THE INTERNET OF AGREEMENTS

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THE BLOCKCHAIN PRIMER

WHERE IS THE CENTRE OF THE WORLD?

Electronic communications have brought us closer together than ever before but we are still not quite in the same room.

In person-to-person communication, a tiny delay as our messages bounce around the world does not matter much. We may have to restart a few sentences on a video call, but we can overcome it. In computer systems a lot can happen in a few fractions of a second. At peak demand, VISA processes 24000 credit card payments in one second. In the delay that a message takes to get to San Francisco and back, VISA has processed thousands of orders.

The New York Stock Exchange processes orders as they arrive. The closer you are to the exchange, the faster your orders clear. This has produced the high frequency trading phenomenon, as traders cram more and more computers as close as possible to exchanges around the world. Central clearing houses can never be fully fair if they operate at the speed of light: the closest player will always have an unfair advantage.

Who gets to be at the centre of our globalized world?

FAIR PLAY IN A DECENTRALIZED WORLD

The blockchain is a technology for fair play in a globalized world. It processes transactions and stores data much like any other computer system, but in a way which is incredibly useful for solving today's challenges.

It works by promoting three fairness advantages.

Everywhere is the same because a blockchain has no center. Blockchain aficionados call this "decentralization." There are no central clearing houses to move computers closer to. Transactions clear in the same amount of time regardless of where in the world they were issued. This means fair play for everybody regardless of their location. This is achieved by running transactions in small batches called "blocks."

The record is permanent to protect transactions. A benefit of decentralization is extremely strong cybersecurity. The process which lets many computers all over the world process transactions together also means that if a machine is compromised, it does not affect the rest of the computers holding the blockchain. A blockchain is a secure sequence ("chain") of blocks.

Nobody is in charge of the global blockchain as a whole. It is operated by a fair consensus which makes all participants equally responsible and equally capable. Local blockchains can be run by a sovereign entity or a company, and they can choose who can participate, similar to an existing corporate network but more secure. Global blockchains work more like the internet itself: anybody can participate, but without compromising the inherent security of the blockchain.

These attributes were first realized in a system called Bitcoin, which created a sort of digital money used mainly by internet natives who dreamed it might some day become a rival to gold as a store of value. Bitcoin continues to compete for space as an international currency, but the main innovation has moved past it into a new domain: smart contracts.

SMART CONTRACTS

A smart contract is a way of making a deal, and locking in all the details, using the fairness and security of the blockchain. These agreements could be simple things like a bond or an option, or more complex instruments which look more like a small computer program than a financial instrument as it is commonly understood. The financial industry already uses a lot of software to represent financial instruments, so this is an extension of existing practices.

A smart contract can also interact with the real world. For example, imagine a self-driving car which needs to recharge. Both the charging station and the car can access the blockchain using wireless internet. The smart contract says it will pay for electricity at a pre-agreed price. The charging station checks the car is the car listed on the contract, and the smart contract automatically pays as the electricity is delivered.

Other systems could provide this kind of functionality, but none with the elegance and simplicity of a smart contract. In a world with enormous numbers of smart devices cooperating to produce high quality services, this functionality may be a key security, reliability and service breakthrough.

REGISTERS

Another way to see the blockchain is as a register or ledger. The attributes of fairness, permanence and so on are a good fit for what we want from record keeping systems, including public records. A blockchain allows one to check if an item is provably unique: exactly one owner for a car, or building, or domain name. This attribute is useful and convenient within a nation, helping with routine processes like asset transfers. It is also potentially very useful internationally because it provides a single source of truth when doing transactions in an unfamiliar environment.

In the UK, for example, selling a house is a complex multi-stage process involving several intermediaries who execute an essentially medieval bureaucratic process to effect a property transfer. The UK Government Digital Service Registers Authority is examining how blockchains and similar systems could streamline processes as simple as registering a new company and as complex as proving identity to issue passports. The hope is that a standard technology for maintaining and publishing government statutory registers could make many operations both inside of government and in business easier, more convenient, and safer. The safety and integrity of public records, in an age of increasing cybersecurity concerns, is paramount.

When we created the initial ideas which grew into the Dubai Blockchain Strategy, our intention was to build on the pre-existing strengths of government. Secure record keeping is a core competence of the state. New technology allows government to extend its services in new ways. The original conception inside of Bitcoin and Ethereum (two leading blockchain projects) was that many goverment-type services could be provided without strong reliance on state support. However, as our understanding of the blockchain has matured, it becomes increasingly apparent that the blockchain is a natural fit for the needs of the state. As we move forwards, each new technology permits sovereign authority to provide services in new ways through a process of constant adaptation, innovation and improvement.

ABOUT THE AUTHOR

Vinay Gupta had an instrumental role in developing the Dubai Blockchain Strategy. He project managed the launch of the smart contract blockchain Ethereum, and is a member of the Global Blockchain Council. He recently founded hexayurt.capital — a London-based VC investing broadly in the technology space.

GLOBALIZATION 2.0

LIBERATING PRODUCTIVITY BY MAKING SIMPLE THINGS EASY

When simple things get easier, big systems can become more productive.

The containerization of shipping, and the quality revolution in manufacturing which made mobile phones possible both came from cost and reliability breakthroughs in fundamental processes. Blockchain technologies stand poised to repeat this revolution for the slowest and most difficult parts of the day to day process of running an organization: compliance, regulation and the paperwork. Business, government and society will all benefit.

Globalized trade and cheap microelectronics came from a series of refinements in very basic processes which, when it was all added together, produced a revolution. Imagine a future in which many business deals have this property, allowing for a tightly meshed international business environment in which efficiently connecting resources from all over the world is a creative act. Computers to do most of the grinding administrative work of aligning all the details. People make the creative decisions. Although this may seem like a large step from where we are today, we firmly believe that such a world is possible, that it is coming towards us, and that it is a better world for all. Reducing transaction costs and risks can change the world.

DEEP DIGITIZATION: FINALLY FIXING THE PAPERWORK

Today international trade and other forms of international cooperation are profoundly difficult at a large scale because the individual links may be just a little bit unreliable. If a project requires assembling components from all around the world, even if they can be shipped very quickly using air freight services, the risk that a supplier will glitch, or something will get stuck in customs holding back the entire project is always very real. The least reliable part of the process is the part with the least computerization: customs, bills of lading, and so on. Robot ports hauling standardized steel sea containers still rely on paper bills of lading in most cases. This mismatch, between the world of near-instantaneous electronic communication and the hard realities of bureaucracy can be resolved with blockchain technology.

We can bring the world of paperwork up to the speed of the rest of the global economy.

Today machine-to-machine cooperation involving business and government are slow, costly and often require quite a bit of “manual labor” (programming) to create. The main problem is one of standards. Each organization has its own IT solutions and ideas about how to do things, and building the bridges between these organizations is often as much a manual process as hauling tons of coffee off a ship one bag at a time, as it was done before the advent of containerization.

MAKING DEALS BY HAND

If a local airport, local hotel and a local taxi service want to set up an automated system to pick up guests at the airport, the principle of the deal might take 20 minutes to agree. But making the computers link the booking system to the taxi allocation software might cost more than the deal is worth to any party. When organizations work together with machine-to-machine coordination as part of the framework of the deal, there is a good chance the computer part of the agreement will be the stalling point. The costs simply stop cooperation in all too many cases.

ANY PLACE WHERE COMPUTERS AND THE REAL WORLD INTERSECT CAN BE TRANSFORMED

We still coordinate with humans because it is often simply more economically efficient and more flexible here and now. But manual coordination does not scale and in the long run might be more expensive, and it will always be a little bit unreliable. This could be thought of as the "craft mode of production" for deals and coordination. It is as inefficient as hand-making furniture or clothes. Deals and coordination are still bespoke.

The problem this raises is that forming complex value networks is difficult when people are part of the process. Human processes are flexible, resilient, but also just a little bit fallible. If we imagine a large scale cooperation with hundreds or thousands of organizations collaborating, but each link is a little bit unreliable, it's obvious to see there will be a lot of difficulty. Errors made in one place get passed on to other places, and problems ripple out. In manufacturing, this is like buying unreliable components: they throw the rest of the precise production process into chaos.

AUTOMATED RELIABILITY FOR COMPLEX SYSTEMS

Cultures which master and deploy these kinds of highly reliable and efficient systems can do amazing things. Most of the organizations which have these skills are advanced manufacturing organizations. For example, an aircraft or a mobile phone contains thousands of parts, manufactured by hundreds of contractors. One substandard component can render a phone useless, and with planes the reliability issues are even more vital. These devices can only exist because each individual component has a defect rate so low that when the whole device is put together, with all those individual components adding their risk of failure to the whole, the device is still extremely reliable. This is only possible because of quality control regimes like Six Sigma which provide near-zero defect rate manufacturing.

WHEN SIMPLE THINGS GET EASIER, BIG SYSTEMS CAN BECOME MORE PRODUCTIVE

Systems can only get big and complicated because each individual component is incredibly reliable. If we try and build systems at this level without extremely reliable underlying systems, there will be lots of errors, contingency management, and redundancy, and heavy and expensive recovery plans. Such systems seldom fulfill their economic potential. Even when they work, people instinctively see the inefficiency and know that with the right changes, another, better world is possible.

What if we had near zero defect computerization of deals and administrative processes in business and government? How does the world change when business and government transactions are as flawlessly efficient as modern manufacturing?

TRANSPARENCY AND INTERNATIONAL DEVELOPMENT

That same kind of complexity bedevils international development efforts. Instead of component vendors, we have field partners who actually dig wells or install solar panels. For the project as a whole to succeed, each has to do a good job, and this has to be demonstrated to funders without taking %20 of the project budget to do the auditing and proving. In more complex collaborations, each aid agency may wish to use its own tracking and monitoring systems, and interoperability between these systems is as hard as any other kind of computer-based cooperation. Projects get tangled because there are lots of details, and things always snag.

But if shared global registers - blockchains - could be used to track money and benefits generated from an international aid project, could better and more ambitious projects be coordinated? In business, what if blockchain style precision and transparency could be bought to building real estate portfolios or coordinating air travel arrangements and booking hotels? What if we could deploy reliable software agents ("smart contracts' by another name) to make our back-up arrangements if something goes wrong?

THE INTERNET OF AGREEMENTS

In the Internet of Agreements™, when technologists deliver machine-to-machine handling of agreements to a high enough standard, it will revolutionize business and international cooperation. The blockchain is the most likely platform to give rise to that world: it is the world that the smart contract ecosystem will create as it matures.

As we move forwards down this path, we will start to see the enormous potential for productivity improvements which the digital age has always promised. The parallels to container shipping, advanced manufacturing and logistics, and the internet itself are clear: if all the small steps are really reliable, the big things happen much, much more easily. Today contracts between organizations are hard to understand, difficult to read for both humans and computers, and are hard to combine together to create new services, or delegate to third parties to carry out on our behalf.

REDUCING TRANSACTION COSTS AND RISKS CAN CHANGE THE WORLD

Combining two contracts to create a third contract - "composability of contracts" - does not really work except in very specialized cases, and certainly not in a fluid and transferrable fashion. We have institutions like subletting of real estate, or service level agreements with associated compensation, but every single link in such chains is a paper contract with fallible humans on each end. It is very difficult to create new products and services by recombining elements in the marketplace when those components have independent legal and administrative complexity. This limits the effectiveness of many areas of the economy.

Just as manufacturing can only be as fast as the slowest process, networks of contracts are as reliable as the least reliable contract. The result is companies in the centre of these "networks of contracts." These large companies absorb slack and problems in the many contracts required to get the job done: prime contractors act something like insurers or market makers for the skills and talents of many smaller companies. They are there to absorb and manage unreliability. They charge hefty fees for taking this role in securing delivery.

Of course trucks will still break down, and apartments will still have plumbing problems. But the incidental complexity involved in business operations could go down by a very large factor, into a domain where a much more complex, contingent and interwoven business environment will emerge. Such an environment might be as different from today's business environment as container shipping is superior to packing boats by hand. It will be better for government, business and people.

THE SHARING ECONOMY

The sharing economy is currently structured in a model that Robin Chase, the founder of ZipCar (a very successful car sharing service) describes in her book "Peers, Inc." The Peers, Inc model describes Peers who are a network of asset owners with a spare room, a car which isn't used while they are at work, or similar sleeping assets. The "Inc." is an incorporated company which joins these assets together into an accessible market. This central clearing house typically charges a substantial fee for this service. In return the company manages software creation costs, legal and regulatory interfaces with government, marketing and advertising for the brand and so on.

However, this model makes it quite hard for the Peers to get a square deal from the Inc in the centre. Because the Inc is a company with a few thousand staff, and the Peer is typically an individual with a little sliver of resources to share, in the event of a dispute they are not evenly matched. This pattern replicates between market makers and vendors at all scales. SWIFT and VISA are quite powerful compared to their member banks: being barred from either network would be catastrophic for many financial institutions. Dee Hock, the founder of VISA, tried and failed to build an interbank network before VISA was created because of these commercial dynamics.

To get the Peers a square deal in such an environment requires some kind of collective representation or altered ownership model, or regulation from the government. A future can be envisaged in which peers are formed into collective bargaining blocs a little like labor unions, or a future in which peers own the Inc structure which represents them, or a future in which the government regulates sharing economy companies quite strictly to ensure a fair deal for all. Government levels the playing field between powerful institutions and ordinary people in many areas. The sharing economy may continue to throw out the kind of problems which cause governments to pay attention and take action.

WHEN ORGANIZATIONS WORK TOGETHER WITH MACHINE-TO-MACHINE COORDINATION AS PART OF THE FRAMEWORK OF THE DEAL, THERE IS A GOOD CHANCE THE COMPUTER PART OF THE AGREEMENT WILL BE THE STALLING POINT

However, in a business environment in which a forest of small contracts, represented as blockchain smart contracts, is woven together into a reliable mesh of interlocking deals, with support from the government, perhaps the balance shifts towards the Peers. When the cost and complexity of running a sharing economy market for cars, housing or some other resource drops by %90 or %95 because of automated contracting infrastructure on blockchains perhaps the natural economic equilibrium will favor many small actors working together in networks rather than larger single corporate bodies. The implication here is that as the Nobel prize winning economist Ronald Coase predicted, as transaction costs drop, flexible markets replace natural monopolies at every scale with a corresponding increase in the baseline efficiency of the whole economy.

A sharing economy deal, organized one person at a time, might involve five or even eight participants: a buyer, a seller, a cleaner, an insurer, a dispute resolution service, an auditor and perhaps additional pre-paid services like tow truck cover for a car rental. Making these agreements at an individual level is simply too expensive, but in a smart contract environment it could be as simple as sending an email: software makes sure the deals are simple to set up and reliably executed.

BLOCKCHAINS FOR REGULATORS

What is the outlook for international cooperation in a world like this? Because we have no automated way of handling compliance with local regulations, most cross border deals have some degree of additional complexity simply because they are cross border. This complexity encourages people to trade mainly within their own countries, and this leaves economic opportunities unexplored. To smooth out these issues, it is often decided to flatten local regulatory frameworks on a large scale. For example, the Single Market in Europe is one attempt to make cross border trade easier. Much of the impact of the Single Market is driven by regulatory factors independent of the Eurozone: trade agreements are mainly an exercise in cutting red tape. WIPO, WTO and the international trade agreements extend this basic trend globally.

If there were reasonably competent computer representations of that red tape so it could be managed by automated systems, might it be possible to create streamlined commercial zones based on software mapping out regulatory requirements, rather than having to simplify the regulatory situation to the point where a human can navigate? Nations and regions could keep their local regulatory frameworks, if they were presented in a framework which would allow companies from the rest of the world to use software to understand and adapt their offerings to the local environment. We may not need the blunt instrument of regulatory standardization to enable global trade in only a few years.

THE SAFETY AND INTEGRITY OF PUBLIC RECORDS, IN AN AGE OF INCREASING CYBERSECURITY CONCERNS, IS PARAMOUNT

Making regulations legible to computers is a long journey. However, the wave of digitization which is being triggered by the adoption of blockchain technologies across the landscape shows the global direction of travel. Every industry and most large economies have several areas of innovation and disruption as blockchains are adopted, and there is little doubt in the minds of most practitioners that these trends can only grow and converge. The problems that the blockchain solves are long standing, expensive and profitable to resolve, and so progress will be at least stable, and possibly extremely rapid.

UNDERSTANDING GLOBALIZATION 2.0

Computers have come a very long way since the golden age of facilitating international trade by flattening local regulation. That paradigm is old and has not been challenged in many decades. But now the technology has caught up with the challenges of representing the real world. If we correctly deploy technology to facilitate international trade, we can get a much better new equilibrium: on one hand, local flexibility and the ability of local governments to regulate in the interests of their people. On the other hand, the ability to cheaply and effectively form international complex value networks to liberate the productivity which is still locked up behind transaction costs and regulatory diversity.

You could think of this model as “Globalization 2.0” The first globalization was an industrial model of globalization, where everything has to be made with the same standards before people can work together. In Globalization 2.0 computers take the strain of handling local differences in standards, regulation and consumer preference, and advanced manufacturing meets these requirements because it can run small batches tailored to local needs efficiently.

Computers handle the red tape, and the blockchain is the next step.

CONCLUSION

BLOCKCHAINS OPEN THE DOOR TO THIS NEW WORLD

Computers are capable of doing far more than they currently do for us. Because they are a relatively recent technology, society, business and government are only slowly adapting to the new capabilities which are at our fingertips. But in an ever more crowded and resource-constrained world, it is very helpful if we can rapidly adapt to new conditions and get the benefits from every opportunity. Constrained budgets go much further if we do not leave useful doors closed.

Simply getting a much higher quality representation of the physical and legal world loaded into computers is an enormous step forwards. In the same way that digital mapping gave us a whole range of new services and occasionally goods, getting existing property rights databases (land ownership, company directorships and similar structures) into a form where computers can easily get at them will allow for all kinds of optimizations. The same may be true for other diverse areas like identity systems (to fight credit card fraud and streamline relationships with public service providers), medical, energy systems, self-driving cars and other automated transport systems, and more. Any place where computers and the real world intersect can be transformed.

Laying strong, solid foundations for the 21st century means having a bold, coherent vision for the future. We believe there is a broad, open opportunity to begin the economic transformation of the global economy to take full advantage of the reduction in transaction costs and increase in security which blockchain technology offers. We expect the field to mature rapidly beyond the pilot stage and to deliver clear economic and security benefits very quickly. Before meaningful work can begin on internationalization and trade using blockchains, individual governments must get at least some part of their internal systems up to speed on this new technology platform.