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EDITORIAL

Electronic Markets on blockchain markets

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Dear readers,

This issue of Electronic Markets includes a special issue on the potential and the limits of blockchain technology for networked businesses. Since 2008, distributed storage and computing technologies have seen a steep rise and received much attention in academia and practice. Blockchain is now recognized as one of the paramount information technologies that are expected to transform many industries. For example, Warner and Wäger (2019, p. 327) state that "new digital technologies such as blockchain, cloud, and IoT platforms are changing the nature of dynamic capabilities because organizations can now scale up or scale down their operations at a speed, ease, and cost that was not possible only a decade ago". Much of the transformational power of these technologies is based on their infrastructural qualities (e.g. Luo et al. 2018 for cloud computing, Meyer et al. 2019 for blockchain and Zhu et al. 2020 for IoT and blockchain) and their role as general purpose technologies (Kane 2017). It may be assumed that the availability of an integrated information infrastructure that links all value chain (or value network) participants changes the interplay with business processes and business models. As argued in a prior editorial (see Alt and Zimmermann 2015), this reasoning is based on the analogy to the intraorganizational environment where integrated information systems have created an infrastructure for cross-functional processes and organization structures. However, designing similar infrastructures in the interorganizational domain is challenging as soon as the notion of infrastructure also comprises the more complex and diverse business aspects.

This follows the assessment of Kubicek and Cimander (2009), wo found the business level to be the most challenging. They argued that the seamless integration (i.e. interoperability) between organizations needs to be addressed on four levels with solutions for technical and syntactical interoperability being "fully developed" and solutions for semantic and organizational interoperability being either "theoretically developed" or still "vague [...] with large scope of interpretation" (p. 5). Obviously, this assessment dates back one decade and clearly before the advent of the infrastructure technologies mentioned above. This leads to the question of whether and how blockchain technology contributes to the interoperability of organizations and which potentials this technology holds for electronic markets. In general, Kubicek and Cimander (2009, p. 2) distinguish three "basic strategies" for coordinating cross-organizational processes. These are the centralization of tasks, the standardization of processes and the installation of clearing houses. While all of them are feasible and examples exist, research in the intraorganizational domain suggests that a straight answer is difficult since the impact of information technology depends on many factors. For example, in their seminal work Gurbaxani and Whang (1991) argued that factors internal (e.g. strategy, culture) and external (e.g. competition) to the organization determine whether firms "use information systems to decentralize some decision rights and to centralize others" (Gurbaxani and Whang 1991, p. 71). The same may be observed in the interorganizational domain: as summarized in the last editorial (Alt 2020), digital platforms and ecosystems have created interorganizational infrastructures that allow a centralization of distributed activities as well as their coordination on a decentralized basis.

Five perspectives on blockchain markets

To discuss the impact of blockchain technology on (electronic) markets in more detail, the notion of blockchain markets will be used in the following. It serves to identify the market of blockchain applications, the application of blockchain (as well as the broader distributed ledger) technology for electronic markets and the application of electronic market mechanisms for blockchain technologies. This yields five perspectives where blockchain technologies generate value (see Table 1 for a summary).

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Table 1 Values of five blockchain market perspectives

Perspective	Value
1. Blockchain technologies as market	• Creation of new market segment with business opportunities • New technological infrastructures for digital transformation
2. Goods on electronic markets	• Emergence of new electronic market segments • New investment strategies with cryptocurrency trading
3. Currencies in electronic markets	• Reduced costs in primary transactions (frictionless trade) • More efficient payment infrastructures
4. Infrastructure for electronic markets	• Increased security and transparency of centralized markets • New decentralized marketplace models without intermediary • Improved transaction efficiency in networked businesses
5. Electronic markets in consensus mechanisms	• Improved efficiency and ecology of consensus mechanisms (e.g. mining operations) • New business models for consensus mechanisms (e.g. blockchain mining)

First, blockchain technologies are a *market in themselves*. As per 25 May 2020, the price-tracking service for cryptoassets Coinmarketcap listed 5500 cryptocurrencies with an impressive total market capitalization of USD 258 bn for this newly created market segment (Coinmarketcap 2020a). Although Bitcoin dominates this market with a share of 66.5%, the increasing number of new currencies makes this market a universe that is difficult to oversee. As a common denominator, these cryptocurrencies use cryptology for accessing and storing data in distributed databases, which comprise procedures for synchronizing the distributed data in order to achieve consistency. The notion of currency implies that exchange objects exist for compensating the participating actors. Over the past years, the cryptocurrency market has seen a rising variety of schemes or frameworks, which enhance the spectrum of technological infrastructures for digital transformation. These frameworks may be described as specific configurations of a cryptocurrency's front- and backend design parameters. Among their design parameters are the

- role of the network nodes (e.g. miners, validators and master-nodes vs. regular nodes),
- scope of data replication (e.g. full vs. lightweight nodes),
- adopted consensus mechanism (e.g. proof-of-work vs. proof-of-stake and others),
- degree of anonymity (e.g. transparent vs. obscure trail of transactions),
- implemented data structure (e.g. sequential blocks vs. directed acyclic graphs),
- size of the data segments (e.g. blocks of 1 MB vs. 32 MB),
- location of data storage (e.g. on-chain vs. off-chain), and the
- accessibility of the network (e.g. public vs. private blockchains).

The market of cryptocurrencies has become increasingly complex and diverse with newly developed as well as with enhanced frameworks (e.g. occuring in soft and/or hard forks). Some cryptocurrencies have deviated in important aspects from the blockchain concept (e.g. with non-chain data structures) that they are more appropriately referred to as distributed ledgers. In addition, cryptocurrencies are established on other cryptocurrencies. For example, Ethereum's ERC-20 token is used by several cryptocurrencies (e.g. Eos, Tron, USD Chain) and TeleCoin is built on top of Dash and PIVX. To navigate the dynamic token market identification and classification initiatives such as ITIN, the international token identification number, and ITC, the International Token Classification, have been proposed in analogy to the international security identification number (ISIN) and now await adoption (ITSA 2020).

Second, blockchain-based cryptocurrencies are traded *goods on electronic markets*. In parallel with the evolution of cryptocurrencies many cryptocurrency exchanges have appeared. The respective listing available on Coinmarketcap lists 341 marketplaces per 25 May 2020 with Binance being the largest by trading volume followed by Huobi Global and Bilaxy (Coinmarketcap 2020b). These digital platforms for trading cryptocurrencies are classical electronic markets with a centralized topology. Similar to foreign exchange markets, these "coin markets" pursue different business models. Among them are order-book exchanges, which focus on matching buyers and sellers, trading platforms, which focus on trading cryptocurrencies and derivatives via multiple exchanges as well as custodial exchanges, which primarily store cryptocurrency funds (Hileman and Rauchs 2017, p. 27ff). Depending on this strategic orientation, fees differ between the individual providers. Among the examples are fees for trading (e.g. 0.10% of trading volume at Binance), for the margins obtained in trading (e.g. 0.01–0.02% per trade at Kraken), fees for being inactive (e.g. five USD after 12 months at eToro) and for depositing or withdrawing money (e.g. 5% for credit/debitcards at Coinmama). While most exchanges operate markets for some hundred cryptocurrencies (e.g. Binance, Bittrex), others (e.g. Bitpanda, Coinbase) are limited to currencies with substantial market capitalization such as Bitcoin and Tether. Some exchanges (e.g. Coinbase, Kraken) also include the exchange between fiat currencies (i.e. "classical" currencies backed by governments such as the US Dollar or the Euro) and allow deposits in fiat currencies. In this case, the exchange's IT systems are also linked to payment networks, such as SEPA in Europe or ACH in the US. Overall, the cryptocurrencies allow new investment strategies for traders and established banks have already opened cryptoportfolios and cryptofunds. However, these strategies also involve risks. Cryptocurrencies are asset classes with uncertainties since forks might lead to cyptocurrencies being discontinued and since the markets are rather volatile. In addition, the electronic market places for cryptocurrencies are mostly implemented on centralized information systems. This implies that the specific advantages of blockchain technologies, i.e. the high security levels regarding data access, integrity and immutability are not applicable to most of these platforms. In fact, Feder et al. (2017, p. 138) state that by 2013 "45% of Bitcoin currency exchanges had closed, and that many are plagued by frequent outages and security breaches." Their research mentions that the once leading cryptoexchange Mt. Gox experienced 34 Distributed Denial of Service attacks prior to shutting down their operations in 2014 and they list similar attacks on other cryptoexchanges. At Mt. Gox, the theft of private keys from the centralized platform led to the loss of all cryptocurrencies held by the exchange, which amounted to 850,000 Bitcoins (Wieczner 2018). In view of the implications on the monetary system, providers of cryptoexchanges have alerted regulators worldwide and many national legislations now demand a license for commercially trading cryptocurrencies.

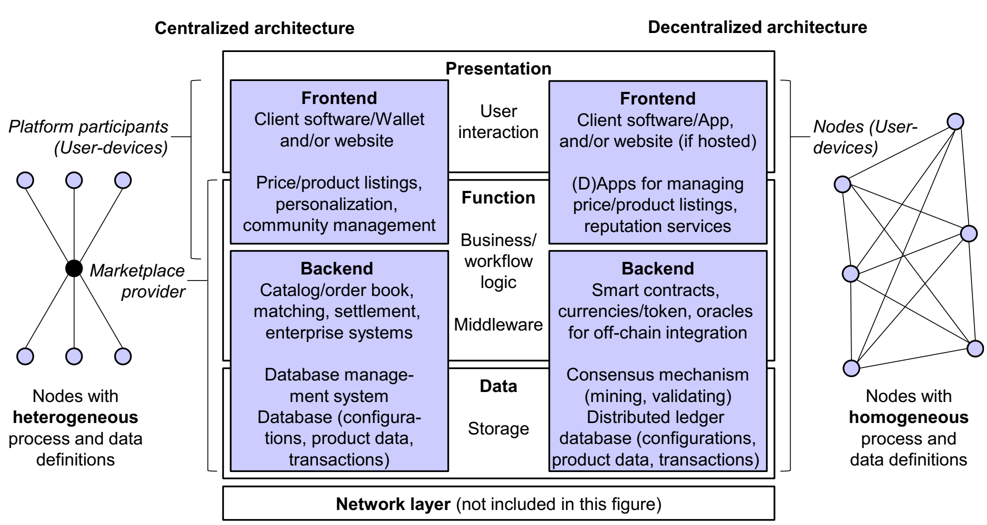
Third, blockchain technologies may contribute *electronic currencies in electronic markets*. This perspective takes a broader view than the second perspective and recognizes cryptocurrencies as currencies in economic transactions. In general, currencies serve three functions: they are a medium of exchange, a unit of account and a store of value (Baur et al. 2018). While established (fiat) currencies such as the US Dollar or the Euro typically meet these requirements due to the stability goals of the supporting governments and central banks, the situation is often different in less developed countries and cryptocurrencies. With cryptocurrencies being typically governed by open (developer) communities or businesses and not by political bodies, many of them have primarily served speculation purposes. Even the widespread Bitcoin "is mainly used as a speculative investment despite or due to its high volatility and large returns" (Baur et al. 2018, p. 178). The volatility makes it a risky storage for value and the small number of outlets a rather limited medium of exchange. At the same time, the inefficiencies in interorganizational transactions and the decentralized and anonymous nature of cryptopayments might prove as strong arguments for the diffusion of cryptocurrencies. By creating an efficient and secure means of exchange, they might reduce the friction that still exists in many value chains and payment systems. Although this favors their diffusion, additional developments are required to contain volatility and to increase trust. Several approaches are already under way that aim at linking the high efficiency of a digital payment scheme with more stability. Among them are:

- *Cryptoexchange currencies* that were initiated by the exchange providers themselves to establish a unit of account for the respective platform, for example the Binance Coin BNB, the Bitpanda Ecosystem Token BEST or the Huobi Token HT. It is the goal of these platform providers to also have the currencies accepted on other cryptoexchanges.
- *Central bank digital currencies* (CBDC) that are discussed as cryptocurrencies being issued by central banks (Lannquist et al. 2020). Similar to existing fiat currencies, the CBDCs would be backed up by central banks and are either offered in transactions between retail and central banks or with regular (corporate or private) transacting parties.
- *Stable coins* as an approach to attain stability by linking a cryptocurrency to the rates of established reference values, such as gold or stable fiat currencies like the US Dollar or the Euro. Examples of stable coins may be found in cryptocurrencies such as Paxos Standard (1:1 of PAX with the US Dollar) and the much debated Libra token (1:1 of LBA with different national currencies), which is announced as "Simple Global Payment System" (Libra 2020).

Fourth, blockchain technologies may serve as *infrastructure technology for electronic markets*. In principle, this applies to the question of whether electronic markets use blockchain technology for their own operations. As mentioned above, this will not appeal to most existing cryptocurrency exchanges, which pursue a centralized marketplace design and have the market functionality (e.g. a credit auction) implemented in centralized software. Obviously, the lack of distributed functionality in this topology limits the benefits of replacing the centralized database with a distributed database. One motivation may address the repeated security breaches that occurred with the cryptocurrency marketplaces and another the transparency of marketplace processes (see Lee 2019, p. 774). The latter goes back to the tasks of intermediaries like platform providers, which are to collect offerings and requests from various sources (e.g. via their APIs) and to match this data following certain rules. The steps involved in this data transformation (e.g. homogenization, classification) are often not transparent and the providers might use these tasks to strengthen their competitive position in the market (Kumar and van Dissel 1996). To reduce concerns of opportunistic behavior among the platform participants, platform providers may increase transparency by adopting blockchain technologies, which store data in a distributed database. Depending on the configuration and data protection rules (e.g. Finck 2018), some data (e.g. transactions) may be stored on-chain and other data (e.g. product specifications) may be stored off-chain in separate databases at the platform provider or in systems at the platform participants. Obviously, this leads to the question of whether platform providers are still necessary and paves the road towards completely decentralized blockchain-based electronic marketplaces or decentralized exchanges (DEX). Important benefits are conceivable for all main functionalities of electronic markets (Subramanian 2018, p. 80f): more up-to-date and unbiased product information when matching buyers and sellers, higher levels regarding the privacy of personal data when validating transactions (in particular in international settings) as well as lower transaction costs involved in the (re)negotiation and the enforcement of contracts. In addition, DEX contribute to bypassing intermediaries and to reducing the costs for mediating between buyers and sellers (Wigand 2020). Along the third perspective mentioned above, existing decentralized marketplaces, such as Particl (e-commerce platform), IOTA (data marketplace) or Lazooz (mobility platform) have introduced their own cryptocurrencies (e.g. PART, MIOTA and ZOOZ) to facilitate transactions, while other decentralized e-commerce platforms such as OpenBazaar or OpenSea use third party currencies (e.g. ZCash and (W)ETH). Overall, these examples and research on decentralized markets (e.g. Serban et al. 2008, Prasad et al. 2018, Kabi and Franqueira 2019) have shown the feasibility of implementing marketplace functionality in distributed settings. For the financial domain, the notion of decentralized finance (DeFi) has spread (e.g. Schär 2020), which is based on decentralized exchange protocols (e.g. 0x, (Air)Swap, Bancor, Kyber Network, Market, UniSwap) and allows a glimpse of a variety of new decentralized business models.

All of these initiatives highlight the possibility of replacing the separate organization for managing the organization gap in the interorganizational setting. Figure 1 shows this by mapping the functionalities of electronic marketplaces to the three general layers of application systems (presentation, function, data, see Evans 2004). In the centralized client-server architecture model, users access the platform functionalities and the market backend with the catalog, matching and settlement functionality as well as the database via (more or less comprehensive) frontends (e.g. Menychtas et al. 2012). In many cases, the marketplace application is linked with enterprise applications for marketing, accounting, HR and the like. In the decentralized scenario, each node would (more or less) comprise all three layers implemented in blockchain-based markets (e.g. Viswanathan et al. 2019). While price and product listings may be included in the frontend, much of the market functionality is implemented in specific decentralized applications (so-called DApps, such as Auctionity or MPX), which specify the steps in electronic trading (e.g. place and browse orders, auction mechanism). They could be complemented with decentralized community services, for example reputation services, which are described in more detail in an article of this issue (see Hesse and Teubner 2020). In addition, decentralized price feeds (or other data obtained via connectors referred to as "oracles") could support the selection of offerings and price discovery by providing links to off-chain databases (e.g. via Arbitrum or Mixicles). The infrastructure becomes less complex if electronic markets do not include price discovery and the matching of buyers and sellers. As illustrated with the many use cases collected by Casino et al. (2019), the applicability of blockchain

Fig. 1 Architecture of centralized and decentralized electronic markets



technology as a distributed system of records for sharing information end-to-end in (per se) distributed supply chains is meanwhile undisputed and reflects an isomorphism that has been recognized as co-evolution in another editorial (Alt 2018). For networked businesses, the blockchain infrastructure creates a common but distributed application system with homogeneous databases and processes. However, this homogeneity typically applies to a certain blockchain implementation and with the multitude of such implementations a new interorganizational heterogeneity arises. This calls for solutions that not only integrate blockchain systems to internal enterprise systems, but also to other blockchains. Diverse initiatives are already looming on the horizon that aim at providing solutions for this integration challenge (e.g. Blockchain Interoperability Alliance, Chainlink or Enterprise Ethereum Alliance).

Fifth, there is the possibility to use *electronic markets in consensus mechanisms*. This perspective would tap the large body of knowledge on (electronic) auction mechanisms for designing consensus (e.g. mining or validation) in blockchain systems. In fact, existing consensus mechanisms already mirror market principles, for example, proof-of-work may be conceived as a first price auction mechanism. If users decide to pay higher fees, their transactions will be processed with higher priority (i.e. faster) by the miners. Research has revealed that alternative mechanisms for determining this sequence could benefit users and miners alike. For example, Basu et al. (2019) replaced the first price auction with a second price auction for fees in the Bitcoin system and report "more stable, predictable fees in cryptocurrencies" by preventing users from bidding strategically (Basu et al. 2019, p. 3). As argued by the authors, transactions in blockchain systems will have to be prioritized regardless whether proof-of-work, proof-of-stake or another mechanism is implemented. This implies that insights from auction theory will be beneficial for discussing improvements of consensus mechanisms. In addition, research by Chan et al. (2020) has shown that a mining procedure based on bidding for blocks ("the miner with the closest bid will get the mining reward and will consolidate the block into [the] blockchain" Chan et al. 2020, p. 61) would also contribute to significantly reducing the amount of energy required for mining new blocks.

Special issue articles

In summary, the five perspectives suggest that contrary to the earlier statement of Kubicek and Cimander challenges still exist for distributed technologies on the technological level, in particular regarding performance, scalability and ecology. Many challenges also persist regarding the business aspects and, in particular, regarding the adoption in the business world. This means that much of the potential of blockchain technology as general purpose technology still needs to be unlocked. In this vein, Hughes et al. (2019, p. 115) report that "studies have highlighted that transformative applications are still not commercially available and few organisations have progressed their blockchain solutions beyond the feasibility or prototype stage." (Hughes et al. 2019, p. 115). This need for research sets the stage for the present special issue, which is titled "Potential and limits of blockchain technology for networked businesses". The guest editors Roger Bons, Johan Versendaal, Liudmila Zavolokina and Weidong Larry Shi have organized this special issue to explicitly consider blockchain technology as a facilitator for new coordination mechanisms and for new (i.e. decentralized) forms of electronic markets. Their goal was "not to promote a technology push, but rather to investigate the emerging technology's potential impact on how organizations interoperate through electronic markets" (Bons et al. 2020). By combining the open call for papers with a fast track of the "Blockchain Technology" mini-track at the Hawaii International Conference on System Sciences (HICSS) in 2019, the guest editors were successful in compiling eight papers in their special issue, which they will all introduce in their separate preface. They emphasize several of the five perspectives: new business models, new forms of collaboration and investments as well as more efficient trading.

An opinion from the business world complements the research papers of this special issue. This interview with an executive from the European Energy Exchange (EEX) shows how a worldwide leading electronic market provider assesses the impact of blockchain technology on their strategy and their operations. Overall, Tobias Paulun sees advantages of centralized as well as of decentralized markets. On the one hand, he sees the centralized electronic market platform as unrivaled in the segment of wholesale energy trading in terms of efficiency and trust. At present, the benefits of the existing exchange procedures remain superior to the more recent blockchain infrastructures, which generate little added value in this market segment. On the other hand, access to the centralized exchange systems is limited to certified participants and requires other market participants (e.g. companies as prosumers of energy) to participate in energy trading via brokers. Often, these participants have decided against the complexities and risks of energy trading, which leaves a large number of potential market participants that does not participate in energy trading today. Due to the decentralized nature of these participants, decentralized blockchain technologies may prove beneficial, but still face important challenges. Similar to the expectation of Bons et al. (2020), whereas "old and new technologies may very well complement one another", Paulun also expects centralized platforms and blockchain markets to co-exist (Alt and Wende 2020).

In addition to the special issue section and the interview, three papers are part of this issue's general research section. The first supports the argumentation of this editorial, whereas blockchain technologies enable the decentralization of many activities. Maik Hesse and Timm Teubner show this with their exciting analysis in the area of reputation management titled "Reputation portability – quo vadis?" (Hesse and Teubner 2020). They recognize that while customer feedback embedded in reputation scores is important for building trust in digital platforms, these trust-building mechanisms are largely limited to the respective platforms. Based on a conceptual model that was developed in multiple steps, the authors analyze personal information management systems (PIMS) and discuss possible future decentralized scenarios. Both remaining general research papers are fast-tracked from the HICSS mini-track on "Social Information Systems" in 2019. The authors Niklas Kühl, Marius Mühlthaler and Marc Goutier show in their paper how customer needs may be automatically derived from social media platforms using the example of Twitter data in the e-mobility domain (Kühl et al. 2020). Based on this data, the design-oriented methodology led to the deployment of a web service that applies a supervised machine learning algorithm and may be used for constantly eliciting customer needs for potentially increasing customer satisfaction. The third and final paper of this issue presents research on the skills (or affordances) of chatbots, which the authors Emanuel Stoeckli, Christian Dremel, Falk Uebernickel and Walter Brenner observed in 17 organizations. These affordances were derived from generalized use cases and classified in lower-level and higher-level affordances and constraints. The findings contribute in discovering and exploiting the potentials when linking social information systems (i.e. the chatbots) with traditional enterprises systems, such as customer relationship management systems (Stoeckli et al. 2020).

Awards and board members

Last but not least, the second issue of each volume is also an opportunity to thank authors and reviewers alike for their contribution to Electronic Markets. One symbol are the annual awards for outstanding papers and best reviewers. The candidates were identified in an internal quantitative and qualitative screening of papers and reviews. For the outstanding paper award, citations and download figures were analyzed together with a qualitative pre-screening by the Editorial Team in a first step and a voting among Senior and Associate Editors in a second step. The best reviewers were determined based on the number of reviews and on how they contributed in providing elaborate constructive feedback. Based on this process the awardees are:

- *Outstanding papers*: Henner Gimpel, Daniel Rau and Maximilian Röglinger for their research on FinTech start-ups (Gimpel et al. 2018) and Dominik Jung, Verena Dorner, Christof Weinhardt and Hakan Pusmaz for their design of a robo-advisor (Jung et al. 2018).
- *Best reviewers*: Maria Madlberger from Webster Vienna Private University in Austria and Peter Gomber from Goethe University Frankfurt in Germany.

The entire team of Electronic Markets wishes to congratulate these colleagues for their achievement and thanks all colleagues who helped determine this year's awardees. Another big thank-you goes to the guest editor team of the present special issue and all the authors, reviewers as well as editors, who were involved in the articles of this issue! Truly, people are the key resource of an academic journal, which also applies to the Advisory Board of Electronic Markets. We are grateful that Antje Stobbe, Veni Markovski, Raj Ramaraj and Frank Riemensperger were available for advice during the past six years and cordially welcome several esteemed colleagues to the Advisory Board. We are happy that Rahul Basole from GeogiaTech and Accenture, Harry Bouwman from Delft University, Eric Clemons from the University of Pennsylvania, Svenja Falk from Accenture, Ali F. Farhoomand from the University of Hong Kong, Eric Johnson from Vanderbilt University, Stefan Klein from the University of Münster, James Short from the University of California San Diego, Charles Steinfield from Michigan State University, Yao-Hua Tan from Delft University, Hannes Werthner from the Technical University of Vienna, Andrew Whinston from Texas University, Rolf Wigand from Arizona State University, Howard Williams from Strathclyde University and Jing Zhao from the China University of Geosciences have agreed to join the Advisory Board.

Thank you to all of them and we hope you enjoy reading this issue of Electronic Markets.

Your EM-team.

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