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GROUP

# Institutionalizing Crypto:

Transaction Accounting and Processing Meets the Blockchain

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# Vision

While the crypto asset market may be at the frontier of digital technology, the infrastructure for institutions to manage, process and account for crypto assets is, how do we say politely...not. Individuals trading personal caches of cryptocurrency, tokens or digital securities leverage technologies such as Microsoft Excel and Google Sheets to track their trading. But once we begin to discuss institutional, professional trading houses and/or miners, the number and complexity of transactions quickly exceeds the capabilities of the technologies that individuals use.

The transaction volume and complexity generated from just about any professional, institutional or dealer-type trader outstrips the capacity of personal record-keeping technology. The level of sophistication needed to process and account for crypto and crypto-based assets is far more challenging to commercially process than even the most sophisticated asset classes on traditional back-office institutional trading systems.

Traditional securities processing and accounting systems are not conducive to facilitating blockchain/digital ledger-type assets that can be traded around the globe 24/7/365 across a panoply of execution venues. And the around-the-clock trading of these assets doesn't take into consideration a completely different way of holding, paying and accounting for digital assets than more standard asset classes. Even modern systems developed to process traditional assets are, in many cases, at a loss in this new digital asset/blockchain/DLT world.

TABB Group does not believe that operational challenges are the long tent pole issue stopping traders, brokers and institutional investors from jumping headlong into digital assets. But unless traders, brokers and institutional investors/asset managers get their processing and accounting infrastructures upgraded, operational issues will quickly lead to processing bottlenecks, accounting differences and reconciliation nightmares as performance, competition or fee pressures push firms into new assets and asset classes that they are not prepared to process.

For the unprepared traditional financial institution, the adoption of crypto assets will lead to significant processing headaches. TABB Group believes that unless newer crypto-enabled solutions are adopted, it will become increasingly difficult for traditional investors, brokers and more active crypto investors, traders or miners to efficiently process these transactions.

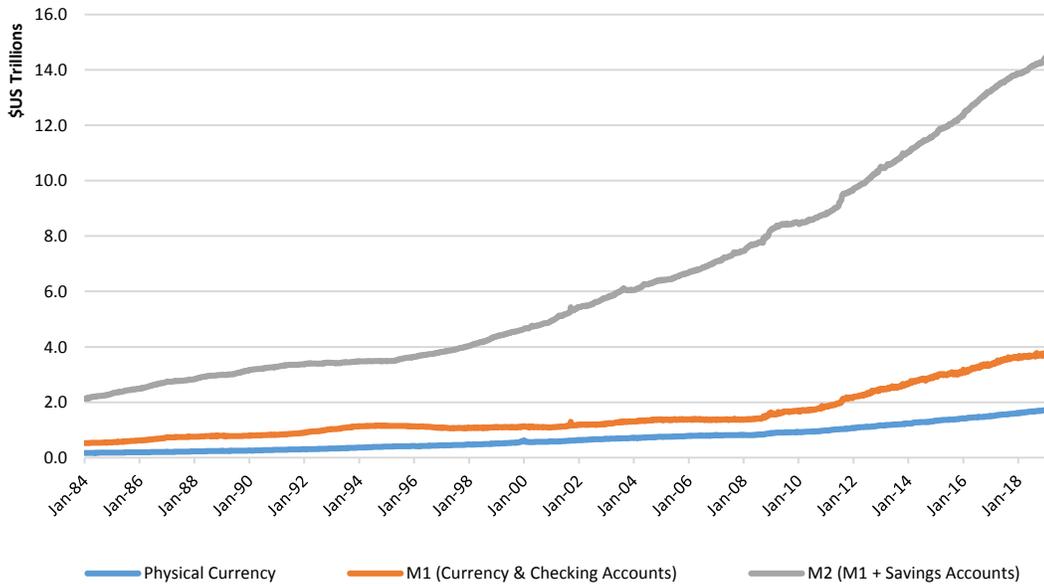
In other words, for most players in the institutional investment value chain, crypto processing and accounting isn't an issue today, but if these firms are not prepared when they jump into the crypto pool, the processing and accounting challenges will quickly become big, ugly and very costly to fix.

# Introduction

Crypto assets are different.

Crypto assets are natively digital, meaning they only exist in the memory of a computer. This feature is not unique. Most traditional trading assets are digitally native. When was the last time you held a stock certificate? Stock and bond certificates went out of fashion with the creation of the DTC in 1973. Even the majority of currencies mainly exist as zeros and ones on central bank computer systems. Physical currency only represents 45% of the strictest definition of US money supply (M1, the value of physical currency, or cash, and checking deposits) and only 10% of M2, a more widely used definition of money, which is M1 plus savings deposits, small value time deposits (<\$100,000) and money market mutual fund accounts. (See Exhibit 1)

**Exhibit 1: Physical Currency Vs. Other Monetary Measures**



Source: Federal Reserve Bank of St. Louis

The most significant aspect of crypto assets is that under certain scenarios, they don't exist in any one place. They exist on a distributed ledger instead of in a centralized depository. The key to controlling crypto assets relies on cryptographically secure messages sent to and received from a distributed blockchain using a combination of public and private keys. This is very different from traditional electronic assets, which rely on a network of trusted parties and their vetted clients. While many crypto assets such as bitcoin and ether are completely distributed, some crypto-asset implementations are controlled by a single governing body such as the schema being developed by the Australian Stock Exchange (ASX) to

replace CHESSE, its clearing, settlement and depository platform. Even for securities and crypto keys stored on private blockchains/distributed ledgers, processing can be significantly different than dematerialized traditional assets (assets held in a depository that are digitally represented and electronically transferrable through the depository infrastructure).

So, what's the big deal? What if bonds and equities are held centrally and crypto on a blockchain? How does that impact securities processing and accounting? Aren't all these products just blips on a computer screen?

As firms begin to process crypto assets, complications will arise. While both traditional currencies and cryptocurrencies sit on a bank's ledger, they have very different processing footprints that make accounting for crypto assets much more challenging for traditional processing systems.

Beyond the digital nature of crypto assets, management of crypto keys, which enables the transfer of crypto assets, is incredibly important, as a loss of control of the private key can mean a complete loss of asset ownership.

Crypto assets also trade around the globe on a 24/7/365 basis, across more than 200 exchanges and over-the-counter platforms. Crypto exchanges do not adhere to a common symbology, and, for the most part, do not support common gateways. Although some institutionally oriented crypto exchanges support FIX, a common messaging protocol used by traditional capital markets trading venues, most do not. These assets can also be traded and settled over-the-counter between two or more consenting parties, bypassing any centralized (or decentralized) exchange, clearinghouse or entity. Creating a mechanism to capture the trading data, normalize transactions and reconcile to various exchanges and OTC trading partners can be incredibly challenging.

Outside of trading, the pricing/valuation of these transactions can be challenging, which is somewhat curious since crypto assets are theoretically held on a centralized blockchain and transparent. But theory and practice differ as many exchanges take crypto assets off the public blockchain for trading, settlement and custody. These off-chain exchange transactions do not hit the blockchain, so true ownership and pricing may be more opaque than one might expect.

While crypto exchanges make their market data available, few regulators oversee the market to ensure the accuracy and reliability of the data. A recent analysis submitted to the US Securities and Exchange Commission by Bitwise Asset Management to support its crypto ETF application found that roughly 95% of bitcoin trading volume reporting by a popular crypto data aggregation site was fake<sup>1</sup>. The combination of off- and on-chain transactions also complicates reconciliation, as some transactions can be validated through the blockchain (those transfers into and out of exchanges) while those transactions within the exchange need to be validated through exchange/custodian reconciliation.

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<sup>1</sup> "Most Bitcoin Trading Faked by Unregulated Exchanges," Study Finds, The Wall Street Journal, March 22, 2019, by Paul Vigna.

# Today's Process

To understand the shortfalls of traditional trading and investment technologies in processing crypto, it is important to understand the current process which, while neither simple nor straightforward, has grown out of decades of legacy processes and the needs of asset owners, investors, brokers, exchanges, custodians and depositories.

With the help of investment consultants/advisors, asset owners determine how they want their assets allocated, which is typically to multiple investment managers. Professional investors put these assets to work either collectively within a fund structure or in a separate account. Portfolio managers and advisors make investment decisions, and most use a custodian to hold client cash and securities to ensure that investment decisions are being managed legitimately.

Investment decisions are executed by traders, who aggregate the instructions of many portfolio managers into block trades, which can be sent to a single broker or aggregated across multiple brokers. Brokers execute these trades either at one time or break them into multiple executions, which can be executed within the broker, across multiple exchanges or trading venues. When sending each execution back to an investment manager, brokers typically aggregate many individual trades or fills into one collective execution, which is then average-priced and allocated to individual portfolio managers or separately managed accounts.

Once the allocations are confirmed, brokers modify the trades to represent the actual buyer or seller, with the average price for the full value of the trade. Once trades are booked, notification is sent to a custodian, who settles transactions into individual investors' accounts and/or funds.

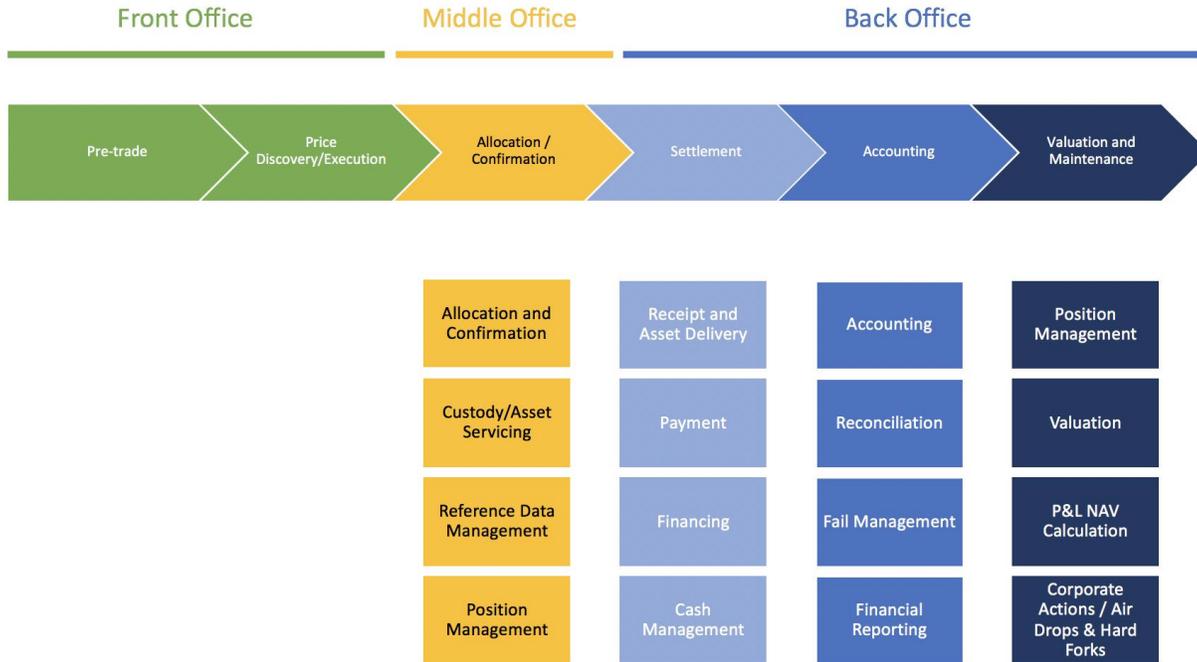
On the broker side, a trading venue forwards every execution to a clearinghouse, which aggregates and nets all the trades for each broker and security to calculate a net settlement balance order. This allows the hundreds — if not thousands — of buys and sells from a single broker for a single security to be netted out to a single security and money movement. The DTCC currently nets approximately 97% of all US equity trades, turning 100 million trades into 3 million daily settlements, which occur on the second morning after trade date (in most major market equities).

Once a trade is settled, paid for and sitting in a custodian's account at the depository, the securities do not stay immobilized and will most likely be lent to hedge funds or investors who are short that security. This process (securities lending) generates additional returns for the portfolio.

Brokers, funds or custodians need to track the value and the location of their securities even when they are sitting in the depository. This tracking means a constant reconciliation between all the parties (funds, custodians, brokers and depositories), in which each one reconciles the current position and value to ensure that positions and any corporate action (dividends, splits, name changes, mergers and

acquisitions) is properly accounted for. This enables a firm's financial statements to truly reflect the current value and state of a firm's investments. (See Exhibit 2)

**Exhibit 2: Front, Mid- and Back-Office Processing**



Source: TABB Group

# A Broken or Obsolete Process?

Is all this back and forth necessary, or is it a function of an outdated process, which blockchain can fix?

Blockchain can streamline the process, possibly remove some or all the clearing and depository functions, and reduce the need for such an intensive reconciliation process, but much of today's process will still be needed within a digitized asset ecosystem.

An asset owner, especially a large one, will most likely need assistance in selecting investment advisors. Asset owners typically work with multiple advisors, and advisors work with many owners. Trading will most likely continue to be managed by traders even though the investment process will be more highly automated in the future, since it is not efficient for each portfolio manager to address markets individually, and as trading requires different skills than managing assets. Although trading will become more automated, human guidance and oversight will most likely always be needed unless a manager is swapped out for a completely passive/index-based strategy.

And as long as the sell side interacts with the market multiple times a day, there will be a benefit to batching trades for settlement instead of settling each trade independently. As long as a broker executes multiple buy and sell orders for the same asset across different clients, the benefits from netting hundreds, if not thousands, of orders reduces the risk of settling those orders independently. If the blockchain settlement process were extremely cheap and efficient, there could be a case made that gross settlement (settling each trade individually) would be more efficient than netting, but once securities and cash are moved, the process for fixing errant trades becomes more challenging. Instead of fixing a pending settlement, once the cash and crypto have moved, the errant cash and securities movements need to be reclaimed. Given the fact that one party has control of the asset, the counterparty may not be eager to make the correction, especially if that counterparty is anonymous.

Firms across the spectrum will also continue to need to validate their positions, accounting and financial results as long as they need to represent their financial condition to regulators, investors and interested parties.

The bottom line is that while blockchain can make the trading/settlement process more efficient, much of the institutional trading process exists out of a business need, not out of a loyalty to legacy infrastructure.

# The Challenges of Fitting Crypto Into This Process

While the traditional investment process is convoluted, the systems and processes work fairly well for traditional securities. Layering crypto assets onto a more traditional processing system, however, may raise new concerns. (See Exhibit 3)

**Exhibit 3: Crypto Back-Office Risks from Traditional Processing Infrastructures**



Source: TABB Group

## The Crypto Exchange World

There are more than 200 cryptocurrency exchanges around the globe, and almost as many have gone out of business. Even some of the oldest and largest crypto exchanges such as Mt. Gox no longer exist. Interacting with these platforms is not easy or standard. Some exchanges were developed with institutional investors in mind, and exchange providers like NASDAQ, SIX (Swiss exchange) and ICE are building out their own crypto exchange platforms. Many exchanges, however, were built by technologists who had little or no concern for existing institutional practices or processes. Until there is a consistent standard — or a major consolidation of platforms — institutional crypto investors and traders must contend with numerous technology and data challenges.

*“There are so many small things. You have regulators changing their minds, you’ve got different exchanges doing things differently, even looking at this as an alternative asset. There are a lot of gaps to fill. In the crypto derivatives world for example, everything is an exotic.”*

- Crypto Fund Administrator

## Crypto Connectivity and Access

When crypto trading is done on a peer-to-peer basis and isn't relegated to regulated exchanges, there is an almost unlimited number of counterparties, wallets and infrastructure providers to connect with.

Harmonizing and standardizing how these counterparties, wallets and infrastructure providers communicate becomes important for seamless processing. Not only are there a plethora of exchanges (centralized or distributed), there are OTC trading desks, mining pools, a gaggle of crypto wallets and a wide swath of trading partners. This open trading environment, in the short run, is not conducive to connectivity standards and protocols, as each platform can make its own protocol and connectivity decisions. Crypto exchanges were not designed as traditional financial trading venues, with buyers and sellers transacting through brokers on exchanges and settling their transactions through clearinghouses and depositories. In many cases, crypto exchanges were developed as all-encompassing communities that facilitate brokerage, trading, client custody, trade matching and market-making. Initially designed to serve mostly retail customers, these exchanges, in many instances, do not have an incentive to develop exchange-type application programming interfaces (APIs). By creating a walled ecosystem, the exchanges can not only create and manage a better client experience, they make it more difficult for clients to leave, which, of course, enhances the exchanges' business models.

Instead of supporting FIX, exchange binary gateways such as ITCH/OUCH, and other industry-standard connectivity protocols such as ISO/SWIFT 20022, many developers at these exchanges, wallets and service providers have adopted web services connectivity technologies. The primary one is representational state transfer, or REST, a common web-based communication protocol to communicate with exchanges. REST is not as robust as FIX and doesn't natively accommodate the language of financial asset trading and processing.

REST, however, isn't a trading protocol, so firms that want to interact with REST-based exchanges need to code bespoke gateways. Given that there are over 200 crypto exchanges, a large number of OTC trading desks, different wallet providers, mining pools and other liquidity sources, developing trading and connectivity protocols is a significant obstacle. The lack of standard protocols also means that organizations cannot rely on existing post-trade APIs to extract transactional data. As exchange platforms innovate and develop new crypto trading products and services, new product-specific post-trade APIs will have to be built. While this can be good for exchanges and their dedicated clientele, it complicates life for anyone trading and/or processing transactions across multiple exchanges as the number of bespoke APIs gets compounded. Just determining where to trade can open up a Pandora's box of issues around how to obtain real-time and post-trade data, managing pricing and valuation, and knowing which assets were bought and sold.

In other words, the lack of adoption of standard institutional protocols dramatically complicates the ability for an investor, broker, trader or miner to obtain and normalize the information they need to process and account for crypto transactions. Without a standard API, firms need to write custom gateways for each platform to obtain critical execution, processing and custody information.

A lack of adoption of even the most vanilla securities processing standards at many of these exchanges is a major obstacle to trading, and requires that institutional investors, traders or service providers develop bespoke infrastructure or leverage a service provider that has developed many of these translation protocols to facilitate connectivity. In addition, once developed, these protocols and linkages need to be maintained. Since exchanges do not remain stable, their business and service offerings over time require them to change their APIs and protocols, which forces exchanges and service providers to alter their feed structures, which in turn pressures firms to monitor and maintain their connectivity gateways. This is especially true in a fast-moving industry such as crypto. Just monitoring exchange gateways and staying abreast of all of their changes is a major initiative.

## Reference Data

Most firms take securities identifiers for granted. In the US there are CUSIPs, in the UK SEDOLs, in Europe ISINs, in Switzerland VALOR numbers, and in Japan there is the SICC. Besides formal securities identifiers, exchanges have related ticker symbols, and larger market data firms have schemas such as the Refinitiv/Reuters Instrument Code (RIC) or the Bloomberg Financial Instrument Global Identifier (FIGI) that enable firms to identify and effectively trade and process the appropriate securities.

Crypto is different. There are no uniform symbols or symbology to identify products consistently across exchanges. Even the most ubiquitous crypto-based product — bitcoin — uses two major ticker symbols: BTC and XBT. There is no CUSIP, ISIN, uber-exchange or numbering authority that provides consistent symbology for crypto assets, and depending on the currency used to trade against bitcoin, getting the symbology right is critical. There is no standard for initial coin offerings (ICOs) to use when deciding on a ticker. What's more, exchanges make their own decisions. For example, Binance uses CMT for CyberMiles and Cryptopia uses CMT for Comet. Both are cryptocurrencies. There are many examples of this across the crypto-sphere.

Using the wrong symbol at the wrong exchange risks buying the wrong crypto asset. This is especially true for crypto non-currency-like assets, be they ICOs, security tokens, IEOs, stablecoins or utility tokens. For example, the symbol AHT has been used for the Anonymized Health Token issued by the Bowhead Health project and Ahoolee Tokens issued by Ahoolee, a shopping engine. In some cases, tokens and cryptocurrencies can share the same ticker. For example, NET has been used for the Nimiq Exchange Token and NetCoin, a cryptocurrency based on Litecon's core, while HOT has been used as symbol for both Hotcoin and Holochain. The lack of ticker standards creates challenges in not only buying the right asset but processing and pricing assets once they are acquired.

Crypto assets also trade 24/7/365. This nonstop market creates internal challenges to systems and processes that traditionally have a closing time and price to value trading positions and funds. Given the global, continuous and fragmented nature of crypto trading, firms will need to determine how, when and on what benchmarks their positions will be captured for financial reporting and valuation purposes.

*“Crypto is a 24/7, 365 market like FX, but even in FX there are closes by convention. In traditional derivatives markets, there is an agreed end of day. There are well understood conventions. In crypto there is no end of day, it is rarely mentioned.”*

- Traditional and Crypto OEMS Technology and Solutions Provider

## Reconciliation

As initially conceived, blockchain should eliminate the need for reconciliation. With a trade represented on a distributed ledger/blockchain, many market participants thought a firm just needed to connect to the blockchain and retrieve every bit of required data.

But that's not the case, especially for professional trading, investing or custodial businesses.

In today's implementation of crypto, not all transactions executed are written directly to a blockchain. Additionally, transactions that are written to the blockchain are unlikely to be sent with all the data needed to represent a trade.

As the crypto market moves from individuals doing one-off transactions to institutions executing hundreds or thousands of transactions a day, there will be internal data that will never be on the blockchain. Data such as internal account information, client instructions, accounting instructions or internal details regarding the trade's origination, commission or mark up, sales person or the responsible portfolio manager will most likely never be represented on the DLT. While this information is critical to generate an institutional trade, it is not relevant to the matching of the buyer and seller. In fact, some of this information could be deleterious to the firm if this information became public.

The mere instantiation of this data within corporate technology infrastructure means that the blockchain isn't enough, and each institution will need to capture trading details and all the color, accounting and reference data that surrounds a trade. And if there is more than one instantiation of a trade, guess what? The dreaded R-word will be required. Reconciliation. And the dream of a reconciliation-free infrastructure, will be just that, a dream.

While blockchain will reduce trade breaks, just putting a record on an internal database means that the database needs to be reconciled to the blockchain, and the internal record and the blockchain record may get out of synchronization.

In reality, most crypto exchanges do not have their matching engines directly connected to a public blockchain but use a centralized private ledger to host the matching engine and execute trades. OTC trades, however, usually settle the crypto leg(s) of a trade directly via a public wallet-to-public wallet transfer or public wallet-to-exchange wallet, although some OTC dealers also support netting on a standard interval basis (e.g., every 15 minutes, daily, etc.). While these trades are effectively public, in practice, investors and dealers can have any number of wallets, so identifying who owns what wallet can be cumbersome (which by itself creates unique issues with confirmation of asset transfer).

# Processing and Valuation Issues

Any solution that supports crypto assets must connect, standardize, reconcile, process and report audit-ready information in a highly secure manner. Decentralized and distributed data must be transformed into business information that can create financial statements, manage risk, track profitability and provide regulatory reporting and transparency. Funds need clean, consumable data for risk reporting and, importantly, NAV calculations. In addition to month-end reporting, the highly volatile nature of crypto assets means that funds often require more frequent NAV reports and portfolio overviews — often weekly or daily. Legacy solutions, however, often struggle to support crypto asset transactions for several reasons, including:

- Different approaches between data venues means that data does not always reconcile. For example, some values may go to two, three or even 23 decimal places.
- Fees accrued in crypto transactions fall under different accounting methods as they are a capital asset and need to be treated as a separate disposal event rather than adding the fee to the purchase price to determine cost basis.
- Solutions for crypto assets must support inconsistent naming conventions and conflicting aliases for the same crypto asset that are typically found in crypto but not traditional financial assets.

Clean, consumable data is not as readily available for crypto assets as it is for traditional asset classes. Middle- and back-office systems for traditional assets are designed to accept normalized feeds while crypto solutions need to pull transactional data from crypto ecosystems that include exchanges, wallets, blockchains, banks and mining pools, and then standardize the results. This process often requires market participants to build their own repository of crypto asset data.

Even with this data captured, specialist reconciliation tools are needed to verify accuracy and completeness by reconciling exchange balances versus transactions. Any solution must have the ability to identify breaks and other data gaps and substantiate exchange-reported transfer versus blockchain confirmations.

Tracking cost basis is another challenge for crypto asset trading. With harmonized reference data, centralized clearing, a limited number of intermediaries and standardized processes, determining the cost-basis for traditional assets is fairly straightforward. Accounting systems at most institutions manage this process seamlessly. For retail, many geographies such as the U.S. require that brokers provide tax lots and cost basis information (i.e., on IRS Form 1099-B) and taxable capital gains or loss events (i.e., on IRS Form 8949 and Schedule D). The IRS recently published a [letter](#) stating it has “made it a priority ... to issue guidance ... soon” on acceptable methods for calculating the cost basis, treatment of forks and other issues, but in the meantime, the agency referred to [Notice 2014-21](#), which stated that virtual currency should be treated as property.

A number of unique crypto market structure issues make calculating cost basis difficult. Since there are few, if any, regulated crypto brokers, crypto exchanges have no way of knowing the cost basis of crypto funds taken as deposits. When these assets are sold, an exchange only has information on proceeds and cannot calculate the capital gain or loss. Similarly, there are no tax lot or cost basis information attached to withdrawal transactions. Exchanges do not report on this and do not provide information to tax authorities. In addition, crypto is global, so investors can trade crypto assets over a large number of exchanges in various jurisdictions, further complicating cost-basis accounting and putting the onus squarely on the miner, trader and investor.

# How Are Firms Trading Crypto Today?

Today's institutional crypto investors include a wide range of entities that include hedge funds, endowments, family offices, sovereign wealth funds, crypto miners, IEO/ICO entities, liquidity providers and proprietary trading houses. Depending on their strategies, they execute trades either on an OTC basis (usually when dealing in large sizes) or via one or multiple crypto exchanges.

Trading directly on an exchange is inefficient because centralized exchanges mostly require that clients deposit funds to trade. Even after an account is open, moving fiat currency into and out of a crypto exchange can be manually intensive and time consuming as funding and managing cash is often done by bank wire or online bank transfer. Few banks today facilitate the transfer of fiat currency to crypto exchanges. Retrieving funds from crypto exchanges can be slow as well, as many of these platforms have withdrawal limits. With only a small number of exchanges that fully support institutional-grade communication protocols such as FIX, a trading entity most often has to contend with data that can be unreliable, inconsistent and incomplete.

Today, proprietary trading firms, market-makers and brokers are likely to be trading on these exchanges and transacting bi-laterally to execute larger orders. Proprietary traders and market-makers seek to profit from arbitrage opportunities that tend to be common due to the highly fragmented nature of the current market structure. Brokers are also increasingly executing on behalf of their clients, as the fragmentation, connectivity, account maintenance and asset custody required to trade on individual exchanges is highly problematic.

It is no surprise that larger investors look to OTC markets to negotiate their way through the exchange maze. Investors can conduct a peer-to-peer trade or, as happens more frequently, use one of the prominent crypto OTC dealers. These include B2C2, Cumberland (a subsidiary of DRW), Circle, DVChain, Jump Trading and XBTO. The most common and prevalent method for communication in the OTC market is via electronic messaging platforms such as Skype, Signal, Telegram and even LinkedIn. Before a deal is negotiated via these messaging systems, clients typically have to pass KYC/AML checks (i.e., be onboarded) and assessed for credit worthiness.

Once a trade is agreed to, it settles in stages with one party going first, meaning either sending payment in cash (typically via a bank wire) or effecting a wallet-to-wallet transfer of the crypto asset. Obviously, this stage demands a great deal of trust. Once the bank account or wallet is credited, the counterparty will send the fiat payment or make the crypto transfer.

While originally entirely manual, the OTC process — much like in the traditional financial world — has started to go electronic. For example, Jump Trading has built an OTC platform with a graphical user interface to support crypto trading that provides an audit trail. Other OTC dealers offer APIs that support

*“It took something like two months to add a new crypto exchange using our pre-existing platform, and this doesn't work for such a fast-moving market like crypto. Most crypto exchanges are glorified websites; it's hard to keep track of orders, you have throttling issues like I can't amend more than 10 times in a minute. Our systems need work-arounds for these things.”*

- Crypto OTC Dealer

a request for proposal model, which allows clients to build their own electronic access or OTC price aggregator.

But whether an investor is transacting electronically via a crypto exchange or OTC desk, or conducting a trade manually via phone or messaging platform, the problem of how to handle the post-trade process remains. When volumes are fairly low, today's middle-to-back office functions are often conducted entirely on spreadsheets. This approach is not practical when higher volumes are transacted or when service providers such as brokers or fund administrators are involved.

*"We need a clearinghouse for crypto, but it is a low margin business and the market is not big enough to warrant it right now. It's chicken and egg."*

- Crypto OTC Dealer

Market participants interviewed by TABB Group said middle-to-back office workflows for crypto assets contain a high number of small but significant differences from workflows for traditional assets. Solutions designed to support traditional asset processing cannot be readily adapted to handle the post-trade requirements of crypto assets. Funds trading in these assets mentioned the following challenges:

#### Trading

- The multi-asset nature of crypto assets means they can readily be exchanged for other crypto assets (i.e., bitcoin for a security token offer or utility token, which is sometimes treated as an asset-to-asset trade rather than an FX transaction). This complicates the determination of a cost base and traditional accounting mechanisms.
- Algos and smart order routers need to be custom built for crypto to factor in issues like the difficulty in moving balances between exchanges, latency in on-chain transfers, and the use of stablecoins as collateral.
- Crypto assets are sold in very small amounts, which may cause problems with traditional infrastructures because most platforms do not support the level of fractional ownership common in the crypto market.

*"The volumes of transactions to execute a trade can be staggering. You can have 72 trades but 10,000 executions, and if that is between crypto assets, you get three or four times as much when you factor in payments in fiat."*

- Crypto Fund Administrator

#### Standards and Protocols

- Immaturity and lack of standards around exchange connectivity protocols require custom, high maintenance feed handlers.
- A lack of support for sophisticated order types by exchange leads to investors having to build their own synthetic order generators.

#### Clearing

- The lack of centralized clearing in crypto markets means that transfers of assets are often confirmed by market participants directly, which may require monitoring one or more blockchain wallets and bank accounts.

## Reconciliation and Settlement

- Larger orders are traded over-the-counter, a market that lacks central or bilateral clearing and requires simpler delivery than payment processing. This increases the risk of a failed delivery when crypto is delivered but payment isn't made.
- Transaction data from crypto exchanges can be incomplete or lack reference data and historical capabilities; client systems must have alternate means of tracking, storing and enriching trade data.
- Transactional data must be verified for accuracy and completeness.
- An immature market for third-party custodial services that often requires bespoke connections.
- The concept of 'cold storage,' in which private keys for crypto assets are stored completely off-line and in secure locations (e.g., storage providers Volt and Xapo store client keys in abandoned nuclear bunkers) for enhanced security is unique and can introduce complication in settling trades.

## Accounting

- The multi-jurisdictional nature of cryptocurrencies (assets move more frequently and readily than traditional assets, even in a single trade) means that activities like identifying individual tax lots can be challenging.
- Similarly, cost basis — necessary to compute gains and losses — can be difficult to track.
- Instruments can be unique to specific crypto exchanges as competitive differentiators (and non-existent in traditional financial markets). That can make P&L calculations difficult. One example would be the "inverted swap," which was invented by crypto exchange Bitmex.
- Complicated accounting practices, especially in jurisdictions like the US, which considers crypto assets a currency in some cases but a security in others.
- Without standard valuation processes and times, each firm needs to define its own valuation sources and methodologies.
- Crypto transactions can run to many decimal points (one vendor supports up to 189 decimal places), while traditional asset transactions have fewer. Futures contracts trade in whole units, for example.
- There is no standardized way to account for crypto, so developing financial statements can be more challenging, time-consuming, expensive and error-prone.

*"There are many small things because it is a new industry so there are gaps to fill. But this new asset class present a lot of opportunities too."*

- Crypto Fund Administrator

## Are There Alternatives?

Because the infrastructure to support institutional trading in crypto assets is nascent, there are few best practices or standards. But advances are being made. Banks such as Signature, Metro and Silvergate Bank in the US, and Fidor Bank in Europe, are leading the way in supporting crypto payments and transfers to crypto exchanges, and, in some cases, offering API-based connectivity to support same-day cash payments. These solutions may require custom integrations that are not supported in a traditional middle-to-back office securities platform. A number of US banks allow clients to link their bank accounts to crypto exchange accounts, but this service is often retail-oriented.

In the data world, crypto investors can struggle to obtain reliable, detailed and normalized data, both for pricing (market data) and enrichment/post-trade (reference data). Some vendors offer data products that include consolidated market data feeds, reference data and pricing data for valuation purposes. Vendors in this space include traditional financial market data vendors such as ICE Data Services and Refinitiv as well as new crypto specialist vendors such as CoinMarketCap and Lukka (formerly Libra). While some investors look to receive market data directly through individual exchange or venue feeds, in the crypto world, the delivery protocols, breadth and completeness of these feeds are inferior to those in the traditional financial exchange world, and thus require bespoke development. Crypto-specific OMS/PMS vendors may also offer APIs to access their aggregated market data as well as other data on the system.

Crypto-native reference data and pricing products can help make blockchain-based data work with existing business practices and seamlessly interface with the crypto ecosystem in a validated, compliant and secure manner. For example, Lukka Reference Data tracks and normalizes data for over 3,000 crypto assets across exchanges and blockchains, and its pricing service includes Lukka Prime, a custom methodology purpose-built around institutional requirements as well as GAAP and IFRS guidelines. It also offers institutions the ability to create custom pricing methodologies based on their own requirements.

Importantly, regulations and accounting standards for crypto assets are still under development, which can lead to the need for clunky work arounds. GAAP, for example, requires that fund administrators pick one exchange as a source for pricing an instrument, but in the crypto world, the exchange with the most liquidity for any particular instrument can be a moving target. One prominent alternative fund administrator who TABB Group spoke with explained that his firm follows GAAP rules for financial reporting but not for investor reporting, as the latter is more likely to use a volume-weighted basket of exchanges to more accurately value the crypto portfolio's assets.

Similarly, the custody market for crypto is still in an early stage of development. One market participant noted that the word 'custody' is the most abused term in crypto trading because sometimes it can mean merely safeguarding (custody with a lowercase 'c'), and other times it can mean custodial servicing (custody with a capital 'C'). While the lack of custody solutions is often mentioned as a huge impediment to crypto trading, market participants who TABB Group spoke with agreed that, in reality, there are

adequate solutions. In some cases, it's self-custody and in others it's using one of a number of third-party custodians. In any case, several custodians have started to offer additional services such as insurance and direct settlement to counterparties (provided both counterparties utilize the same custodian). Of course, any middle-to-back office system needs to be able to accommodate various custody options and workflows.

## Traditional Back-Office Systems Challenges

When it comes to middle-to-back office systems for crypto assets, options are limited.

Booking trades on traditional core systems is difficult because the booking, accounting and processing of trades is manual and disengaged from standard electronically-linked services that can be as standard as a simple transaction download from the exchange or the broker. Each step must be manually augmented or done on side ledgers (e.g., Excel) or on separate, often poorly integrated adjunct systems.

To facilitate processing, early institutional adopters of crypto trading have largely been forced to write their own systems, but this has been justifiable only for larger OTC dealers. With in-house system development costing millions of dollars and the average assets under management of a crypto fund not much more than that, this is clearly an unrealistic option for smaller crypto funds, family offices or fund administrators.

## Traditional Back-Office Systems Solutions

While processing risks of traditional infrastructures abound, a few specialized solution providers have been incubating in the market.

Systems processing of crypto assets needs to support a number of functional areas including:

- Books and records: A system of record is required to execute accounting and regulatory processes that include the creation of operational and audit-ready financial data.
- Data analysis: Data-driven insights such as fee attribution and P&L performance data is required to improve performance and analyze growth.
- External reporting: Aggregated views of crypto data provides transparency of business results.

Lukka is a good example of a new product used to bridge the gap between emerging crypto asset and traditional financial ecosystems; its products include Lukka Crypto Office, a middle- and back-office platform; Lukka Reference Data, which provides organizations with a continuously updated crypto security master; and Lukka Pricing, a highly configurable platform that allows organizations significant flexibility in valuing their crypto assets in a GAAP- and/or IFRS-compliant manner.

A veteran of the crypto world, the company started out offering tax and accounting applications for crypto day traders in 2014 and has grown to focus on supporting institutional traders. Clients include funds and fund administrators, firms such as XBTO, a crypto trader and liquidity provider, exchanges, miners,

protocols and accounting firms. Lukka's solutions offer a single on-ramp to connect to exchange platforms, blockchains and other data sources. It also normalizes and enriches transaction records through real-time data processing engines, and supports comprehensive reconciliation and reporting on trading, inventory and tax information, delivered via various formats and APIs.

In addition to specialist solution providers like Lukka, support for post-trade and accounting functionality when trading crypto assets is available as part of front office-oriented systems (e.g., OMS and PMS). Examples here include Caspian and Deltix, which both offer crypto-specialist PMS's and OMS's that include some post-trade functionality. Caspian, a joint venture between Tora, a leading OEMS global trading platform provider, and Kenetic, a proprietary trading and investment firm, offers an OEMS that supports portfolio, accounting, trade life cycle, risk management and account management. The firm's PMS captures transactions, calculates P&L and offers performance analytics. Deltix's CryptoCortex offers an institutional-grade crypto trading platform with post-trade risk management, transaction cost analysis and reporting.

Other providers are focused on specific parts of the post-trade workflow. Examples include Node40, owned by Hashchain Technology, a Canadian crypto mining company, which focuses on tax reporting, and ZeroHash, a subsidiary of institutional crypto exchange SeedCX, which focuses on on-chain settlement services to institutions such as brokers, single-dealer platforms and other institutional trading venues.

# Conclusion

The post-trade processing of crypto assets is beset with many challenges and obstacles due to both an immature market infrastructure and the fact that crypto assets operate in a grey area with regards to regulation and tax laws. However, the market offers great potential, and institutions are increasingly wading in. But institutional firms that embrace crypto assets need a wide range of new and more modern, innovative processing infrastructure to address issues of connectivity to the crypto ecosystem, standardization of data, tricky reconciliation and processing, a lack of clear regulatory guidelines and accounting principles, reporting challenges, and difficulties in dropping audit-ready information into tax documents. It would not be an exaggeration to say that confusion reigns; almost every counterparty does it in its own way.

Despite all the challenges and confusion, there is good news. A host of bright minds and innovative firms are working hard to develop new infrastructure, technology and processes to help funds and trading firms move into this space. Their efforts will be a major contribution to the development, maturity and acceptance of digital currencies.

While the processing of crypto assets is focused on cryptocurrencies, there is a broader vision for this infrastructure as a replacement for 30- or, in some cases, 40-year-old core processing systems. While most institutional firms' existing infrastructure is functional, it is neither cheap to maintain nor state-of-the-art, but the thought of transitioning to a modern processing infrastructure scares most major firms into watching, waiting and dreaming for new and more modern platforms to take shape.

If the crypto asset world continues to develop apace, and a wave of new and modern platforms is developed to process these new structures, TABB Group believes these new platforms could be the impetus needed to finally replace their creaky legacy infrastructure. While many firms feel stranded on their island of legacy technology, this new infrastructure could just be the ship on the horizon they need to streamline their back-office journey.

*“The tech [behind crypto] is still nascent and the re-architecting of capital markets is likely to take a generation, but we are very optimistic about the technology and we treat the coins like any other business.”*

- Head of Digital Asset Strategy, Major Investment Bank

# About

## TABB Group

TABB Group is a financial markets research and strategic advisory firm focused exclusively on capital markets. Founded in 2003 and based on the methodology of first-person knowledge, TABB Group analyzes and quantifies the investing value chain, from the fiduciary and investment manager to the broker, exchange and custodian. Our goal is to help senior business leaders gain a clearer understanding of issues and trends within financial markets so they can better grow their businesses. TABB Group members are regularly cited in the press and speak at industry conferences. For more information about TABB Group, visit [www.tabbgroup.com](http://www.tabbgroup.com).

## TABB Group FinTech Practice

TABB Group's FinTech research practice is specifically designed to help financial institutions understand the latest spending trends, strategies and solutions that are critical to achieving best practices in financial services technology, data, analytics and technical infrastructure. This service also helps technology and data solution sales and marketing organizations understand specific requirements and use cases within financial services and capital markets firms.

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