The maritime IoT landscape in the next decade

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The maritime industry is evolving. Smarter ships, intelligent cargo tracking, automation and a host of fringe technologies are beginning to make an impact on the way shipowners do business. All will come together to form new standards across the next decade.

Many of these new digital solutions, which range from the buzzwords of big data and blockchain to the more literal buzz of drones, robotics and autonomous systems, offer game-changing alternatives to the traditional way of doing things.

Maritime operators are steadily automating operations, dealing proactively with maintenance, improving security and developing greater visibility across the supply chain.

And, for certain shipping giants, increased connectivity has made possible exploration and evolution. Instead of being limited to ferrying goods from one location to another, internet of things (IoT) technology is enabling operators to become global logistics experts and pioneers in emerging fields.

For the rest of the industry with more modest ambitions, costly inefficiencies are being cut down or removed completely.

All of which is timely. Operating costs, geopolitical risks and tensions over trade are coming to the fore. There is also the small matter of adhering to the IMO’s greenhouse gas emission targets, a challenge that necessitates industry-wide co-operation and innovation.

Being caught off guard by these developments is not an option for shipowners. Instead, the tide of emerging technologies is being harnessed.

Maersk Line has an established connected container solution; OOCL is working with Microsoft to embrace artificial intelligence to streamline operations; Cargotec and Orange Business Services have announced a global connectivity partnership; CMA CGM is working with French startup Traxens to add greater visibility to its logistics chain using IoT technology; previously fringe technologies including drones and blockchain are gaining traction.

So how are these technologies set to shift the maritime landscape over the coming decade?

Visibility at sea

With IoT connectivity comes a huge amount of data from which insights can be gleaned. This is the case at every level of the maritime industry, from the individual components of a ship’s engineroom to cargo containers, fleet management and connected ports.
Global IoT connectivity is gradually bringing together all of these disparate elements. And in turn, shipping companies have more data than ever regarding their operations and working environment, as well as a slew of new data-based revenue opportunities.

The most obvious benefit of IoT connectivity lies in how it can transform day-to-day operations at sea, at port and as part of a wider logistics network. Issues can be pinpointed, downtime can be reduced, and processes can be streamlined, changing the face of the maritime industry as we know it.

Nowhere is this clearer than at the Port of Rotterdam, where an endless stream of information is received and analysed regarding ships in dock, cranes in the yard and individual containers. The port’s operators now have greater transparency than any other shipping hub in the world.

The result is that issues are got to the bottom of quickly. Senior manager of IT at MVII terminal Rudy Muller claimed when the port opened that “the IT department has come out of the basement and onto the main floor.”

And he has been proved right three years down the line. The terminal now operates at full capacity, and its operators are moving 25-50% more containers per hour than any other of its competitors in northern Europe.

The port has also partnered with IBM to create a ‘digital twin’, an exact digital replica of its operations that mirrors the movement and status of ships, infrastructure, weather, and water data. This twin enables test scenarios to be run in a no-risk environment and in the long run, will help managers cut out inefficiencies.

In terms of cargo visibility, Maersk’s remote container management sits among the market leaders. With the simple addition of a modem, a wireless SIM card and a satellite link, Maersk technicians can pinpoint the location and operational details of any one of its 270,000 refrigerated reefer containers around the world.

These containers are used to transport perishable goods from A to B, and as such require specialised environments and close monitoring. With IoT connectivity, operators avoid being caught unawares if a problem arises. They learn about issues in time to rescue the situation.

The numbers speak for themselves. Maersk used to spend US$200M each year on physically inspecting containers. The company also used to pay out millions in claims to customers inconvenienced by damaged cargo. With IoT connectivity, that waste and expenditure can and will be a thing of the past.

The final benefit to increased visibility? Once individual containers are setup with a digital identity, customers get a smoother, more personalised service. Enhanced supply chain transparency means it no longer needs to be a case of packing up a container, sending it to the other side of the world and remaining in the dark until it arrives at its destination.

Maersk’s connectivity has largely been supported by network provider Ericsson. And they aren’t the only ones working with global connectivity providers to help clients keep tabs on cargo. At the end of 2017, Finland’s Cargotec signed a deal with Orange Business Services to develop a global handling network.

It’s likely that more of these partnerships will come to fruition in the coming months and years, as shipping companies seek to capitalise on the value added with ever present connectivity.

In part these partnerships will be formed out of necessity. Maritime leaders don’t have the required expertise or infrastructure to build a global connectivity network. That was certainly the case with Cargotec.

“Orange Business Services has expertise on global mobile connectivity,” said a spokesperson for the Finnish company. “No one player in the market has all the needed knowledge and capabilities in-house.”

From visibility to intelligent decision making

The mountains of data generated by IoT connectivity can provide visibility where previously there was none. But making sense of it and turning it into actionable intelligence is another matter entirely.

That’s where AI comes steps in, recognising patterns, connecting disparate data points and proactively directing operations to keep vessels moving and in profit.

AI enters the maritime stage in the familiar guises of predictive analytics and preventative maintenance. Predicting and preventing mechanical failures before they occur is a priceless capability. But it’s from wider AI analytics that shipowners stand to benefit most in the years to come.

Harnessing data from an increasingly connected global supply chain and other external variables, AI can guide ship captains to make more profitable decisions based on weather conditions, port loading times, route congestion and more.

In April Microsoft partnered with OOCL, bringing AI capabilities to the Hong Kong-based shipping company in a 15-week upgrade that OOCL’s chief information officer Steve Siu estimates will save the shipping company around US$10M every year. Unsurprisingly, the two went on to announce an 18-month R&D partnership that will apply machine learning across OOCL’s shipping and network operations.

The efficiency of shipping operations depends on a fluid mixture of different parties and variables. Things can change at a moments notice, and AI that can adapt to those changes objectively in near-real-time offers an obvious advantage to fallible human decision makers.

Microsoft has expertise in deep and reinforcement learning, a type of AI that uses goal-orientated algorithms to attain an objective. In the maritime industry that objective might be something
close to ‘overall efficiency’. The partnership puts OOCL at the forefront of the latest AI R&D, making the most of Microsoft’s domain experts and proven business impact validation in the process.

Embracing AI and all that comes with it is a challenge that is key to the digital transformation of the maritime industry. The adoption of machine learning, cloud computing and edge analytics all require a degree of infrastructure overhaul, subject-specific expertise and, inevitably, collaboration with external partners to reap the rewards.

As a result, it’s likely that the coming years will see further partnerships between technology specialists and the shipping industry’s biggest players as AI capabilities develop further.

Mr Siu argues that these partnerships are vital to the digital transformation of the maritime industry moving forward.

“Truly understanding and integrating an organisation’s business, user experience, and technology with its vision and strategy are the keys to the success of digital transformation,” he says.

“No single company can master all technologies and domain knowledge for driving innovation.” Instead, he points out, “Collaborating with technology experts and stakeholders cultivates innovation and accelerates agile development.

“The shipping industry is at a critical stage of transformation with technologies such as AI... We are glad to see more collaboration and engagement through partnerships on these emerging technologies.”

**Drones: monitoring emissions and revolutionising maintenance**

From transport to construction to offshore oil and gas platforms, drone technology is having an impact in many industries that need data at scale, require regular inspections and carry an element of risk for maintenance crews.

These factors are all applicable in the maritime industry, where downtime has an immediate impact on bottom lines and operating costs are on the rise.

A major element in those rising costs is staffing. So it goes without saying that any technology that can automate or speed up tasks while reducing the manpower required will be welcome.

That’s where drones come to the fore with smarter and safer inspections of key infrastructure. For shipowners, drones provide a new way to process and optimise cargo hold inspections, collecting data at speed without putting crew members at risk. And they do so while adding more objectivity in the process. Video footage can be replayed and analysed. Mistakes will slowly become a thing of the past without the need to rely on recall and subjectivity.
Because drone technology is advancing so rapidly, shipping companies can benefit from higher quality aerial video than ever before, automated surveys and sophisticated computer vision. In simpler terms: safe, speedy inspections, high definition video feeds and results in real-time.

And as accompanying technologies such as predictive analytics and machine learning advance, autonomous aerial platforms could yet take the next step: handling inspection processes from start to finish, monitoring the integrity of vital structures around the clock, analysing data at the edge and preventing minor issues from escalating and disrupting operations.

Aside from revamping conventional inspection and repair methods, drone technology is being adopted to help shipping companies stay on track with emission targets. Several operators, including Denmark’s Explic and the UK’s Martek Marine, are developing aerial platforms capable of flying into emission plumes to ‘sniff’ the carbon and sulphur ascending from a ship’s engines.

The technology has already been adopted for enforcement purposes by the Norwegian Maritime Authority in conjunction with the coast guard. Officials can remotely assess ships’ emissions in 30 minutes – cutting down on the previous procedure that would take an entire day.

“Although known as a somewhat conservative industry, we’ve found the most shipowners to be open and receptive to the use of drone technology,” said Martek Marine's Talisa Gill.

“Where there’s caution, it’s with good reason. Shipowners are often pitched time and money saving ideas, only to find that the reality doesn’t match the dream.”

But Martek Marine has found that both a solid reputation and proven success working with maritime clients has helped to build trust in their concepts and products, which include using drones for visual inspections of inside holds and drydocking support.

In the coming years, Ms Gill expects the use of drones to proliferate across the industry. “Drones with higher payload capacity and operating range could be used for resupplying ships offshore, and in the short term, we expect to see them used for dangerous access work inside ships, monitoring emissions, security, and search and rescue.”

Using drones in the maritime industry opens the door to innovation on a huge scale. Drone technology – spanning everything from battery life to computer vision – will continue to develop and, most significantly, regulations regarding fully-autonomous flight will lessen as safety concerns are eased.

**Making waves: blockchain**

Blockchain is fast becoming the inescapable technology buzzword of our time. Although many of its applications and adoptions are far from convincing, there is little doubt that it holds great potential when it comes to organising and securing a complex web of transactions.
Its combination of cryptographic security and decentralised data storage – forming an immutable record of events – could well turn out to be as transformative a technology as the internet.

All of which explains why the shipping industry is exploring blockchain and its potential applications across the cargo ecosystem.

At the start of the year, Maersk and IBM teamed up to establish a joint venture dedicated to exploring blockchain’s potential in global trade. Elsewhere, in March a consortium made up of AB InBev, Accenture, APL, Kuehne + Nagel and a European customs organisation completed successful tests of a blockchain solution.

There’s Asian interest, too. South Korea’s Hyundai Merchant Marine trialled a similar blockchain solution last year with the help of Samsung.

The ambition? To eliminate the need for printed shipping documents in a move that could save the freight and logistics industry hundreds of millions of dollars every year.

Competing against more established names is CargoX, a Slovenia-based fintech startup with a solution that already promises to ease the “biggest pain points” in global logistics.

CargoX offers an automated bill of lading based on blockchain, which replaces the conventional and expensive paper-based process with a transaction that rivals online banking in terms of speed and efficiency.

The company’s smart bill of lading can quickly be created, transferred from the freight forwarder to the exporter, on to the importer, and finally to the release agent at the port of destination.

The first official smart bill of lading was issued by CargoX on 27 July 27.

The race to perfect paperless shipping is underway. The end goal could transform global trade: a world in which cargo crosses borders while checks and notifications are automated and recorded for the whole supply chain to trace and track.

**The end game: true autonomy and crewless ships**

There was a time when giants of the shipping world rolled their eyes and dismissed the futuristic prospect of fully-autonomous ships.

But it increasingly seems as though they represent the endgame of IoT technologies, artificial intelligence and autonomous systems in maritime.

If you ask Rolls-Royce, crew reductions could begin as early as 2020 as levels of automation increase and operators begin to take control of ships from land. By 2025, the company predicts the presence of remote controlled unmanned coastal vessels. By 2035 – just 17 years from now – Rolls-Royce expects our oceans to be home to fully-autonomous, crewless cargo ships.

So it makes sense that, together with Google, the power, propulsion and engine specialist has started to develop AI with situational awareness that could be the precursor to an automated captain.

However, two Norwegian companies are working to an altogether more ambitious schedule. Agriculture firm Yara International and guidance system manufacturer Kongsberg are currently building *Yara Birkeland*, a US$25M electric vessel capable of operating with full autonomy.

The pioneering container ship is expected to enter service as a manned vessel later this year before remote operations start in 2019.

IMO has in recent months taken the important step of agreeing a definition of what constitutes an autonomous ship. The next move will be to build a regulatory framework for their operation.

The benefits would be huge. Whether or not they are powered by electricity, crewless ships would operate as part of a wider connected ecosystem, taking decisions in real-time based on a stream of data from other vessels, ports, weather conditions and more. But for now, despite the advances in autonomous technology, it’s likely that concerns over liability, safety and cyber security will restrict widespread adoption.

It may well be that crewless ships start small: in the harbour rather than spanning the oceans. The Maritime Port Authority of Singapore, for example, has confirmed plans to develop autonomous ships to assist with everyday harbour operations.

Whatever the timeline for crewless ships, there’s no doubting the appetite for innovation. The tide is turning. All of these emerging technologies are ready to transform the maritime industry in the years to come.