

THE ROLE OF TECHNOLOGY WITHIN ASSET MANAGEMENT

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Technology is a key component of asset management, integral to many aspects of the investment process including trading, risk management, operations and client service. Given today's information-rich environment and the importance of technology in accessing markets, every organization that manages assets – whether it's an asset management company or an asset owner who manages its assets internally – uses technology as part of its investment process. Recently, various observers have questioned the role of technology in asset management. Some have raised concerns that the use of a vendor-provided system or modeling tool by multiple asset managers or asset owners could increase systemic risk. In particular, these concerns are based on the precept that common technology could create a “group-think” dynamic where multiple asset managers could make similar investment decisions at the same time, or where a problem with a widely-used model paradigm could lead to an industry-wide misunderstanding of risk. Others believe a single investment system with a large share of the market could potentially lead to vendor risk. While these are important questions to ask, they reflect a misunderstanding of the heterogeneous nature of asset owners and their differing investment objectives, how investors use technology, and the technology choices available to investors.

References to investment management technology often conjure up images of “super-computers” telling investors what to buy or sell. In reality, while risk analytics and decision support tools are part of the suite of systems that asset managers and asset owners use, a core function of asset management technology is to support a massive exercise in data management and information processing. Asset managers require systems to facilitate the maintenance of data and flow of information between multiple functions within the manager, as well as to other entities involved in the investment process, such as trading counterparties and custodians. Technology provides the unseen “plumbing” that ensures information flows smoothly throughout the ecosystem. Further, the landscape for investment management technology is highly competitive, with many competitors and low barriers to entry for new vendors.

A robust asset management process requires both experienced professionals and technology. The use of proven investment and risk management systems provides significant benefits to the financial system. Integrated investment technology enhances the quality of large volumes of data, supports consistent investment workflows and enables timely communications with both internal functions and external parties. In this paper, we trace the role that investment technology plays throughout the asset management process. In addition, we highlight some of the key processes and controls necessary to asset management and how technology facilitates better risk management and decision-making.

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Asset Management Functions

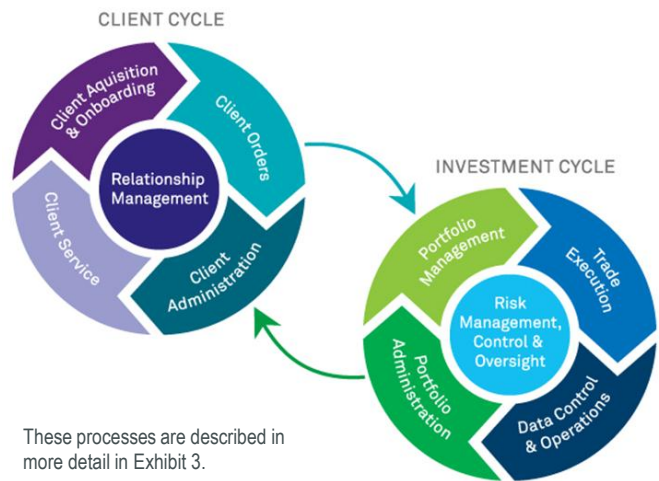
An asset owner, such as a pension plan, insurance company, official institution, bank, foundation, endowment, family office or individual investor, may choose to manage assets directly, to outsource to an asset manager, or to use a combination of direct management and outsourcing. McKinsey & Company estimates that more than three quarters of financial assets are managed directly by the asset owner.¹

Whether investing directly or through an external manager, different asset owners have different investment objectives, different constraints, and different risk tolerances. Pension plans, banks, and insurance companies typically strive to generate sufficient income to meet their projected liabilities, whereas foundations and endowments often seek to maximize long-term returns and preserve principal. The projected liabilities of individual pension plans, banks, and insurance companies differ markedly, leading to different investment objectives and different asset allocations. Likewise, different official institutions have very different charters and thus bespoke investment portfolios. Furthermore, most institutional clients are subject to regulatory and accounting rules which further dictate their investment portfolios.²

Asset managers act in a fiduciary capacity as an agent on behalf of the asset owner, investing the client's assets within specified guidelines for a given investment mandate. Asset managers do not own the assets they manage. The assets are generally held by third party custodians (e.g., banks) selected by these clients. Both in-house and external asset managers live within an ecosystem that consists of multiple players and intermediaries including:

- ▶ Asset owners who make strategic asset allocation and risk tolerance decisions, and often create specific individualized investment guidelines;
- ▶ Intermediaries such as institutional investment consultants and financial advisors who provide advice to asset owners including asset allocation and asset manager selection;
- ▶ Asset managers who manage specific mandates within guidelines specified by the asset owner;
- ▶ Broker-dealers who make markets to buy and sell securities and other instruments by acting as counterparties on most trades;
- ▶ Custodians, who hold client's securities for safekeeping, maintain the official books and records and facilitate trade settlement with counterparties; and
- ▶ Fund administrators and/or accounting agents, who independently calculate net asset values (NAV) and perform additional accounting and reporting functions.

Exhibit 1: TYPICAL PROCESSES AT AN ASSET MANAGER



Other participants in the asset management ecosystem include securities and futures exchanges, electronic trading platforms through which trades are executed (e.g., Tradeweb, MarketAxess, Bloomberg FIT/EMSX) and confirmation platforms through which trades are confirmed with counterparties (e.g., Omgeo OASYS). This ecosystem also relies on a variety of data, including security terms and conditions, ratings, benchmark data, and prices. This data is typically sourced from third party providers of data services or, in the example of ratings, specialty service providers.

Asset managers must process and communicate information between all of these various parties, which requires systems and procedures to receive, process, and transmit information in a consistent, timely and efficient manner. Exhibits 1 and 2 illustrate asset management processes and the asset management ecosystem. While the "Client Cycle" is mostly applicable for third party asset managers, the "Investment Cycle" applies to both third party asset managers and asset owners who manage their assets internally.

1 McKinsey & Company. "Strong Performance but Health Still Fragile: Global Asset Management in 2013. Will the Goose Keep Laying Golden Eggs?"

2 BlackRock. [ViewPoint - Who Owns the Assets? Developing a Better Understanding of the Flow of Assets and the Implications for Financial Regulation, May 2014](#)

Exhibit 2: ASSET MANAGEMENT ECOSYSTEM

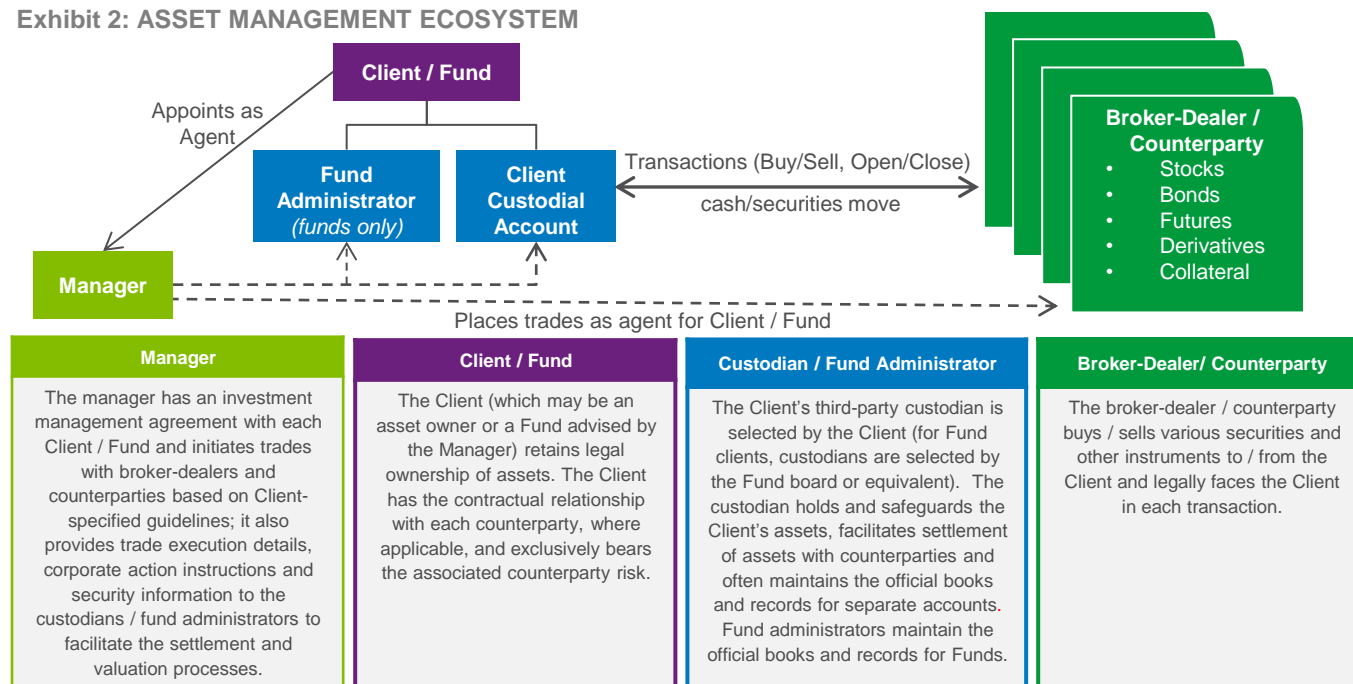


Exhibit 3: ROLE OF TECHNOLOGY WITHIN ASSET MANAGEMENT

PROCESS	TECHNOLOGY NEEDED TO:
CLIENT PROCESS	
Client Acquisition and Onboarding	<ul style="list-style-type: none"> Capture client identifying information and information on fund, investment style (e.g., active, passive), desired outcome (e.g., income, growth), desired risk level/tolerance, portfolio compliance guidelines, regulatory attributes, fee schedules, and client reporting preferences
Client Orders	<ul style="list-style-type: none"> Process subscriptions or redemptions from a portfolio and communicate this information to portfolio managers, who would then invest new cash or raise cash as needed
Client Administration	<ul style="list-style-type: none"> Produce client reports and fund fact sheets based on information contained in the investment system Bill clients based on assets under management (AUM) in the portfolio
Client Service	<ul style="list-style-type: none"> Capture and maintain information on client relationships Provide client service team with timely information on client portfolios to help them address questions and facilitate ongoing dialogue with clients
INVESTMENT PROCESS	
Portfolio Management	<ul style="list-style-type: none"> Provide real-time view of positions, exposures and risks Support "what if" analysis of trade ideas Check recommended trades relative to client-defined portfolio compliance guidelines Communicate orders to traders for execution
Trade Execution	<ul style="list-style-type: none"> View all orders and identify merging/crossing opportunities Send trades to counterparties or execution platforms Check compliance on potential trades Take in and allocate fills from placed orders
Data Control and Operations	<ul style="list-style-type: none"> Receive and load data from third party vendors, including securities, benchmarks, ratings, prices Capture organization-specific data such as internal ratings and sectors Confirm trades with counterparties (typically broker dealers) Communicate trades to custodians, typically via the SWIFT network, and in some cases, communicate trades to fund administrators/accounting agents and to clients Take in information on corporate actions from custodians or data providers and process these changes Manage derivative collateral and margin requirements of cleared and over the counter (OTC) derivatives Communicate cleared trades to Central Counterparties (CCPs)
Portfolio Administration	<ul style="list-style-type: none"> Reconcile cash balances against the records of the custodian Calculate portfolio net asset values (NAVs) and performance Produce performance attribution analysis to allow portfolio managers to understand the decisions driving portfolio returns
Risk Management, Compliance and Oversight	<ul style="list-style-type: none"> Oversee portfolio-level and firm-level risks and exposures Ensure portfolio risks and returns are in line with client-defined objectives Monitor and manage pre-trade and post-trade compliance exceptions throughout the investment process

Role of Technology in the Investment Decision Making Process

Technology supports asset managers in the decision making process, primarily by organizing up-to-date and critical data on portfolios including whether holdings comply with client-stipulated investment guidelines, risk exposures and risk analytics. However, technology does not tell investment professionals what to do. It does not, for example, recommend the optimal level of risk in a portfolio, but rather technology helps investment professionals measure their risks relative to the risk and return objectives specified by clients. While the underlying risk models used in the systems provide important information, there are many other factors that are equally, if not more, important in driving investment decisions. This includes the underlying client's investment objectives, portfolio strategy (e.g., active vs. passive), security indicative data, rating agency ratings, benchmark constituents and weightings, media reports, broker-dealer research, and a manager's own internal research/ratings, among other factors. Additionally, risk models, even those commonly used by multiple asset managers, are "run" differently as they are highly configurable with switches, dials and underlying assumptions, typically customized as specified by a given investment organization.

In order for asset managers to responsibly invest on behalf of their clients, they need robust processes to manage and maintain the tremendous volume of data and information required to have an informed view of the client's current portfolio and risk profile. Historically, asset managers have relied on homegrown technology solutions often used in conjunction with manually maintained spreadsheets to accomplish this. As the landscape has become more complex, the effort required to load, cleanse and process the information needed to support the investment process has increased significantly. Just a few examples include:

- ▶ Managing hundreds of thousands of security level prices from external pricing providers (e.g., Bloomberg, Thomson Reuters, IDC, etc.)
- ▶ Managing benchmark indices from third party providers (e.g., Barclays Global Aggregate, Russell 2000); each benchmark typically contains thousands of constituents, and a typical asset manager can utilize hundreds of benchmarks on behalf of its clients
- ▶ Maintaining millions of security terms and conditions data across client holdings in both the portfolio and its benchmark
- ▶ Reconciling cash balances and position amounts known to the asset manager with the "official books and records" at the custodian and/or fund administrator

Increasingly, asset managers are looking to implement automated solutions to manage this data. Their goals are to reduce data errors emanating from manual processes, to eliminate the need to reconcile data across systems, and to allow investment professionals to focus their time on making investment decisions using sound and reliable data.

The Decision to Build vs. Buy

When implementing technology systems, asset managers must decide whether to build a system internally, integrate multiple vendor products into a combined system, or use one centralized vendor system. Each of these options has its own advantages and disadvantages, as described in Exhibit 4 on the following page.

In summary, at a high level, internal builds provide the most control and the least vendor risk. However large systems are often cost prohibitive to build, maintain and enhance, and have material execution risk. As a result, reliance on internally built systems is becoming less common. While there are proponents of the multiple vendor approach, the flexibility it provides is often overshadowed by data issues, the need for manual processes (and the related risk of human error) and ongoing requirement for multiple internal reconciliations. The centralized vendor system approach offers a good balance of efficiencies and controls, and high quality, reliable data that is achievable at reasonable expense only through the benefits of scale. This approach allows asset managers to benefit from the collective intelligence of the community of organizations using that same underlying technology, if system enhancements are made available to all customers.

Asset Management Technology Vendor Landscape

The market for asset management technology is highly competitive, with many vendors, relatively low costs of moving from one vendor system to another, and relatively low barriers to entry. Examples of asset management technology vendors and systems:

- ▶ **Order Management Systems** (typically cover portfolio management, trading and operations) – Bloomberg, Charles River, Simcorp Dimension, Fidessa LatentZero, Linedata, Eze Castle
- ▶ **Risk Analytics** – FactSet, MSCI Barra, Markit, IDC BondEdge, IBM Algorithmics, Barclays POINT, Citi YieldBook, UBS Delta, Wilshire Axiom
- ▶ **Performance and Accounting** – Princeton Financial Systems, SS&C CAMRA, Simcorp Dimension, BNY Mellon Eagle, Portia

Exhibit 4: PROS AND CONS OF BUILDING VS. BUYING

	PROS	CONS
Build Internally	<ul style="list-style-type: none"> • Full control over systems, technology decisions and development process • Systems tailored to the specifications of the business • Reduced vendor risk in exchange for higher levels of direct responsibility for operational outcomes 	<ul style="list-style-type: none"> • Expensive to maintain and continually enhance to support new market requirements, products and practices • Difficult to attract talented financial modeling and system development professionals • Doesn't benefit from "battle-testing" by other industry participants • Typically longer time to market, with higher execution risk
Integrate Multiple Vendor Products	<ul style="list-style-type: none"> • Mitigates single vendor risk • Different groups within the organization have autonomy to choose a system that best meets their individual needs • Benefit from "battle tested" point solutions used by others in the industry 	<ul style="list-style-type: none"> • Only as strong as the weakest system/vendor • Lack of integrated audit trail across investment process • Need for multiple interfaces and translation of data between systems increases operational risk • Requirement to internally reconcile basic information including positions and trades • Difficult for risk and compliance function to oversee all parts of the process and get a consolidated view across the business
Centralized Vendor System	<ul style="list-style-type: none"> • All parts of the organization looking at the same information • Full and timely information transparency to support risk and compliance function • Allows audit trail across entire investment lifecycle • Benefit from "battle tested" system used by others in the industry 	<ul style="list-style-type: none"> • Higher reliance on single vendor • Requires organizational discipline and commitment to get all parts of the business using a common system • Less control to customize systems for special needs

Trends Impacting Asset Management Operating Models

Recent trends impacting the asset management industry are increasing the need for data and process centralization, both of which are supported in the centralized vendor system approach. In its recent publication, *Global Asset Management 2014: Steering the Course to Growth*,³ The Boston Consulting Group listed five "disruptive trends" that asset managers should consider as they design a target operating model and associated technology infrastructure. These trends are: (i) regulatory change, (ii) the digital and data revolution, (iii) more demanding investors with a growing preference for non-traditional assets, (iv) new competitors providing non-traditional assets, and (v) globalization. Information and observations about these trends and their implications on asset management operating models can help provide insight into the benefits of technology in optimizing outcomes for asset managers and their clients alike.

1. Regulatory change – Regulations, including the Dodd Frank Wall Street Reform and Consumer Protection Act (Dodd-Frank) in the United States, the Alternative Investment Fund Managers Directive (AIFMD) and European Market Infrastructure Regulation (EMIR) in Europe, among others, are requiring asset managers to report enterprise-wide information that can be difficult and expensive to aggregate in the absence of a centralized system. For example, Title IV of Dodd Frank requires managers to provide quarterly or annual reports containing hundreds of data points for each impacted portfolio as well as the overall investment organization (e.g., Form PF, Form PQR), while EMIR requires T+1 reporting of all derivatives trades across the entire organization. Beyond data aggregation and reporting, regulations are impacting the way instruments are traded. For example, Dodd Frank requires that interest rate swaps (IRS) and index credit default swaps (CDS) trading with "US Persons" clear through a central clearing counterparty (CCP) and thus margin on a daily basis. To properly support this requirement, asset managers need to combine derivatives modeling, trading, operations and reconciliations on a single system, and build connectivity to dozens of new platforms and intermediaries.

³ The Boston Consulting Group. *Global Asset Management 2014: Steering the Course to Growth*, July 2014.

2. The digital and data revolution – In recent years, trade execution has become fragmented as broker dealers have reduced inventories of securities following the financial crisis, and as the use of electronic trading has increased. At the same time, there is an increasing amount of trading data available to help traders understand their transaction costs. This has led many asset managers to create teams dedicated to trade execution (separate from portfolio management teams making investment decisions). The use of centralized technology supports communications of order instructions between portfolio managers and traders. This allows asset managers to create a global trading function leveraging centers of excellence to route orders to specialized trading desks to achieve better execution for clients. Also, orders can be passed to additional regions at the end of a local trading day to increase efficiencies and probability of execution in times of declining or constrained liquidity.

3. More demanding investors with a growing preference for non-traditional assets – The low yield environment of the past few years has led to an increased focus on “solutions” or “outcome-oriented” investment mandates, as well as increased demand for alternative asset classes (e.g., real estate, private equity, hedge funds). As opposed to traditional single asset class portfolios managed against a market benchmark, these mandates often require the combination of multiple asset classes within a single client portfolio. Supporting multi-asset class mandates requires a system that provides commonality and consistency in data management, analytics, portfolio management, operations, accounting and client reporting.

4. New competitors providing non-traditional assets – As the demand for alternative asset classes increases, large asset managers must also have the agility to expand to support these areas or risk losing clients. Vendor systems provide faster time to market than internal builds, which are often too time-consuming and cost-prohibitive.

5. Globalization – As smaller emerging markets are growing faster than developed markets, asset managers are continuing to seek global expansion. To do this efficiently, asset managers are often putting in place global operating models, with consistent teams and processes across locations, and the ability to adapt to meet local requirements of each market. Having a centralized system allows asset managers to create “centers of excellence” for certain functions, such as investment operations, wherein a team in one or several global offices supports all investment teams across locations, portfolio types and asset classes. Having teams in different locations share technology and processes

also supports business continuity planning. For example, if a natural disaster were to impact one office, responsibilities performed by teams in that office can be easily shifted to professionals performing the same functions from another location.

BlackRock Recommendations

Investment systems are an important component of the investment process. That said, investment decisions are made by *people*, not investment systems, and checks and balances are required to ensure integrity throughout the investment process. In our experience, successful asset managers consistently excel in the implementation of core best practices:

- ▶ **Checks and balances throughout the investment process supported by clear audit trails.** This includes separation of portfolio management from trading functions, separation of portfolio management/trading from operations (such that the person who executed a trade cannot also confirm that trade), and compliance checks throughout the process.
- ▶ **Daily reconciliations of all transactions with custodians.** This acts as a key check for all data, as issues with trade and security indicative information can be identified through this process.
- ▶ **Strong and independent risk management function.** Investment systems perform the function of *risk measurement*, which should not be confused with a risk management function. Asset managers should have risk management and control functions that are separate from the portfolio management function and tasked with independently assessing risk-taking within each portfolio. This group should act as a partner to portfolio managers to enhance the portfolio management process by providing top-down and bottom-up oversight. However, both risk managers and portfolio managers need quantifiable measures of risk, based on sound data, to support and inform how they perform these roles.
- ▶ **Model review and validation.** Risk models should be subject to ongoing review and validation including backtesting of model results relative to reality. Risk managers and portfolio managers should review these results regularly to understand potential model weaknesses. Additionally, there should be an ability to “dial” model inputs and assumptions to account for differences in views between risk/portfolio managers and financial modelers. Only authorized risk professionals should be able to make changes to the assumptions used in risk oversight.

► **Ensuring Resilience:** Business continuity and disaster recovery plans should be in place to ensure that asset managers can continue to operate when external events impact the availability of systems, facilities and staff. At a minimum, plans should ensure the ability to recover technology systems, including vendor platforms, and business operations in a timeframe that meets business requirements. These plans should result in recovery strategies for internal staff and systems and provide a mechanism to validate that critical third party providers also maintain appropriate plans. In all cases, firms should test their plans on a regular basis. As firms evolve their business continuity and disaster recovery plans they should focus on creating a resilient environment that negates the consequences of disruptive events.

Conclusion

Asset management starts with the investment objectives and constraints of each client. These differ across market segments such as insurers, pensions, official institutions, and individuals, and across individual entities in each market segment. Internal and external asset managers use technology to manage data, measure risk, test compliance, and address various operational needs. While technology supports decision-making, investment professionals make the actual investment decisions. The decision of what approach to take with systems is specific to each asset manager considering the costs and features of various systems choices. Regardless of the approach taken, asset owners managing assets internally and asset management companies need to implement clear processes with the appropriate checks and balances to ensure integrity throughout the investment process.

BlackRock's Aladdin® Platform

Risk-informed investment management requires the right tools to assess security- and portfolio-level risks, to rebalance portfolios to meet portfolio manager objectives, and to process transactions efficiently. As a result, BlackRock developed an integrated suite of investment management tools designed to be used by BlackRock's investment professionals. Starting in 2000, BlackRock began offering those risk analytics and trade processing tools, as well as advisory services, to external clients under the BlackRock Solutions® ("BRS") brand.

The Aladdin Institutional Business within BlackRock Solutions delivers our risk analysis and investment processing tools, known as Aladdin®, to institutional clients including asset managers, insurers, banks, pensions, and official institutions. Aladdin allows client organizations to combine risk analytics, order management and trade processing on a single system. This can help eliminate redundant data input across multiple systems, enhance data integrity through shared and transparent information, and increase operating efficiencies and controls. Aladdin's risk analytics allow risk managers and portfolio managers to analyze their exposures and risks across asset classes in accordance with their own internal risk management practices and policies, as part of each client's broader investment decision-making process.

BlackRock Solutions configures a distinct technology environment of Aladdin for each client, including both primary and secondary instances to support business continuity. Each instance of Aladdin is segregated both from BlackRock's Aladdin instance as well as from each other Aladdin customer. The system is highly flexible and aggregates third-party data from a variety of sources, as determined by each client, and each client can dial BlackRock models and incorporate other models to conduct analysis in support of their objectives. Aladdin does not make investment (i.e., buy/sell) decisions or replace a company's risk management function; rather, Aladdin supports a company's risk managers, portfolio managers, traders and operations professionals in managing their workflows.

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