
Cube3 Technologies Ltd

Entity: Name (or first name if applying as a natural person)

Cube3 Technologies Ltd

Entity: E-mail address

exec@cube3.tech

Team member introductions

Team members are Mike, Tom and Will, with the addition of Pete primarily in an advisory role.

Michael (Mike) is a Chartered Engineer, having gained a Bachelor of Technology from Loughborough University in the 1970s. His early career was in the challenging environment of Automotive Manufacturing where he was responsible for changing the manufacturing operations of a number of UK household names culminating in recognition in the Institution of Mechanical Engineers award for Manufacturing Effectiveness. His career switched into Logistics and Supply Chain activities where he worked in both operational and strategic roles, before taking up consultancy. Here he has delivered the design, modelling and project management of business solutions for public and private sectors covering health, utilities, automotive, construction, agricultural equipment, cellular telephones, clothing and electronics. Expertise includes: Programme & Project Management, Process re-engineering, Logistics design and Manufacturing Engineering. He is a registered Managing Successful Programmes Practitioner, a Prince2 Practitioner and a SixSigma Black Belt who firmly believes in the people, process and systems approach to transformational change and that such results are achieved by building capable teams based on trust, respect and honesty. He is now largely retired.

Thomas (Tom) was awarded his PhD in Intelligent Automation in June 2018 and holds a Masters degree in Aeronautical Engineering. In 2012 he joined BAE systems as a Student Research Engineer, working on Prognostic Health Management solutions. Following this he became a Research Associate working on Hybrid Strategy for Hydrogen Fuel Cell Vehicles, before joining the Engineering and Physical Sciences Research Council (EPSRC) Centre for Innovative Manufacture in Intelligent Automation at Loughborough University, where he currently works as a Research Engineer. Here he helps manage the group's PLM server, network storage servers and assists with the two Deep Learning computers, whilst developing custom mechatronic solutions for a number of large aerospace companies. He is the author of 9 publications and is the recipient of 4 Honours & Awards including one contribution which helped Loughborough Universities gain the award The Queen's Anniversary Prize for High-Value Manufacturing.

William (Will) was awarded his PhD in October 2017 having received both undergraduate and graduate degrees at Loughborough University. His primary research interests include robotics, unmanned vehicles and machine vision, with his PhD thesis focussing on automated aircraft taxiing. Since graduating, William continues at Loughborough University as a Research Associate in mechatronics, working on robotics and deep learning. Much of his work involves industrial and mobile robotics, predominantly using the Linux based Robot Operating System (ROS). His primary experience in server management comes from the setup and administration of deep learning servers, used to train robots for human interaction. William has also been involved in several large European projects, including the Open-Manufacturing-Operating-System (openMOS), which focuses on Industry 4.0 and Intelligent Cyber Physical Systems. His role in the openMOS project is to develop large scale simulation of industrial standards, including the deployment of OPC-UA to a large cluster of embedded systems, intended to represent a virtual factory for testing.

Peter (Pete) has an MEng in Computer Science and worked as a data analyst and programmer for a logistics consultancy during University vacations. Upon graduation he secured a position with one of the Big 4 Accountancy firms. Unfortunately, he developed a serious long-term health condition before he could start this role and has been unable to work since that point, over a decade ago. Since then he has kept up with developments in computing and technology as his health has permitted. He developed an interest in running an enterprise grade server set-up on his local network so that media centres could feed multiple TVs. Driven by a desire to do things right and a thirst to learn new skills this has evolved to encompass two servers running the Proxmox hypervisor with redundant mirrored ZFS storage and UPS backup, it currently provides local shared storage, personal cloud and calendar management facilities for his household. He began to follow cryptocurrency in 2016, starting with a small mining operation focussed on Ethereum as well as some direct investments. He also runs nodes for a number of projects including Particl, HEAT and Ethereum. He purchased his first Factoids in 2016 and has since kept a keen eye on the project. Whilst his health condition will primarily limit him to largely an advisory role in this venture, his technical experience and understanding of the blockchain space will be invaluable.

Introduce your Entity/Company

Cube3 Technologies Ltd is a UK based business operating from the Oxford Area. It has 4 founders: Pete, Tom, Will and Mike. Of the founders Pete acts in an advisory capacity only because of long-term illness. Tom is the Chief Operating Officer, Will is the Chief Technical Officer and Mike is the Chief Executive Officer. We intend to continue with a small core team and will add other resources on a contract basis as the business develops. We have demonstrable capability and experience in business, commerce and academia with a real passion to improve the integrity of information used for decision making. We have been involved with Blockchain related technology since 2016 and have formed Cube3 Technology Ltd to advance this.

How many nodes do you envision to run on the Factom Community Testnet (or other testnets?)

2

What type of legal structure does your team use?

UK Limited Company, equivalent to a LLC in the US

Will you operate as an incorporated company?

Yes

If yes to the above, where are you/will you incorporate? Are you already incorporated?

We are an incorporated company in the UK. Company Number 11433103. Please see attached certificate.

Are there any major shareholders (>10%) other than the members in your application?

No

Do you and/or your team members have previous experience running a business or managing large capital? If so, make a short writeup of your experience below.

Mike has the most experience of running a business. He was a significant member of a management team running a \$56m pa turnover manufacturing business in Scotland. He has managed a significant number of multi million \$ projects. He has operational experience of running teams of 20plus people and annual operating budgets in excess of \$1.5m pa. His more recent experience in consulting involved him with the senior executives of a number of blue-chip companies across a wide range of business sectors.

[What has your team done to ensure a proactive approach to managing the financial aspects of your business?](#)

Mike as CEO has direct responsibility for the financial management of the business. This entails budgeting together with the management of both the procure to pay cycle and the order to cash cycle in process and operational terms. We have researched appropriate accountants and will formally appoint one on ANO confirmation. When it is necessary to liquidate any of the Factoids we have the services of an experienced cryptocurrency trader to ensure this is done in a way that provides the best value for us and in turn for the protocol whilst minimizing market disruption.

[Clarify your commitment to the Factom protocol? What have you brought to the table already, and what will you bring in the future?](#)

Our commitment to the Factom protocol has its origins in an initial purchase of Factoids in 2016 as part of a diversified long-term (10 year+) crypto investment portfolio. Pete has been a keen follower of developments with this project, having joined the Slack back in 2017.

Following a positive assessment of the opportunity to become an ANO we have established a number of VPS instances across a range of providers in order to test their suitability for Mainnet operation. So far 2 have formally become testnet servers, 1 in the Authority set and 1 follower node. An additional server has been setup to provide centralized logging and will be configured to monitor the uptime of the others and send alerts in case of malfunction. We have built operating experience across the team in deploying these servers and have conducted a successful "Brain-Swap" on the testnet.

It is our intent to operate 2 Mainnet Nodes as dedicated servers in geo separate locations, each with a fully functioning back-up node and maximum redundancy. Operations will run as defined business processes with risk management at the core and a continuous improvement (with caution) ethos.

We have identified opportunities for development of applications that use Factom which, once the basic server operation capability has been proven, we will seek to pursue, provided there is a sound business case. We may seek grant support to bolster this. In addition, whilst we are competent system administrators, we have identified a number of areas in which we will conduct research to identify and then implement best-practices. This includes a robust centralized logging solution and appropriate auditing techniques to identify unauthorized access of any of our servers. If the community is interested we would be happy to publish these findings, perhaps subject to peer-review by other experienced infrastructure ANOs. We would do this because we recognize it is in our best interests for all Factom nodes to be run as securely and professionally as possible.

Please see our full proposal document for further details.

[What is your/your entity's motivation for applying for hosting Factom Authority servers?](#)

Our motivation for running factom servers stem from our beliefs. We believe that business and political decision making can be improved through greater confidence in the fidelity of the information. It must be. We have personally suffered from poor decisions, particularly with regard to health issues, at governmental level. We can make a real difference. Blockchain technology is one of the most fundamental tools in our armoury to make this difference. Factom, in particular is well placed to be really significant. In addition we believe we have the skill sets to run reliable nodes and believe it is of the utmost importance that all nodes are run to the highest standards for the Factom vision to become a reality. Naturally we expect a significant financial upside over the medium to long term but this will not be realized without taking on considerable risk and expending proper effort to make sure the Factom network is operationally sound. With our unique skill set and current personal circumstances, we find ourselves in the exciting position of being able to provide support to this network at a time when the market conditions are less than favourable to other entrants (who may not be prepared to take on the significant time and financial commitments without more certainty on reward).

What vision do you/your entity have of the future of Factom?

Our vision for working with Factom is to capitalise on the “Honesty is subversive” belief of Paul Snow and by working together encourage the use of Factom to increase geometrically as people adopt it as the norm; disrupting the inefficiency of traditional record keeping, disparate information and legal tussles over who actually said what.

What will your efficiency be with only one node?	0,5999999999999998
What will your efficiency be with two nodes?	0,6999999999999996

Node #1 Type	Dedicated server
<i>Node #1 Location (VPS: Provider, Region // Other: Country, City, Datacenter)</i>	The provider is nine (nine.ch). They were established in 2004 and are ISO27001 certified. Their datacentres are based in Zurich, Switzerland and all have redundant power, climate control and internet connectivity as well as 24/7 security and support staff
<i>Node #1 CPU, Number of cores</i>	10
<i>Node #1 CPU, type & clock-speed</i>	Intel XEON E5-2630v4 2.2GHz base clock, 3.1 GHz Turbo frequency
<i>Node #1 RAM, amount in GB</i>	32
<i>Node #1 RAM, scalable if < 24 GB</i>	Not applicable (>= 24 GB)
<i>Node #1: Storage, RAID type</i>	RAID 1
<i>Node #1: Storage, Disk type</i>	SSD
<i>Node #1: Storage, Free Size in GB for Factom</i>	340
<i>Node #1: Storage, Do you have a separate factom volume/disks?</i>	Separate volume(s)
<i>Node #1: Connection & uplink speed (not just your NIC speed)</i>	1 Gbit

Node #2 Type	Dedicated server
<i>Node #2 Location (VPS: Provider, Region // Other: Country, City, Datacenter)</i>	The provider is Internetport Sweden AB. They have been established for over 10 years. Their datacentres are in the Swedish cities of Hudiksvall and Kista and are both fully redundant and fault tolerant in terms of power, cooling and internet connectivity.
<i>Node #2 CPU, Number of cores</i>	4
<i>Node #2 CPU, type & clock-speed</i>	Intel XEON E3-1220v6, 3GHZ base clock, 3.5GHz Turbo frequency
<i>Node #2 RAM, amount in GB</i>	32
<i>Node #2 RAM, scalable if < 24 GB</i>	Not applicable (>= 24 GB)
<i>Node #2: Storage, RAID type</i>	RAID 1
<i>Node #2: Storage, Disk type</i>	SSD
<i>Node #2: Storage, Free Size in GB for Factom</i>	440
<i>Node #2: Storage, Do you have a separate factom volume/disks?</i>	Separate volume(s)
<i>Node #2: Connection & uplink speed (not just your NIC speed)</i>	1 Gbit

Add any other information relevant to server specifications and hosting, including planned availability of your maintenance team and how you would propose to handle an unscheduled restart.

Please see [Cube3 Technologies Ltd_Response to Server Specification Question.pdf](#)

Which date did you join the Factom community testnet (approximate date is ok)?
6/27/2018

How does your team administer the nodes (more options possible)?
By more than 1 team member

How many people in your team are able to operate the servers (including direct hired personnel, but excluding hired fallback companies)?

3 team members providing 24/7 support. In addition Pete (an advisor) is also capable of operating the servers

How many years of combined experience does your team have on running production servers?

2

Could you elaborate on the production servers your team has managed (amounts, OS-types, purpose)?

2 years of formal experience running production servers, specifically the set up and administration of deep learning servers, used to train robots for human interaction at the University of Loughborough (2 deep learning servers, both running Ubuntu 16.04. Each has 256Gb of Ram, 20 cores and two Tesla k80's. There are around 10-15 users conducting research to manage. Both are dedicated remote systems).

Some team members have significant experience with servers that may not fall under a strict definition of "production" but nonetheless are important pieces of infrastructure that people rely on. Their roles in implementing, supporting and maintaining them have provided them with valuable experience. These include:

Running a 50 raspberry pi cluster for distributed factory simulation. Each pi is running raspbian, with communications split between a mixture of linked via a OPC-UA server/client interface, a ROS installation and direct GPIO interfaces between paired Pis. This cluster also plugs into 7 ubuntu desktops which communicate via ROS and display a graphical version of the simulation using VREP.

PLM (Product Lifecycle Management) server implementation administration for research at a large university. (5 years) (1 server, Windows with SQL Server)

Server administration which included IP maintenance and the implementation of a data policy to respect Non-Disclosure Agreements covering reception, storage and disposal of data. (3 years)

Management of back-up RAID arrays for critical and secure data.(2 years)

In addition, other members of the team have administered their own local network servers for file share, personal cloud, calendar management etc. for a no. of years. These use the open-source debian-based Proxmox hypervisor and VMs running Ubuntu Server. They have also run a small GPU mining farm for a no. of years as well as run nodes for a no. of blockchain projects including Particl, HEAT and Ethereum.

Have you run follower nodes outside the qualified-node pool on the testnet? If so to what effect? Other contributions to the testnet?

No. We currently have 1 testnet node in the authority set and 1 follower node that we can use to "brain-swap" between whenever upgrades are required.

Have you run any mainnet nodes? If yes, please elaborate why, and for how long

No

How are you going to make sure your nodes operate securely?

Please see attached file Cube3 Technologies Ltd_Response to Security of Node Question.pdf

How are you going to make sure you are able to respond quickly?

Cube3 will operate a 24/7 rota to ensure at least one system administrator is on-duty at all times. When on-duty, each system administrator will ensure that, for the duration of their shift, they are contactable via their

main phone/SMS number and email. They may use a number of personal devices to meet this requirement, each set with clear distinct audible alerts in case of phone/SMS so they know instantly it is a Factom ANO alert. They will also ensure they are within easy-reach of their main laptop and have a secondary workstation as a failover as well as having their SSH key devices to hand. They will keep a 3G/4G modem available in case their main broadband connection fails. Our monitoring servers will alert the on-duty system administrator if there is a fault with any of our Factom node servers or one of the monitoring servers. This alert will be sent via a phone call or SMS as per the individual system administrator's preference. An email will go out in parallel so the message will still be received in the unlikely event of a local cell-phone network failure.

System administrators will have Cube3's incident response procedures to hand so that when they have identified the problem there will be a clear plan of action in order to deal with it immediately.

[Could you provide a picture on how you would see your ideal auth node infrastructure?](#)

We would opt to run a high-performance dedicated machine of similar specification to the systems we have proposed earlier in the application. These will have dual redundant power supply units (PSUs) and two Nvme solid state drives (SSDs) in a Zettabyte File System(ZFS) mirror. It would be attached to an UPS to provide resilience for any mains power interruptions and will be located in a Tier3+ datacentre with redundant power, network and air conditioning/cooling.

We would implement standard security hardening procedures as detailed in our earlier response, including shutting down of non-essential services. A Secure Shell (SSH) bastion server would be used to gain administrative access to the machine and will use SSH keypairs instead of passwords and additionally require 2 factor authentication (2FA) to logon. Appropriate ingress and egress firewall rules will be implemented on the edge router residing at the boundary of the network as well as on the server OS itself.

A complete duplicate of this setup will be run in parallel as a secondary system in a geographically distinct Tier3+ datacentre, hosted by a different provider with separate administration and billing infrastructure from the first. It may be used with a manually implemented failover strategy, alternatively if a reliable automatic system can be devised the 2 setups may be linked via an OpenVPN secure network so that the connection will be impervious to Man in the Middle attacks.

Both nodes will be continuously monitored via 2 geographically distinct monitoring servers that evaluate the nodes' control panel on port 8090. In addition the 2 monitoring servers monitor each other and if one goes down the other will alert the on-duty system administrator so we cannot be left without monitoring. It is done in this way, rather than having the Factom nodes themselves monitor the monitoring servers, in order that as little additional services as possible are having to be run on the Factom nodes, so that their operation is not jeopardized.

All systems will have their logs automatically sent via Transmission Control Protocol (TCP) to an external centralized logging server located in another datacentre using Rsyslog, such that if a server is hacked an attacker will not be able to delete their traces.

All server administrators will have dual secure devices to logon for redundancy in case of emergency and dual network access, eg. broadband and 4G failover. They will also have a 2FA backup device. (Please refer to our earlier answers for more detail on this).

As you can see, what we are currently planning to implement is virtually this ideal. In a perfect world, with unlimited funds, it may be possible to further strengthen this setup with the following configuration but this would only be done if extensive testing can demonstrate the superiority of this solution despite the additional complexity.

Instead of a single machine, each datacentre would contain 3 machines of identical specifications running a Proxmox high availability cluster. Depending on the hardware requirements at least 2 of the machines in this cluster could also form a Ceph storage cluster to provide the required distributed redundant storage. Alternatively, 2 additional machines may be used to provide this. It will use separate physical networks for

outbound internet, shared storage communication and shared cluster communication. The Factom node would be run in a VM and would utilize hardware fencing to ensure if the machine running the VM goes down then it stays down and cannot be restarted without informed administrator intervention and instead the VM is automatically spun up on another machine in the cluster. This setup should theoretically provide complete redundancy in the event of CPU/RAM/Motherboard failure. It may make sense for the 3 machines to be located in separate racks, provided the datacentre can accommodate the required discrete network cabling so that, for example, a switch failure in a rack won't bring the cluster down.

[Free-text. Add any additional information deemed relevant.](#)

Our proposal and responses are comprehensive and therefore quite long. The proposal document is designed to take the reader through our thinking from beginning to end whereas the question responses address the specific questions raised. (In fact the limitations of the Google Forms have required us to add specific responses to individual questions as PDF documents.)

As such there is overlap between the proposal document and the question responses. Either will give the reader a good understanding of the Cube3 Technologies intent in submitting to be a Factom Authority Node Operator. Together they should address most aspects of how Cube3 can participate in this amazing challenge. We are grateful for you taking the time to read our comprehensive response and are ready to answer any further questions you may have.

[Add any application supporting files here](#)

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