reflected in the opinions of the investment firms with half having a

neutral opinion on whether better IBOR solutions will provide benefits for regulatory reporting and only 21% believed it would be highly important.

Graph 17 - The role of investment position keeping data for regulatory reporting



Although most regulatory reporting requirements are supported from historical data there are some that may have an intraday reporting requirement, for example, substantial shareholding notices. The conundrum for investment firms is if there are new regulatory requirement that cannot be satisfied by historical data - would investment firms be comfortable in supplying this data from highly dynamic data that is sourced from a number of different systems or would this force firms to adopt other approaches?

8 Sponsors

We are very grateful to the five sponsors of this research who are very committed to providing data management solutions to the Australian market. In this section we provide their views of the benefits of their solutions can provide.

DST Global Solutions

About Anova IBOR from DST Global Solutions

Maintaining an Investment Book of Record (IBOR) is an operational goal for major investment managers seeking to improve front office decision making. An Investment Book of Record provides an updated intraday view of a firm's stock and cash positions enabling organisations to make investment decisions based on updated position activity wherever – and in whatever system – that activity has occurred. Anova IBOR provides the key features needed for organisations looking to advance their position management capability and improve position data quality.

Key Benefits of Anova IBOR

Maintaining an Investment Book of Record provides key benefits to the entire organisation including:

- **Better information for investment decision making:** Anova IBOR provides investment professionals, fund managers and portfolio managers with the intraday stock and cash position information they require in order to make informed investment decisions.
- **More effective cash management:** Anova IBOR provides current and anticipated views of investible cash allowing portfolio managers to optimise their cash positions.
- **Exposure management:** Anova IBOR allows the middle office to understand exposures to asset classes, geographies, brokers, counterparties – or any entity –intraday.
- **Business reporting:** clients and senior managers are increasingly demanding up to the minute reports and Anova IBOR provides extensive position data intraday which allows meaningful and current reporting.
- **Reducing operational risk:** where firms have outsourced to one or more providers they risk not knowing their positions in event of failure at the outsourcer. Anova IBOR acts as an insulation layer and allows the firm to change outsourcers more easily preventing lock-in to a single provider.

Key features of Anova IBOR

- **Real time position keeping:** The Anova IBOR engine constantly recalculates positions and captures any new event that impacts positions. Within the engine, positions are recalculated immediately and made available to all IBOR consumers.
- **Intraday snapshots:** Anova can produce intraday snapshots of IBOR scheduled to run at specific times or ad hoc as required by the business.
- **IBOR reflects all events:** Anova IBOR consumes all events that impact positions including trade events, corporate actions, subscriptions and redemptions.
- **IBOR dashboards:** Anova contains a number of dashboards specifically developed for IBOR which allow the user to view positions at a glance and to drill down to specific transactions.
- **Multiple position states:** Anova maintains different trade statuses (estimated, executed, confirmed and settled) enabling position interrogation by state.
- **Forward looking:** Anova allows the user to look at future views of positions based on all information known in the present.

- **Historical store:** Anova contains a historical data store so that retrospective positions can be created allowing for analysis of earlier decisions.
- Integration: Anova contains an extensive integration framework allowing it to interoperate as standard with third party systems.
- **Independence:** Anova IBOR is independent of the OMS, middle office, investment account systems and/or outsourced service providers and therefore provides a single aggregated IBOR.
- **Scalability:** Anova IBOR is designed for high volume processing environments and scales well to provide a comprehensive solution for major asset managers.
- **Breadth of asset class coverage:** Anova has comprehensive coverage of asset classes

About DST Global Solutions

DST Global Solutions is at the forefront of providing innovative technology software and solutions to the Australian superannuation, wealth and investment management sectors. DST Global Solutions is a wholly owned subsidiary of DST Systems, Inc. and serves more than 230 client organisations from 12 offices internationally to support our growing client base. As a global provider with a proven track record of over 25 years, we have been providing technology solutions which helps give our clients the competitive business advantage that they need to be successful.

DST Global Solutions helps power the data-driven investment industry with award-winning asset servicing solutions like HiPortfolio® and Anova for investment data management and analytics.

Anova is a suite of software products that offer post-trade data aggregation, performance measurement and analytics, compliance, Investment Book of Record (IBOR), and a range of reporting options including support for APRA regulatory reporting.

HiPortfolio® provides critical fund accounting and post-trade data management functions to help asset servicers and managers remain competitive, efficient and in control of their business. It is the category leader in Australia servicing over 70% of the market.

Whatever we do, our goal is simple: to give our clients a genuine performance edge.

For more information about DST Global Solutions, visit:

http://dstgs.com

http://twitter.com/dst_gs

Or email: Anova@dstgs.com

SimCorp

SimCorp Dimension fulfils all the requirements of an advanced IBOR solution. These requirements cover the capture of data from all source systems in all formats utilising different communication technologies. The IBOR's central function is to use events to calculate positions across the full lifecycle of all asset classes. SimCorp Dimension also provides a range of additional functions, such as position history, lock-down periods, handling updates, cancellations, and decomposition of structured products. In addition, SimCorp Dimension forecasts cash and security balances and contains market valuation and key ratios functionality. All of this requires the advanced business logic that SimCorp Dimension has. Finally, SimCorp Dimension disseminates the information to other systems and offers the end-user his or her own view of the information it holds.

"The greatest business advantage for BMO is that the IBOR provides the most up-to-date position data to drive better portfolio and trading decisions. At all times, the IBOR contains full, accurate information on which our portfolio managers can make investment decisions and traders can trade. The risk of wrong decision-making based on incorrect data is simply too high to continue being ignored."

"The main beneficiary of the IBOR is our clients".

Todd Healy, Head of Investment Operations at BMO Global Asset Management

The SimCorp Dimension IBOR has enabled BMO Global Asset Management to:

- grow fund family by 40%
- on-board 3-4 clients a week, whereas previously, the firm could only on-board 3-4 clients per quarter

About SimCorp

Since 1971, SimCorp has been providing investment and portfolio management software and services to the world's leading investment managers, asset managers, fund managers, fund administrators, pension funds, insurance funds, and wealth managers. Based on its world-class software platforms, SimCorp Dimension and SimCorp Coric, SimCorp provides global financial organizations with the tools they need to mitigate risk, reduce cost, and enable growth. Listed on the NASDAQ OMX Copenhagen, SimCorp is a global company, regionally covering all of Europe, North America, and Asia Pacific.

SimCorp Solutions

SimCorp's solutions support the complete buy-side investment management value chain or any part of it. Built on a solid foundation of functional capabilities combined with value-added services, our solutions map directly to each and every phase of buy-side investment processing. SimCorp matches its solutions to the way you do business – now and in the future.

SimCorp

SimCorp's state-of-the-art solutions are the result of over 40 years' experience serving the needs of buy-side investment managers.

We offer a series of distinct yet fully integrated functional solutions that optimise your workflows and automate your business processes. We combine these best-in-class solutions with made-to-measure implementation and related services.

With SimCorp, you can choose the combination of solutions that fits your current requirements and allows you to develop and grow your business. You get the best of both worlds: best-of-breed functionality, located within a fully integrated set of solutions. You decide which solutions you need – and when. We will help implement and deploy the solutions to match your specific workflows and processes.

In other words – you chose and implement the solutions you need now. As your business requirements grow, you simply expand the functional usage of the system.

SimCorp Dimension thereby enables your business capabilities to expand at low marginal costs.

Eagle Investment Systems

Eagle Investment Systems, a subsidiary of BNY Mellon, is committed to helping financial institutions worldwide grow assets efficiently with its award-winning portfolio management suite of data management, investment accounting and performance measurement solutions that are delivered over its secure private cloud, Eagle ACCESS℠.

Eagle deploys trusted solutions and services that create operational efficiencies and help reduce complexity and risk for its global client base of over 150 global investment managers, mutual funds, insurance companies, pension funds, sovereign wealth, hedge funds, public funds, broker dealers and private wealth managers. According to global league tables, nearly half of the top 25 largest money managers are Eagle clients and the Eagle platform currently helps manage more than $21trillion of clients' assets.

In the last twelve months, Eagle has been recognized with seven major industry awards including:

- FTF News' Best Buy-Side Operations 2014
- Custody Risk Magazine's Asset Servicing Technology Vendor of the Year 2014
- Best Buy-side Technology Provider 2013
- Ten consecutive years on the FinTech 100
- FSOkx Excellence in Performance Measurement
- FTF News' Best Buy-Side Operations Solution 2013
- FTF News' Best Enterprise Data 2013

Eagle's Data Centric Solution for IBOR

With a data centric approach to IBOR, Eagle clients are provided with a single source of data, and have access to the underlying, granular detail they need to make sound business decisions. In addition, they have the ability to both validate and enrich the data across all of the systems allowing the data to be delivered to downstream consumers as they require – not as the accounting or trading system views it. Finally, because new data is not being created or reprocessed, the risk of inaccuracy is greatly reduced and data is available much faster, reducing latency. With a data centric approach, the entire organization will be using a single, qualified version of the truth, which is a supportable, sustainable solution that balances current and future technology requirements with new regulatory or client-driven demands.

Key Benefits of Eagle Data Management

Maintaining a centralized single version of truth that can be leveraged across the whole organization opens up the ability to:

- **Improve transparency** with data lineage from integration through validation, enrichment, aggregation and consumption.
- **Be efficient** through centrally managing data, removing the need to touch data across multiple systems, multiple times.

- **Reduce operational risk** through seamless operational workflow and exception based processing ensuring all systems are supplied with consistently verified and accurate data, wherever or whatever the source.
- **Be agile** by not being tied to single solutions increasing the ability to support multiple accounting solutions and multiple investment systems.
- **Improve management information** through business intelligence tools allowing business users the ability to access and analyse all investment data including cash and corporate actions.

Key features of Eagle Data Management

- **Technically mature:** with modern technology that can either be deployed at a client site or provided as a software service.
- **Architecturally sound:** simplifying the way systems architectures can be developed with unconstrained scalability and reduced complexity.
- **Data integration:** provides ability to load and verify data from multiple accounting systems and third-party administrators as required with standard capabilities to include intraday feeds when required.
- **Reference Data Centre:** provides the ability to validate and prioritize reference, issuer, pricing & FX, positions and account data.
- **Enrichment:** provides a rules-based engine to enrich cash, transactions and positions data to solve daily business problems, such as creating synthetic positions for exposure performance.
- **Data warehouse:** provides current, time series and historical data storage capabilities with look-through capabilities at the fund and asset levels.
- **Data extraction tools:** provides ability to feed downstream systems through reporting capability leveraging the use of API calls.
- **Reporting, Business intelligence and Business tools:** incorporates all of the tools to support intelligent and complex data query and manipulation.
- **Eagle Ecosystem:** allows you to leverage the value of your data through integration with FINCAD® F3® risk framework, combined with MathWorks® MATLAB® to provide greater transparency and a low cost source of risk and analytic data.
- **Dynamic data:** provides the ability to store data in many states, including estimated, committed, contractual and physical positions.
- **Historical positions:** provides integral data warehouse natively storing historical time series supporting thorough investment performance reporting capabilities with the ability to include benchmarks and yield curves.
- **Access to information:** provides the capability for business users and technical staff through the use of reporting, business intelligence and business tools to extract information from the underlying data. This includes business application, such as investment performance measurement.

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Eze Software Group

Eze recognizes that establishing an IBOR means additional work for an investment firm. Among other things, there are additional interfaces to configure, more data to manage, and new reconciliations to run. To keep the incremental work to a minimum, Eze Software goes to great lengths to understand what a given client really needs from an IBOR solution. Eze Software then works to deliver what that client needs using a combination of its products, including Eze OMS, Tradar PMS, and Eze Data Management. Below are brief overviews of these three products:

Eze OMS

Eze OMS™ is a global multi-strategy order management system that streamlines the investment cycle for all asset classes from idea generation through settlement. The Eze OMS provides functionality to support portfolio modelling and analytics, compliance, trading, and operations and offers intuitive workflows specific to asset class. Today more than 500 buy-side firms use the Eze OMS to manage their investment process.

Tradar PMS

The Tradar™ PMS is a global multi-strategy, multi-asset class, portfolio modelling, management, and accounting solution. It provides functionality to support trade capture, securities and corporate action management as well as external reconciliation. Today more than 200 buy side firms use the Tradar PMS to manage their operational process. Sitting at the heart of your organization, the Tradar PMS manages your entire workflow in a way that is intuitive, scalable, and customisable to your requirements.

Eze Data Management

Eze Data Management is a scalable and comprehensive solution for enterprise-wide data management that aggregates, consolidates, transforms, reconciles, visualizes and distributes your positions, analytics, regulatory, and reference data from an unlimited number of disparate internal and external sources. Consisting of a robust and extensible investment data warehouse, integrated ETL utility, workflow tools, and interactive Business Intelligence dashboards and reporting, Eze Data Management provides a solution that allows for controlled and transparent management of all your investment data, from acquisition, aggregation and enrichment, through automated regulatory filing, reporting, and distribution. Seamlessly integrate with the Eze OMS, Tradar PMS, and other systems including industry-leading accounting and risk platforms to provide streamlined workflows for sound data management, reporting, Form PF regulatory filing, and dynamic data analysis.

About Eze Software Group

Eze Software Group (“Eze Software”) is a premier provider of global, multi-asset class investment technology solutions for the front, middle, and back office. Formed in 2013, Eze Software brings together the proven success of the RealTick® EMS, Eze OMS™, and Tradar PMS teams.

Eze Software Group

Eze Software partners with more than 1,500 buy-side and sell-side institutions in 30 countries across North and South America, EMEA, and Asia Pacific. Its diverse client base includes broker-dealers, endowments, family offices, hedge funds, institutional asset managers, mutual funds, pension funds, and wealth managers.

Eze Software employs more than 800 people worldwide. It is headquartered in Boston with offices in Sydney, Atlanta, Chicago, Dallas, Hong Kong, London, New York, Rio de Janeiro, San Francisco, Singapore, and Stamford. Offering award-winning products and unparalleled customer service, Eze Software Group is committed to providing cutting-edge solutions for your investment needs.

Learn more at ezesoft.com

Markit

Enterprise Data Management

The Markit Enterprise Data Management (EDM) platform puts quality, audited data at the centre of your organisation. We empower those who understand the data to manage the data, regardless of the complexity, volume or scope of the project. Markit EDM builds gold copy masters across all data types, deliver tangible data governance, risk management and compliance frameworks and rationalise legacy architectures. The award winning software integrates with existing architecture, providing an accessible, central platform for cleansed and intelligent data. The Markit EDM platform will manage and enrich the complex data required to feed order management, compliance, performance, accounting and risk systems in a consistent, fully-audited environment. Markit EDM combines business intelligence and ease of use with a flexible, open architecture.

The Markit EDM Solutions Layer represents a fresh approach to Data Management - by combining our market leading Markit EDM Suite with our best practices approach, clients can construct an efficient and effective data management organisation. Indeed, effective data management requires more than just software; it requires a detailed understanding of the uses to which data is going to be put, and a process of implementing a system that ensures the data environment works. The Markit EDM best practices approach is designed to have the flexibility to meet the data management requirements of many different organisations. We work in partnership with our clients to create a data management architecture that meets the needs of the individual institution to deliver accurate, audited and timely data where and when it is needed.

Key Benefits for IBOR

Markit's solution helps firms maintain an Investment Book of Record by:

- Providing access to a unique, trustworthy source of information for better investment decisions: Markit EDM can accommodate all types of data, in particular position, transaction corporate actions, securities and portfolio data. User-defined business validation rules will ensure that the data is accurate and can be trusted downstream, in turn enabling investment teams to improve their confidence in making key decisions.
- Allowing firms to follow the evolution of their business requirements: Markit EDM’s flexible and intuitive approach enables business users to customise what types of rules, hierarchies, validations, exceptions, overrides, workflows, etc. are necessary in order to support their specific requirements at a given time.
- Reducing operational risk, freeing up key resources: Markit EDM will automate most data operations and allow a smaller number of end users to only focus on exceptions or key items that require attention. Moreover, the product will guide such users in the possible actions they can take, reducing the chance of manual errors.
- Removing the dependency on outsourcers or internal systems: Markit EDM can interface with any system or outsourcer in an automatic fashion using any format, therefore acting as an insulation layer.

For more information visit www.markit.com.

Appendix A: List of Figures, Tables & graphs

Figures

Tables

Graphs