

The undersea internet

How can submarines get online? Mandar Chitre has the answer. "We have all this wonderful wireless technology - why not bring it underwater?"

says Chitre, a researcher of underwater communications at the National University of Singapore, and a technical advisor to Subnero, a Singapore-based sub-aquatic internet firm.

Unlike expensive, impractical and damage-prone cabling, or radio, which fails underwater, Subnero's networks use pulses of sound that travel between underwater nodes distributed a few kilometres apart. To connect with terrestrial technologies, the nodes communicate with gateway buoys on the water's surface, linking to the above-sea internet via cellular networks or satellites.

Still, undersea broadband is a way off, due to the low data rates. Also, sound waves in water travel 100,000 times slower than radio waves. "It's like starting from scratch with the internet,"

Balloons and drones can connect the offline billions - but what if you're under the ocean?

says Chitre, 38, who developed the technology over ten years at a cost of about SGD \$5 million (£2.4m) and helped form Subnero in 2012.

Working with environmental agencies and utility companies in Asia, defence organisations in Europe and Asia, and researchers around the world, Subnero is also making parts of the technology freely available for academic use and innovation. Applications could include wireless-enabled aquatic drones conducting real-time analysis, and augmented-reality goggles for divers. "Communication underwater is at a tipping point," says Chitre. JeremyKingsley.subnero.com

