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“As you go through the supply chain, there are many points at which you are handing off responsibility and accountability,” says Pindar. “For someone to govern that process and provide insurance that those drugs are delivered in a good state, they needed a safeguard. What blockchain does is that each party within that supply chain is in charge of their own particular dataset, but they share their data with everyone else. People don’t have the ability to manipulate data and say ‘it wasn’t me, your honour’.”

» *As blockchain becomes established in finance, US federal health IT officials, suppliers and developers are looking at its use in healthcare.*

HIGH-VALUE WINES

Gemalto is looking at other areas where many organisations or people need to share data, including on the yields of agricultural land, which as well as being useful to farmers, can also be vital for commodity traders. UK startup [Everledger](#), which already uses a blockchain system to track diamonds, is extending its use to one particular agricultural product: high-value wines.

Last December, wine expert Maureen Downey and Everledger used its new Chai Wine Vault system to record its first certification – of a 2001 bottle from French producer Chateau Margaux. The IBM-based ledger stores more than 90 pieces of data, as well as ownership and storage history.

Leoni Runge, project manager at Everledger, says the system aims to tackle fraud, with the company estimating that one-fifth of international “fine wine” sales are of counterfeit bottles. The diamond industry has a certificate system, but for older wines, authentication is based on factors such as whether a label’s design

and paper matches the kind used by that producer in the stated year of production. “We have built a digital way to store all this data,” she says.

Although Everledger’s system does not currently track environmental factors, such as bottle temperature – Runge says the reputation of the organisation storing the wine is usually sufficient – the company has designed a tamper-evident radio-frequency

identification ([RFID](#)) tag that sits above the bottle’s cork.

High-value wine bottles typically carry holograms, but these do not protect against the misuse of a needle-based system designed to sample wine without opening it, which can also be used to remove the original and replace it with something cheaper.

Despite using a blockchain system, Everledger does not make all the information collected by Downey available on its certificates of authenticity. “That would be a ‘how to do it yourself’ guide for fraudsters,” she says.

SENSITIVE DATA

It can make sense to divide information between a blockchain system and a separate one for sensitive or personal data, says Rupert Colchester, IBM’s blockchain leader in the UK and Ireland. “It is important to design an enterprise blockchain solution so that the right people in the network see the right pieces of data,” he says. “It’s not like bitcoin in that sense, where everything is there for everyone to see as long as you’ve got the key.”

Colchester says blockchain systems in supply chains can demonstrate provenance, as Everledger does, but also provide visibility

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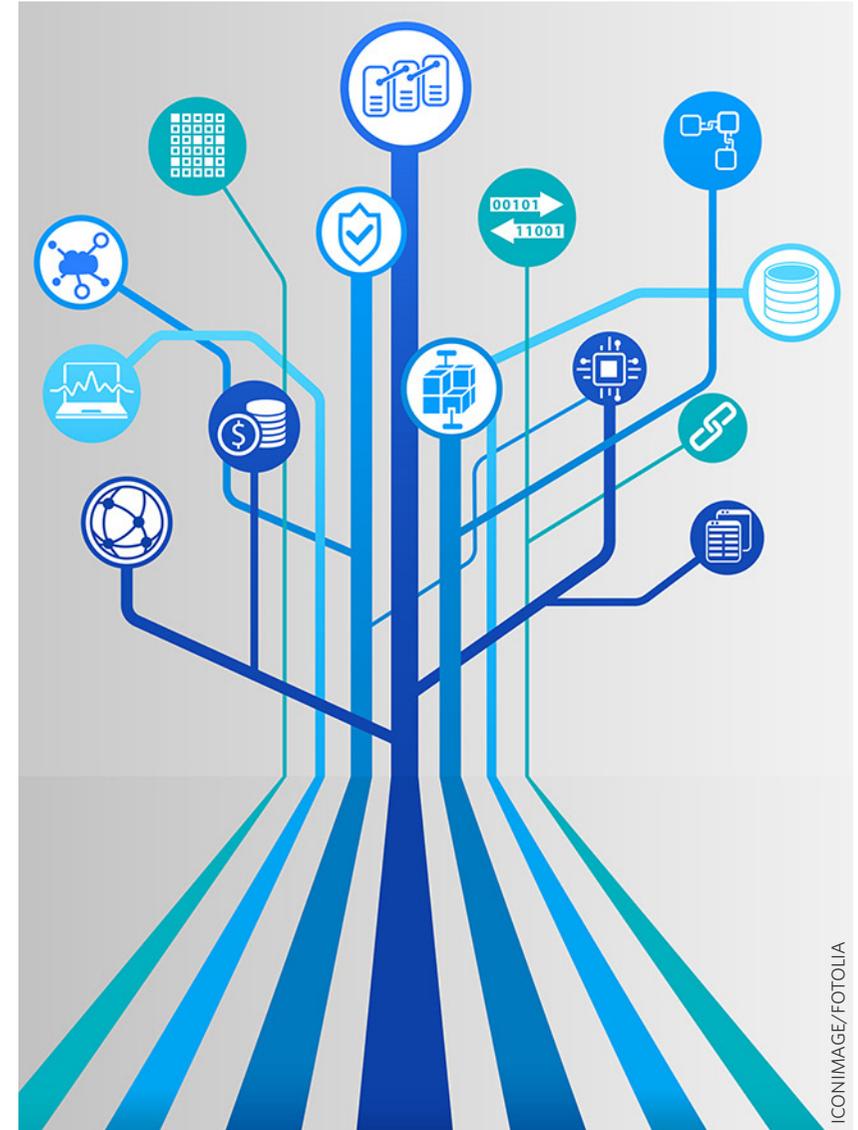
for participants and improve efficiency by reducing paperwork. In March, [IBM and Danish shipping company Maersk](#) announced collaboration on a blockchain-based system for tracking consignments that will address visibility and efficiency.

In one pilot project, Maersk found that moving a shipment of avocados from Nairobi to Amsterdam involved nearly 30 people and organisations making more than 200 interactions and communications. "What they have taken is manual paper-based processes, humans carrying documents such as air courier expenses, and turned it into digital documents," Colchester says of the new system, which will be marketed by Maersk.

Supply chains may be a key area for blockchain, but Colchester says IBM is investigating other game-changing business models. "As long as you've got the need for consensus and you have a business network there with a pain-point, often around trust or inefficiency or process, then you can start to think about how to deploy, how might smart contracts fit in, how can you split the privacy on who can see what," he says.

ENERGY MARKET

Electron is working on using blockchain outside physical supply chains. It is building a system for sharing information between those involved in supplying energy. Co-founder Jo-Jo Hubbard says data on the UK's 55 million gas and electricity meters is held by about two dozen organisations and shared through a monthly DVD. Partly because of this, it takes up to three weeks to switch supplier and about one in 20 switches fail to happen because of bad data, she says.



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Electron has built a blockchain platform with the scale to hold this information, although it is currently filled with dummy data. "We wanted to show that blockchain could handle the energy sector at a national scale," says Hubbard. The company is talking to independent suppliers – which are more likely to benefit from switching than the legacy ones – about using its system, which it plans to provide free with charges for extra services.

She says it may also be used for smart grid processes, such as local load-balancing of supply and demand. "Having a perfect record of where all the meters in the UK are is a key piece of infrastructure for getting that sort of localised flexibility set up," says Hubbard. "I think blockchain is good at creating trust and transparency between service providers and service users."

Some of the data Electron handles will be personal, such as from smart meters, which could be used by rival suppliers to generate quotes. The firm is still looking at how to handle personal data, but Hubbard says a blockchain system can contain access tokens or hashes of data, with other systems holding sensitive information.

Other potential uses for blockchain include recording access to healthcare records, which Google's UK-based DeepMind artificial intelligence unit plans to use for its work with [NHS patient data](#).

IBM is working with the US Food and Drug Administration on using blockchain to track use of personal health data by its Watson system, initially focusing on oncology.

Blockchain could also be used to validate personal qualifications, with the UK's Ufi charitable trust funding a research project into how this could work. Tony Wheeler, head of innovation at Digital Assess, which is undertaking the project, says that although the technology looks relatively simple, there could be cultural resistance from awarding bodies. He thinks such a ledger would work best if run by a trusted institution, such as Ufi or Jisc, a membership organisation that provides shared IT services to UK higher and further education institutions.

Australian startup Zimrii is working on a blockchain-based service that will allow independent musicians to sell downloads to fans, distribute the proceeds between collaborators and allow interaction with managers. "In the music industry, there are a lot of intermediaries in the creation and production of

music," says co-founder Mo Jalloh. "We are targeting independent music artists who appear on Spotify but don't have as much power as they would through a distributed platform."

Zimrii plans to allow musicians to decide how much they charge and how this is split. "It is suited for processes where there are a lot of steps in a process, and you're looking to reduce the amount of inefficiencies in that," Jalloh says of blockchain. "It brings two parties together where there's a lack of trust in that relationship. Blockchain enables that trust to be established, and enables commerce or transactions to occur." ■

“BLOCKCHAIN IS GOOD AT CREATING TRUST AND TRANSPARENCY BETWEEN SERVICE PROVIDERS AND USERS”

JO-JO HUBBARD, ELECTRON

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