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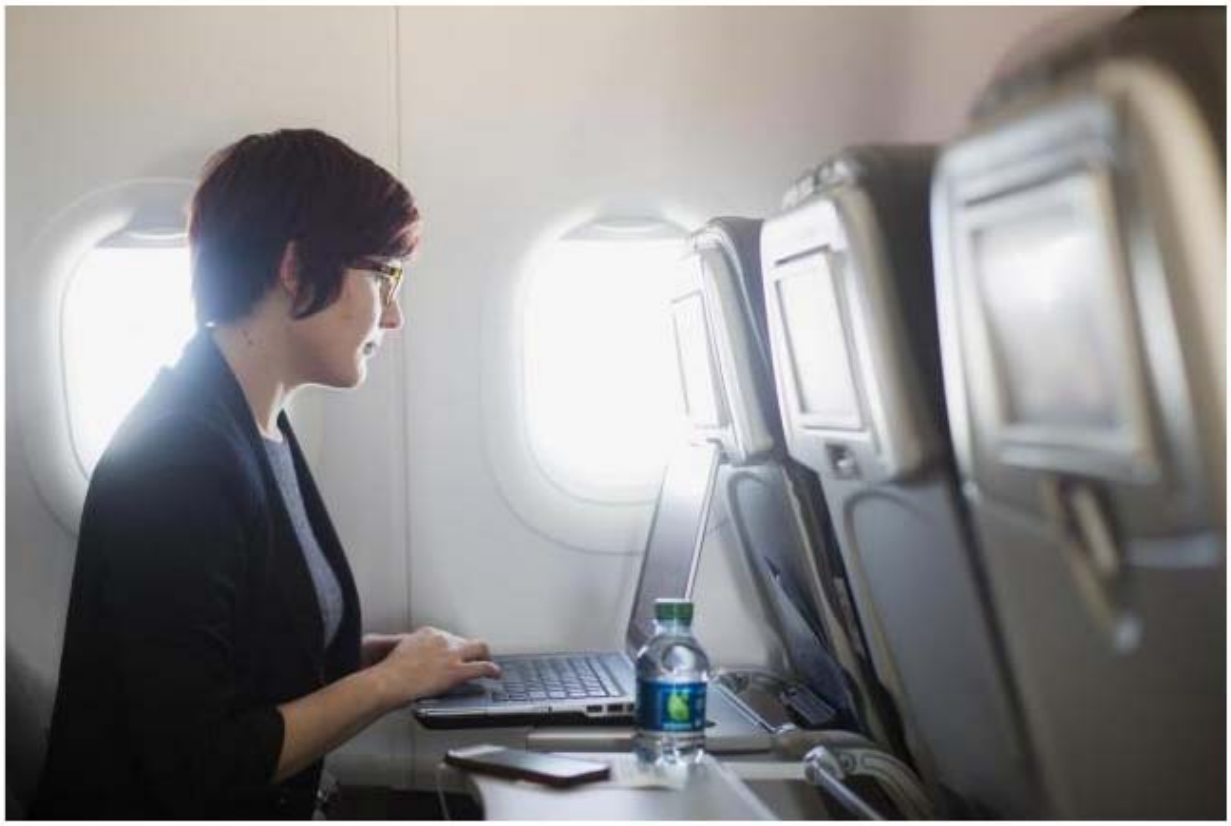
From balloons to shrimp-filled shallows, the future is wireless

SINGAPORE | BY JEREMY WAGSTAFF



A woman uses her computer to test a new high speed in-flight Internet service named Fli-Fi while on a special JetBlue media flight out of John F. Kennedy International Airport in New York, in this file picture taken December 11, 2013.

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The Internet may feel like it's everywhere, but large pockets of sky, swathes of land and most of the oceans are still beyond a signal's reach.

Three decades after the first cellphone went on sale - the $4,000 Motorola DynaTAC 8000X "Brick" - half the world remains unconnected. For some it costs too much, but up to a fifth of the

population, or some 1.4 billion people, live where "the basic network infrastructure has yet to be built," according to a Facebook white paper last month.

Even these figures, says Kurtis Heimerl, whose Berkeley-based start-up Endaga has helped build one of the world's smallest telecoms networks in an eastern Indonesian village, ignore the many people who have a cellphone but have to travel hours to make a call or send a message. "Everyone in our community has a phone and a SIM card," he says. "But they're not covered."

Heimerl reckons up to 2 billion people live most of their lives without easy access to cellular coverage. "It's not getting better at the dramatic rate you think."

The challenge is to find a way to connect those people, at an attractive cost.

And then there's the frontier beyond that: the oceans.

Improving the range and speed of communications beneath the seas that cover more than two-thirds of the planet is a must for environmental monitoring - climate recording, pollution control, predicting natural disasters like tsunami, monitoring oil and gas fields, and protecting harbors.

There is also interest from oceanographers looking to map the sea bed, marine biologists, deep-sea archaeologists and those hunting for natural resources, or even searching for lost vessels or aircraft. Canadian miner Nautilus Minerals Inc said last week it came to an agreement with Papua New Guinea, allowing it to start work on the world's first undersea metal mining project, digging for copper, gold and silver 1,500 meters (4,921 feet) beneath the Bismark Sea.

And there's politics: China recently joined other major powers in deep-sea exploration, partly driven by a need to exploit oil, gas and mineral reserves. This year, Beijing plans to sink a 6-person 'workstation' to the sea bed, a potential precursor to a deep-sea 'space station' which, researchers say, could be inhabited.

"Our ability to communicate in water is limited," says Jay Nagarajan, whose Singapore start-up Subnero builds underwater modems. "It's a blue ocean space - if you'll forgive the expression."

BALLOONS, DRONES, SATELLITES

Back on land, the challenge is being taken up by a range of players - from high-minded academics wanting to help lift rural populations out of poverty to internet giants keen to add them to their social networks.

Google, for example, is buying Titan Aerospace, a maker of drones that can stay airborne for years, while Facebook has bought UK-based drone maker Ascenta. CEO Mark Zuckerburg has said Facebook is working on drones and satellites to help bring the Internet to the nearly two thirds of the world that doesn't yet have it. As part of its Project Loon, Google last year launched a balloon 20 km (12.4 miles) into the skies above New Zealand, providing wireless speeds of up to 3G quality to an area twice the size of New York City.

But these are experimental technologies, unlikely to be commercially viable for a decade, says Christian Patouraux, CEO of another Singapore start-up, Kacific. Its solution is a satellite network that aims to bring affordable internet to 40 million people in the so-called 'Blue Continent' - from eastern Indonesia to the Pacific islands.

A mix of technologies will prevail, says Patouraux - from fiber optic cables, 3G and LTE mobile technologies to satellites like his HTS Ku-band, which he hopes to launch by end-2016. "No single technology will ever solve everything," he said.

Indeed, satellite technology - the main method of connectivity until submarine cables became faster and cheaper - is enjoying a comeback. While Kacific, O3b and others aim at hard-to-reach markets, satellite internet is having success even in some developed markets. Last year, ViaSat topped a benchmarking study of broadband speeds by the U.S. Federal Communications Commission.

And today's airline passengers increasingly expect to be able to go online while flying, with around 40 percent of U.S. jetliners now offering some Wi-Fi. The number of commercial planes worldwide with wireless internet or cellphone service, or both, will triple in the next decade, says research firm IHS.

WHITE SPACE

Densely populated Singapore is experimenting with so-called 'white space', using those parts of the wireless spectrum previously set aside for television signals. This year, it has quietly started

offering what it calls SuperWifi to deliver wireless signals over 5 km or more to beaches and tourist spots.

This is not just a first-world solution. Endaga"s Heimerl is working with co-founder Shaddi Hasan to use parts of the GSM spectrum to build his village-level telco in the hills of Papua.

That means an ordinary GSM cellphone can connect without any tweaks or hardware. Users can phone anyone on the same network and send SMS messages to the outside world through a deal with a Swedish operator.

Such communities, says Heimerl, will have to come up with such solutions because major telecoms firms just aren't interested. "The problem is that these communities are small," says Heimerl, "and even with the price of hardware falling the carriers would rather install 4G in cities than equipment in these communities."

The notion of breaking free of telecoms companies isn't just a pipe dream.

MESH

Part of the answer lies in mesh networks, where devices themselves serve as nodes connecting users - not unlike a trucker's CB radio, says Paul Gardner-Stephen, Rural, Remote & Humanitarian Telecommunications Fellow at Flinders University in SouthAustralia.

Gardner-Stephen has developed a mesh technology called Serval that has been used by activists lobbying against the demolition of slums in Nigeria, and is being tested by the New Zealand Red Cross.

Mesh networks aren't necessarily small, rural and poor: Athens, Berlin and Vienna have them, too. And Google Chairman Eric Schmidt has called them "the most essential form of digital communication and the cheapest to deploy."

Even without a balloon and Google's heft, mesh networks offer a bright future, says Gardner-Stephen. If handset makers were to open up their chips to tweaks so their radios could communicate over long distances, it would be possible to relay messages more than a kilometer.

In any case, he says, the Internet is no longer about instantaneous communication. As long as we know our data will arrive at some point, the possibilities open up to thinking of our devices more as data couriers, storing messages on behalf of one community until they are carried by a villager to another node they can connect to, passing those messages on several times a day.

It's not our present vision of a network where messages are transmitted in an instant, but more like a digital postal service, which might well be enough for some.

"Is the Internet going to be what it looks like today? The answer is no," said Gardner-Stephen.

PISTOL SHRIMPS

As the Internet changes, so will its boundaries.

As more devices communicate with other devices - Cisco Systems Inc estimates there will be 2 billion such connections by 2018 - so is interest increasing in connecting those harder-to-reach devices, including those underwater, that are beyond the reach of satellites, balloons and base stations.

Using the same overground wireless methods for underwater communications isn't possible, because light travels badly in water. Although technologies have improved greatly in recent years, underwater modems still rely on acoustic technologies that limit speeds to a fraction of what we're now used to.

That's partly because there are no agreed standards, says Subnero's Nagarajan, who likens it to the early days of the Internet. Subnero offers underwater modems that look like small torpedoes which, he says, can incorporate competing standards and allow users to configure them.

This is a significant plus, says Mandar Chitre, an academic from the National University of Singapore, who said that off-the-shelf modems don't work in the region's shallow waters.

The problem: a crackling noise that sailors have variously attributed to rolling pebbles, surf, volcanoes, and, according to a U.S. submarine commander off Indonesia in 1942, the Japanese navy dropping some "newfangled gadget" into the water.

The actual culprit has since been identified - the so-called pistol shrimp, whose oversized claw snaps a bubble of hot air at its prey. Only recently has Chitre been able to filter out the shrimp's noise from the sonic pulses an underwater modem sends. His technology is now licensed to Subnero.

There are still problems speeding up transmission and filtering out noise, he says. But the world is opening up to the idea that to understand the ocean means deploying permanent sensors and modems to communicate their data to shore.

And laying submarine cables would cost too much.

"The only way to do this is if you have communications technology. You can't be wiring the whole ocean," he told Reuters. "It's got to be wireless."

(Editing by Ian Geoghegan)

http://www.reuters.com/article/2014/04/27/us-internet-connect-idUSBREA3Q0OH20140427