

“Never out of reachh”

Personal mobile communications 1980-2010

How did we get here?

The broad aim of the talk

- 1 how did we arrive here
- 2 the technologies that were fitted together.
- 3 working break topic.
- 4 How to reach all over the globe.
- 5 What then?

The topics

- brief history, the sciences, the scientists.
- the 1st, 2nd, 3rd generation mobile phone develops into a personal global communicator.
- social consequences; how did the UK miss out on this major business?
- global reach and the 4th generation,
- convergence, education, entertainment, life style.

Whose science and technology?

- The business amalgamates the discoveries of all of these persons, and more
- Faraday, Maxwell, Hertz, Wm. Thompson (Ld Kelvin), Brunel, Marconi, Turing, Shannon, Nyquist, A. Reeves, Volta, Kao, Brunel, Einstein, Tesla, Kilby/Noyce, Shockley/Bardeen/Brattain, Maurer/Keck/Schultz, (Dr Martin) Cooper, Englebart, Babbage, Gates, Jobs, Fourier, Gauss, Kepler, Arthur C Clarke, Among others!

Personal communications 1970 and 2010

- Home phone in over half UK residences.
 - International calls rare, except by government and business.
 - Mobile communication was a BT phone kiosk.
 - BT was a government owned monopoly.
 - Star Trek was already transporting people !
- More mobile phones than people in the UK.
 - Major tool of business and leisure, information, and entertainment.
 - International roaming calls commonplace.
 - Numerous major providers.
 - Convergence of functions to mobile units is rapid.



STAR TREK GOT THERE FIRST

1973-1987 – Analogue phones



What was needed to turn the technology into a global business?

All we needed was.....

- People to do it, educated and skilled,
- Money, strategic direction, infrastructure, power, accounting, handsets, billing, fibre optic networks, regulation,

The S+T needs to make a business.

- Radio infrastructure, antennas, reliable power, mobile phones, batteries, customised low power chips, computing, crypto, fibre optic cables, lasers, space launchers, satellites, ground control stations, SIM cards, security, signalling networks, scientists, emergency provision,
- Civil works, physical infrastructure, GPS, GSM, 3G, Internet, WiFi, WiMax, laptops, engineers, vast amounts of software, test equipment,
- Regulation (GSMA, ITU, CEPT), Standards, management, financial control, fraud detection, criminal deterrence, licensing, data protection,
- Lawful interception.

How it panned out 1987-2010

- Digital mobile communications planned on a global scale by ITU, CEPT, and major companies. This was a gold rush moment.
- Europe at the forefront with Groupe Speciale Mobile. (GSM) – US has different strategy.
- Standards developed between 1982-1987 and subsequently revised 12 times.
- First GSM network calls in Finland in 1991.
- Prolific growth; 3G in 2000. 4G planned.
- 218 countries globally have mobile communications in 2008.
- USA – eventually fell into line, lawyers enriched by suing European firms over patents, but the lesson is that Europe won this battle of technology.

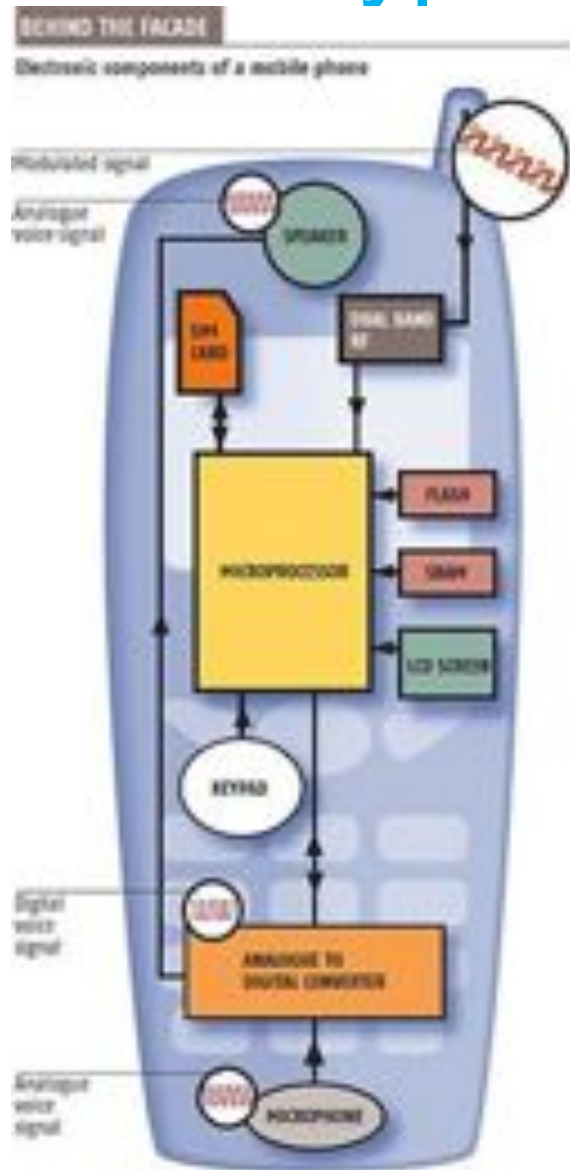
What is needed to make a mobile telephone call from Cheltenham UK to Singapore

Then consider what is needed to make a call from Cheltenham UK to someone camping at an oasis in the empty quarter in Oman, or in Antarctic or climbing Mt McKinley.

LETS TAKE A TYPICAL EVERYDAY CASE AND EXPAND IT TO COMPLETION.

FIRST, GET A PHONE.....

A typical mobile phone.





A mobile phone - the pieces

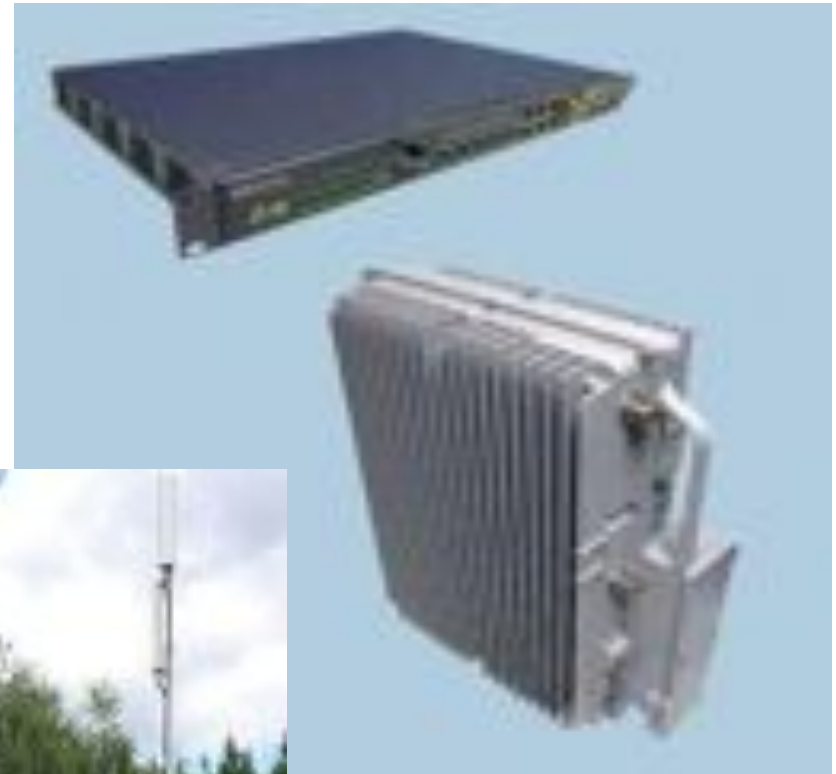


Typical mobile phone masts in Cheltenham Glos.





Other mobile masts

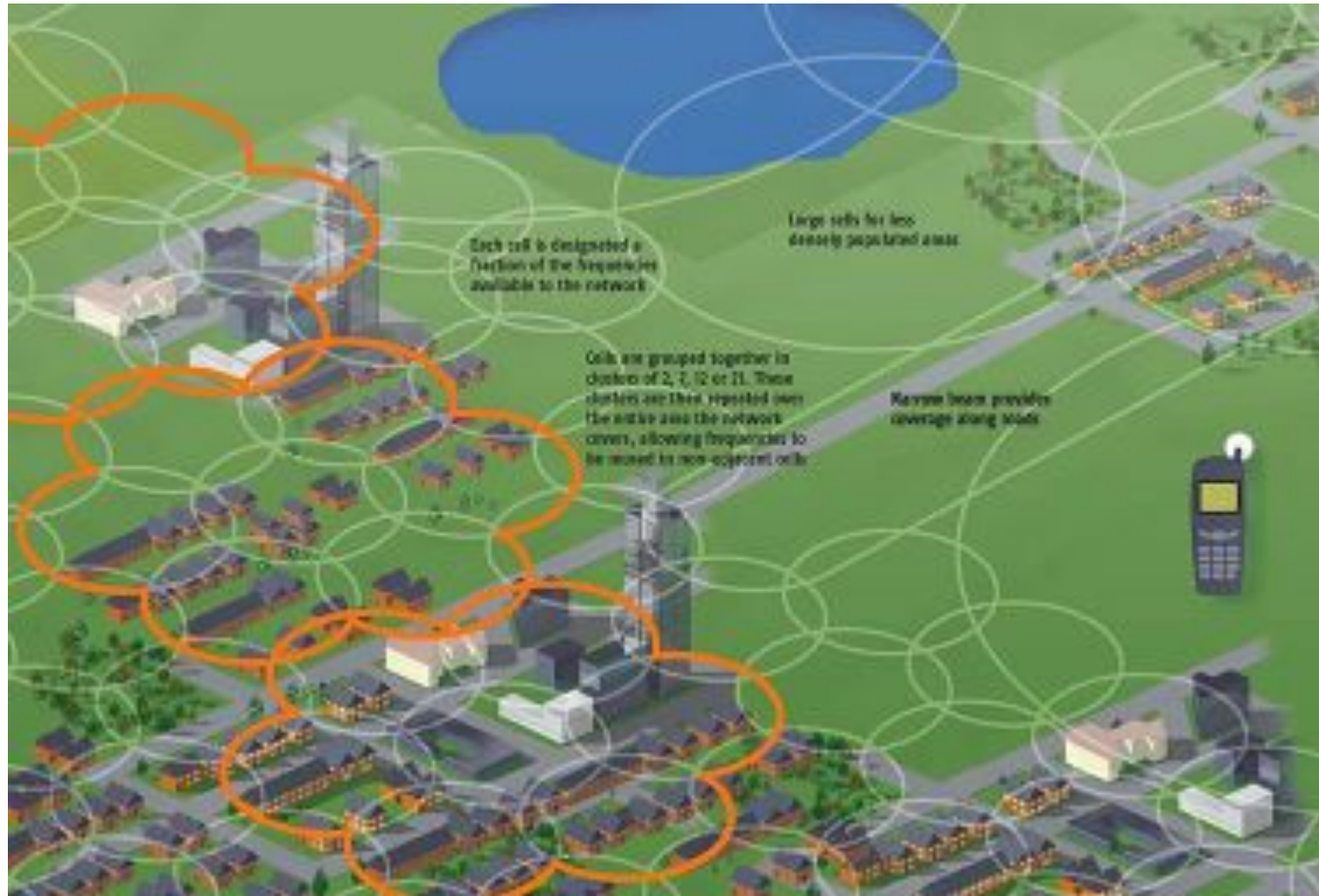


Inside building aerials



Showing the variety of mobile infrastructure, inside and outside buildings.

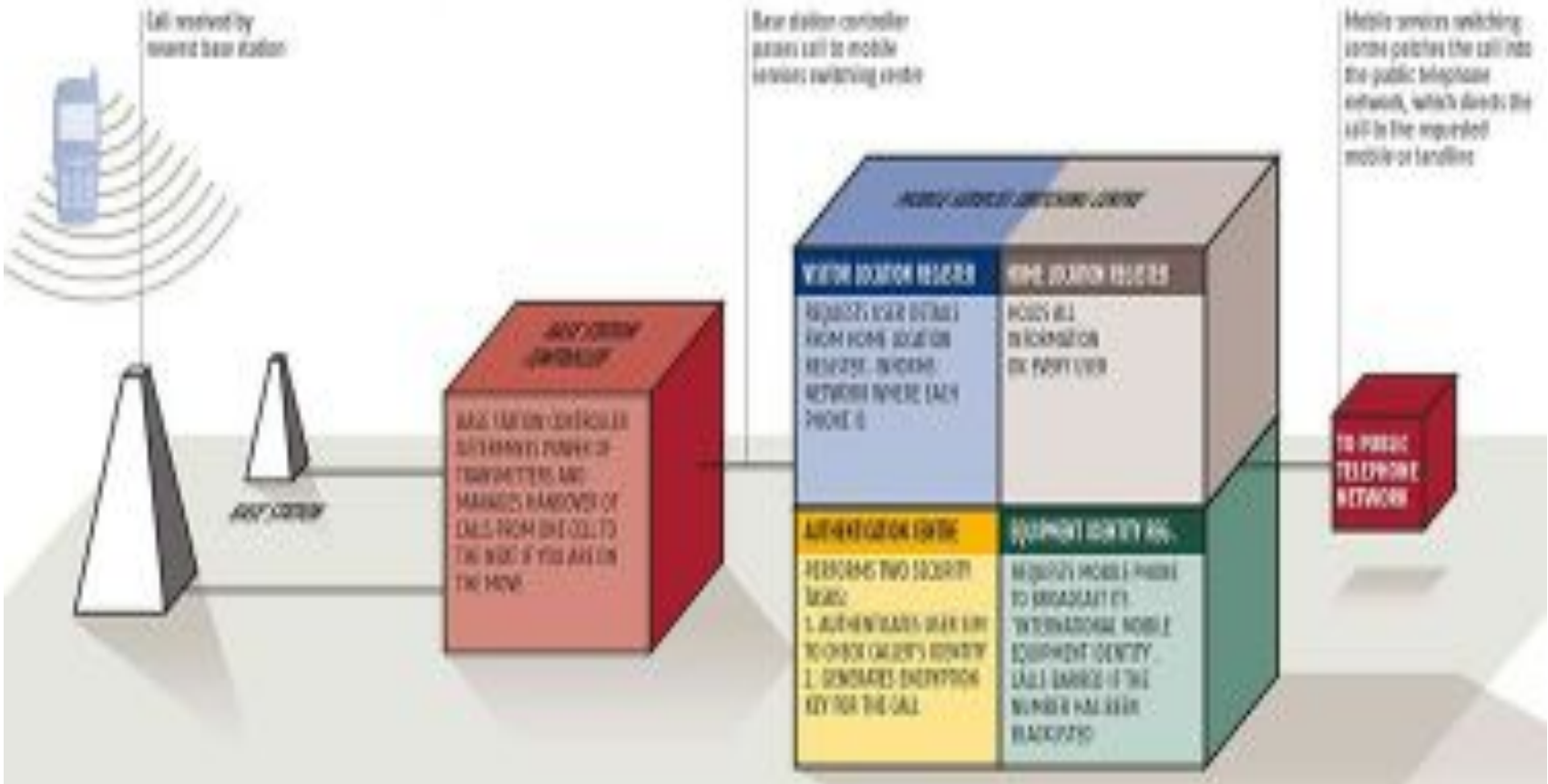
A typical mobile coverage map showing cell structure to cover population density.



A working mobile network diagram

PLACING A CALL

How the network knows who and where you are when you make a call.



How big is the business?

3,633,399,175 handsets,

in 218 countries covering 80% of the world's population in 2008. (GSMA yearbook) - world population 6.6 billion.

3rd quarter 2010 sales

Apple 14.1 million units

RIM 12.4 million units

Nokia 110.4 million units

Samsung 71 million units

LG 24.8 million units.

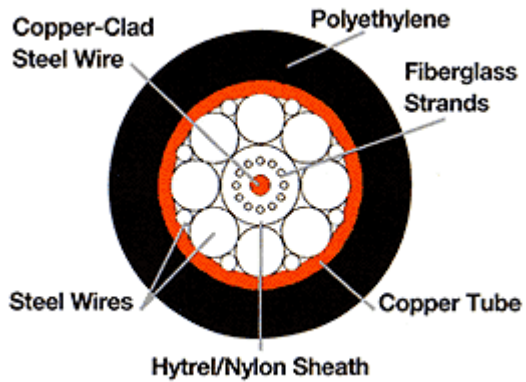
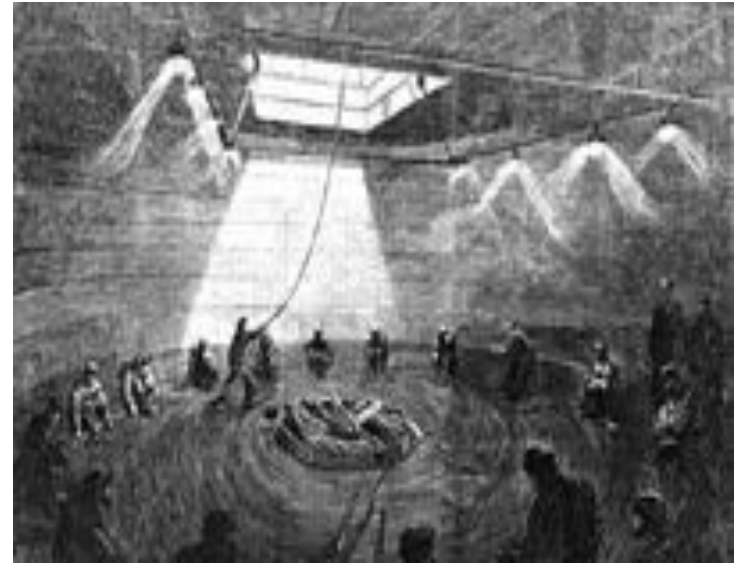
>\$550 Billion business in 2008

A tale of two companies in 2009

- ARM Holdings
 - Cambridge UK
 - Started 1990 ex Acorn
 - 1700 employees
 - Turnover £305m
 - Gross profit £95m
 - R+D £25m
 - R+D staff unknown
 - Licenses intellectual property of RISC integrated circuits, in 90% + of phones, laptops,
- NOKIA
 - Espoo, Finland
 - Starts 1865 in wood pulp
 - 123,500 employees
 - €40.9B
 - € 13.2B
 - € 5.9B
 - 37373 staff
 - Manufactures cell phones, infrastructure, software, telecom kit, has >30% of global market.

Your turn - discussion

- Why did the UK with all its inherent advantages in telecommunications and scientific and technological skills fail to grasp the opportunities to lead this new technology?



Building blocks – cables across Atlantic
1866

Landing a cable in N America





Fibre optics



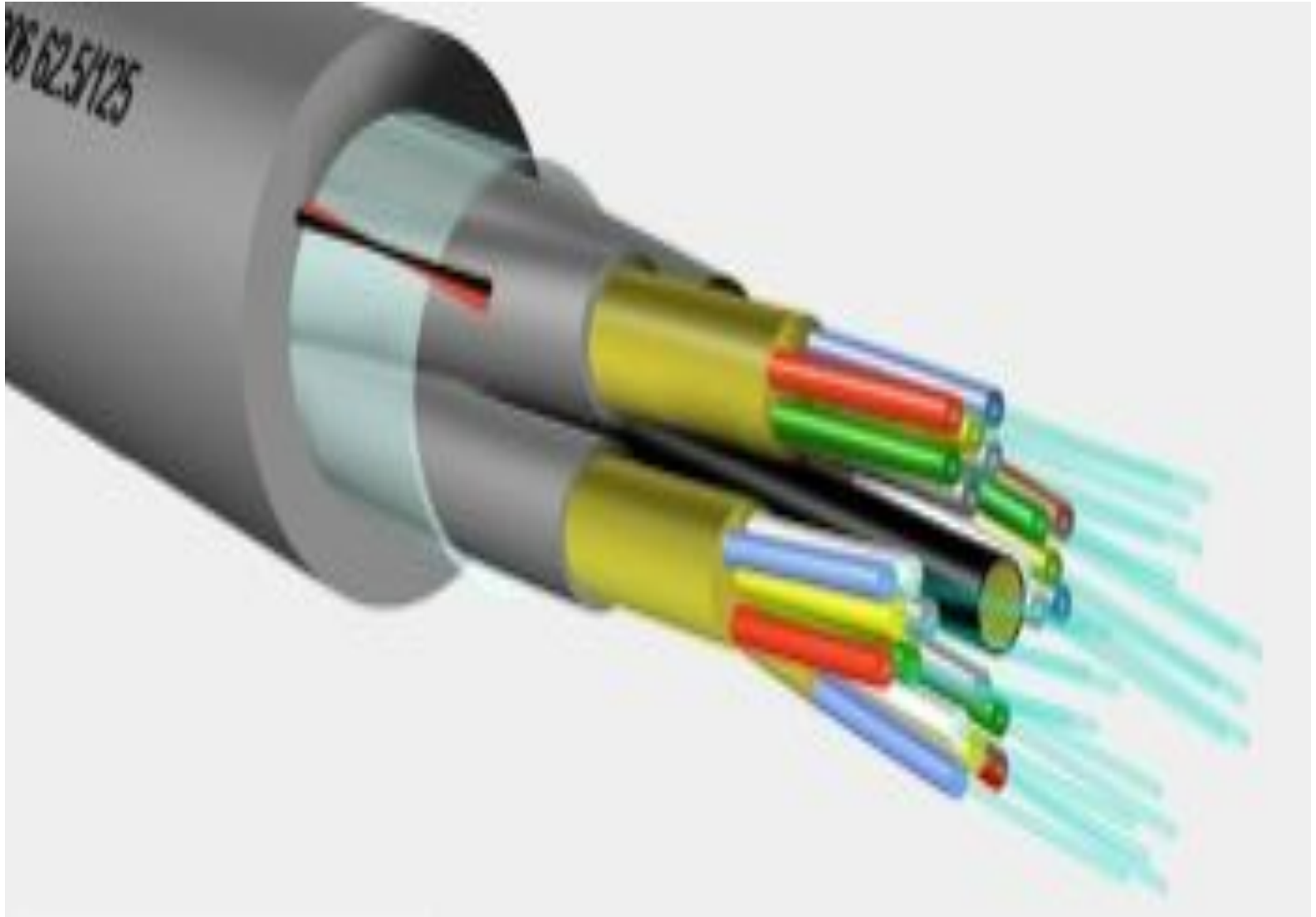
- Phone traffic including mobile is increasingly sent over fibre optic cables around the world because they need vast amounts of bandwidth. Ditto the Internet.
- Some other uses of fibre optics below

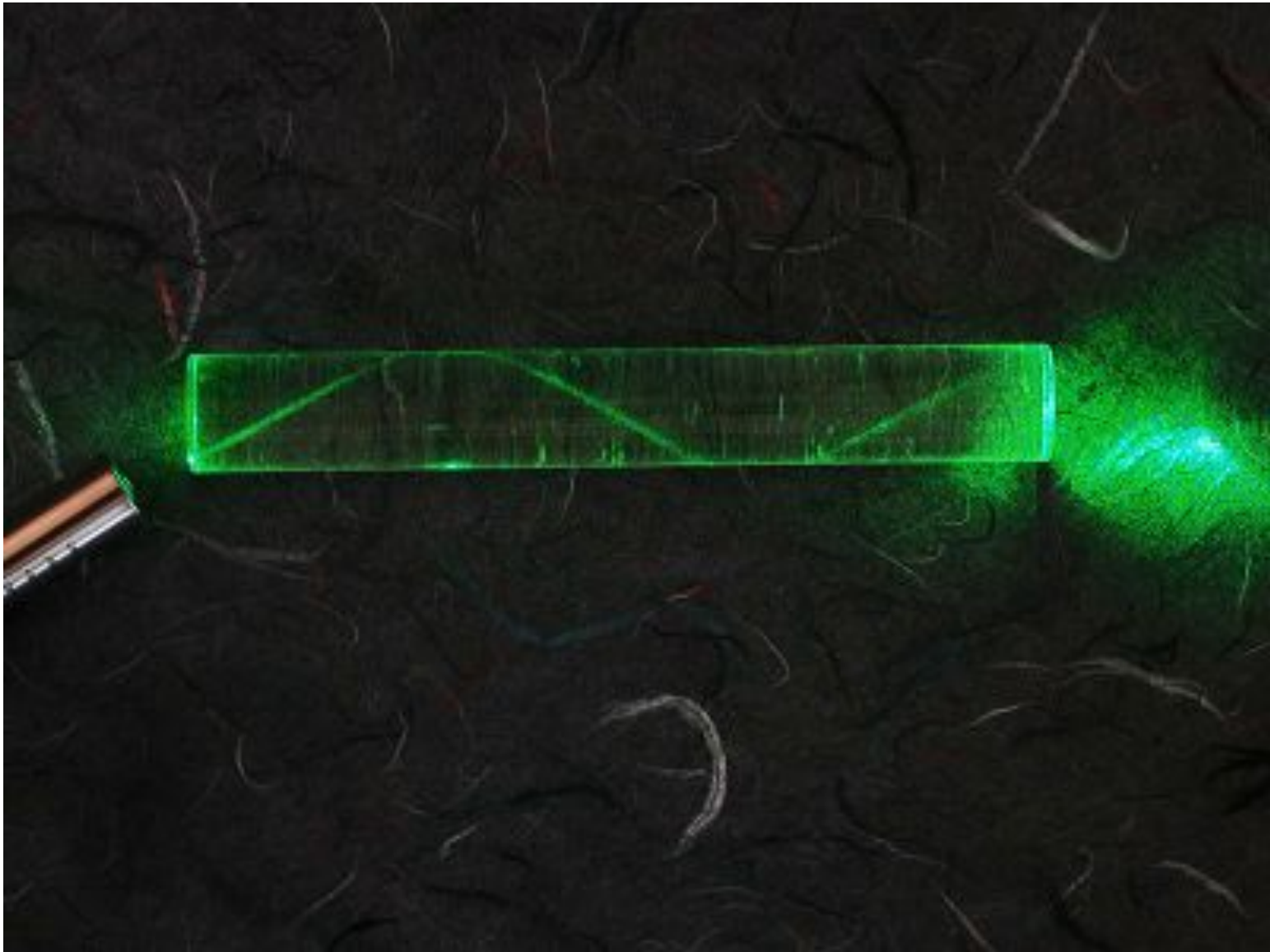


Showing the density of global telephone traffic over fibre optic cable in 2009

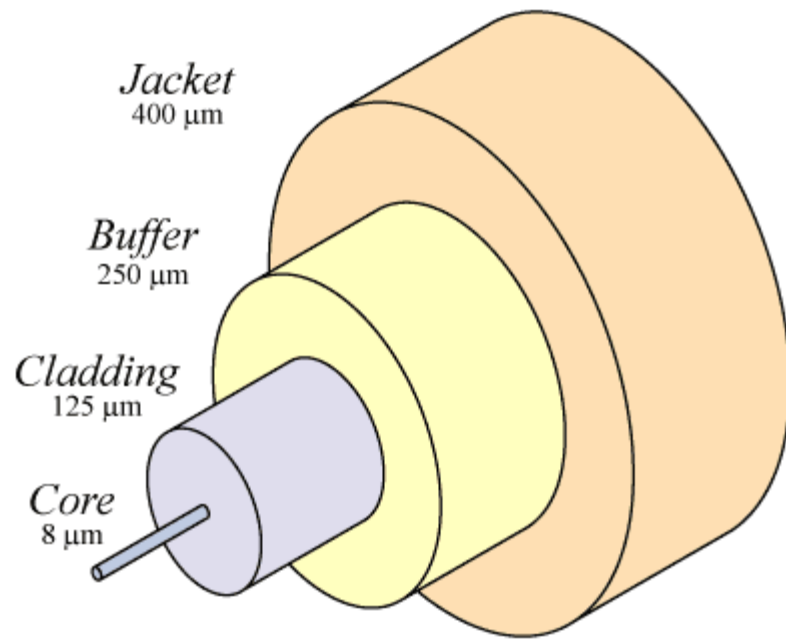


A multi fibre protected cable.





A fibre optic cable in a laboratory showing the reflected transmission mode.



Subsea fibre cable (armoured)



The space segment



- In poorly served areas of the world satellite mobile relay has been successful.
- Intelsat, Inmarsat, Globalstar, Iridium, Thuraya, ICO.
- Launchers, USA, China, France, Japan, Russia, India, Iran, DPRK,
- Production on a vast scale, long term in nature, strong R+D underpins it.

Good news - UK Space agency

- HQ at Swindon
- UK has 6% of global business.
- Over 24900 employed.
- <http://www.ukspaceagency.bis.gov.uk>
- Growth of 8%, >£7.5B to GDP
- 70% of employees have degrees.
- Principal shortage is skilled engineers.



Mobile phones used via satellite relay.

THURAYA satellite relay COVERAGE



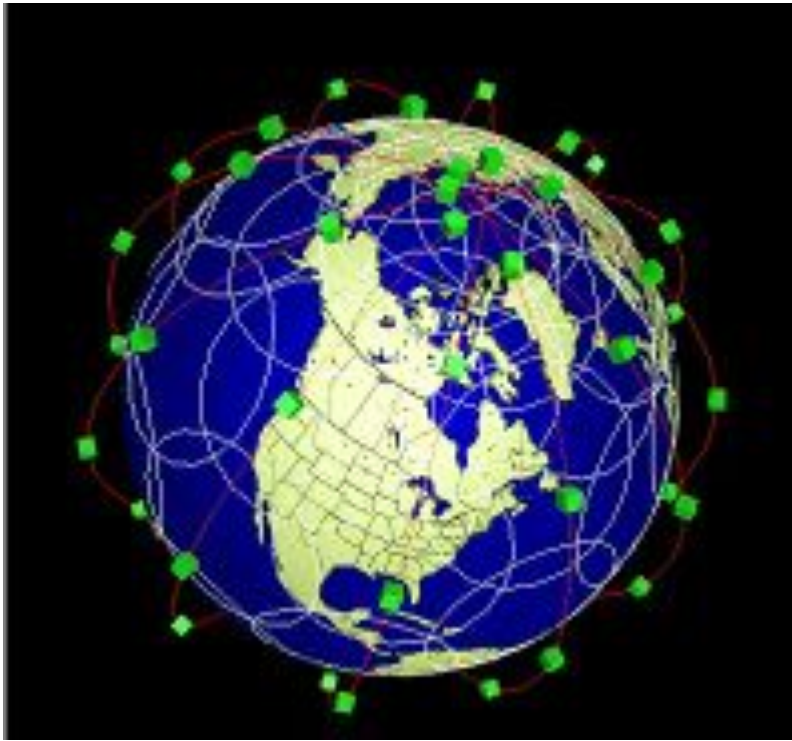
Thuraya main earth gateway station Abu Dhabi.



To ring a Thuraya phone +882 16 xxxxxxxxxx

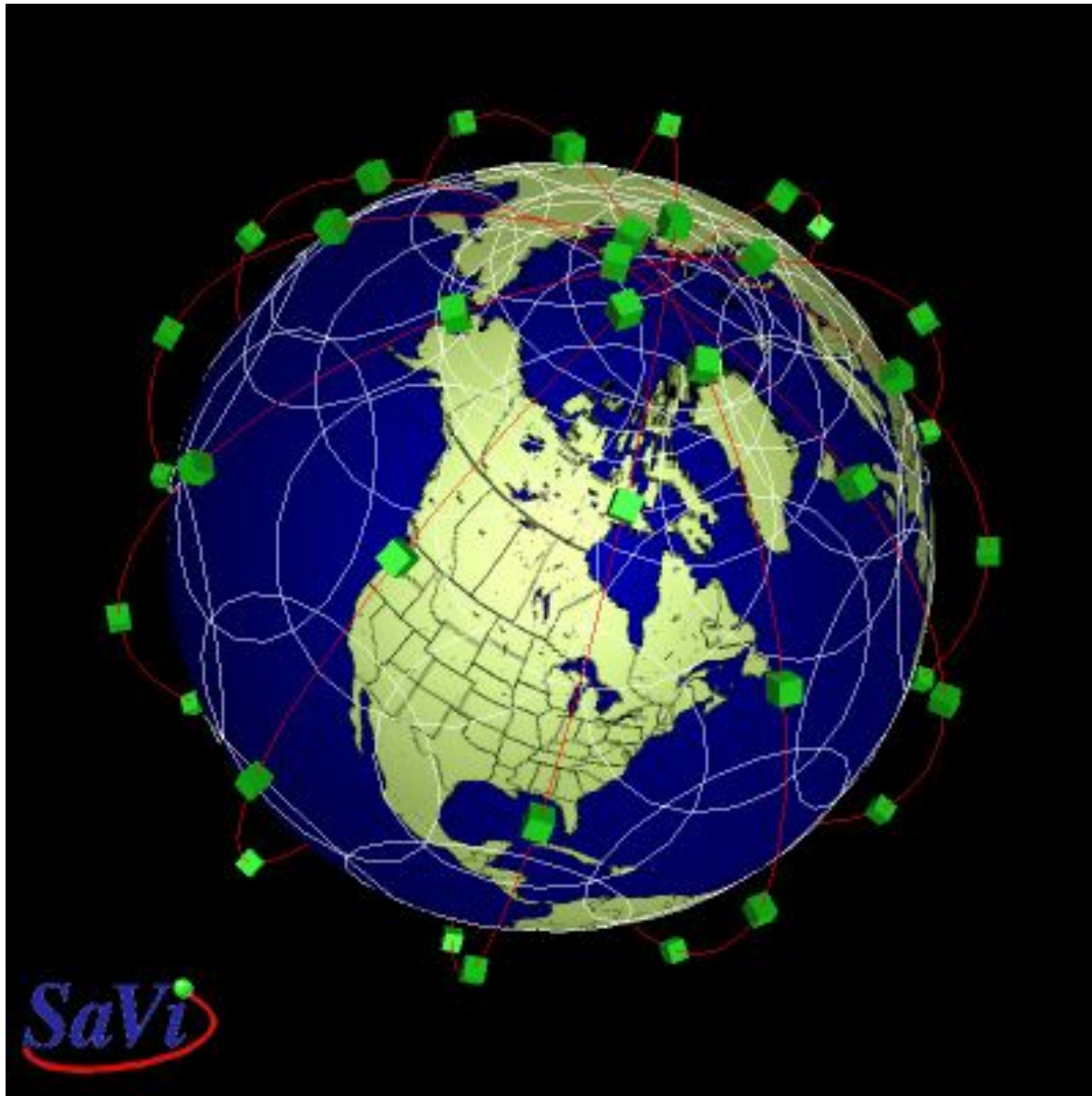
IRIDIUM PHONE IN USE IN ALGERIA.





IRIDIUM satellite mobiles.
Now used by large US
military contingent.

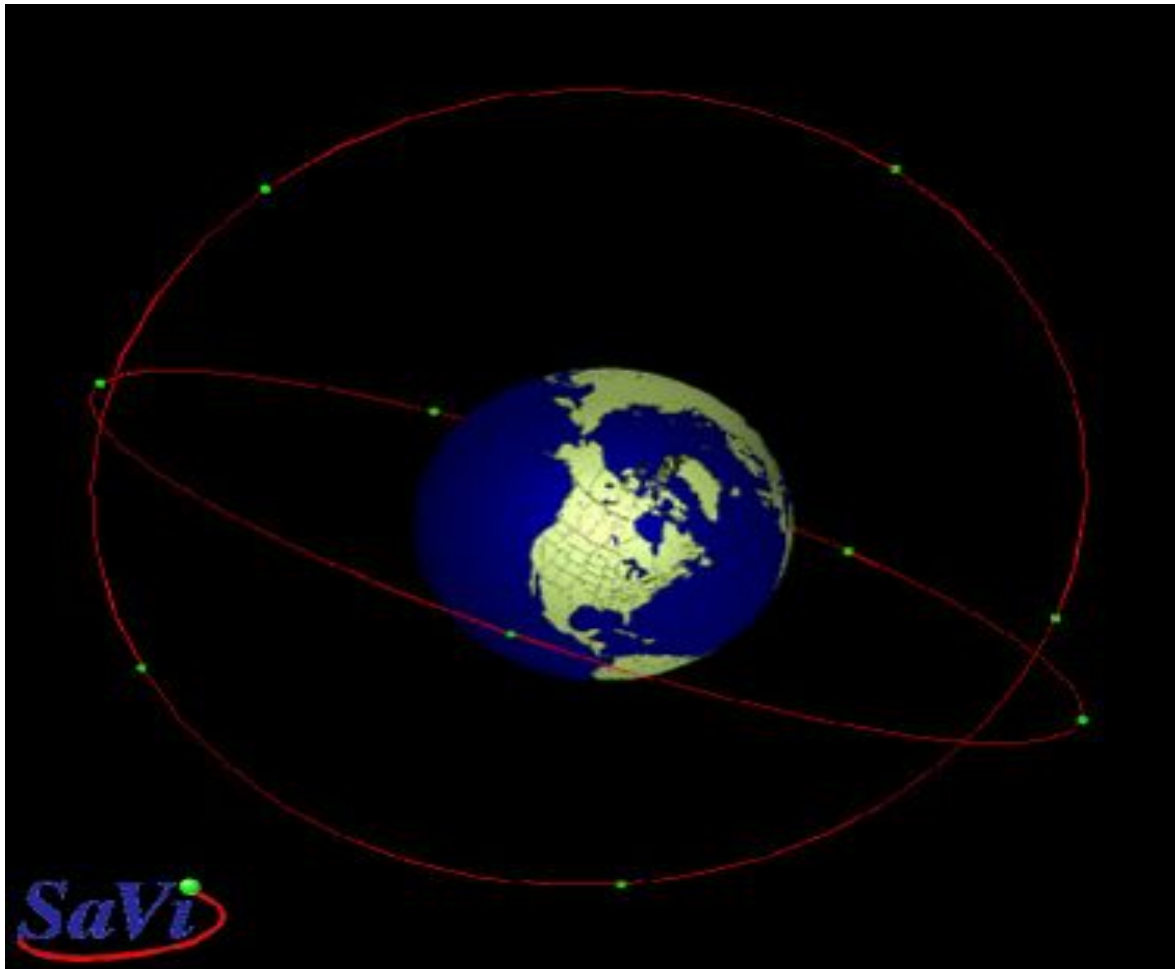




Iridium – nominally 66 satellites in orbit



Photo of Iridium satellite in construction. +8817 or 8816 to call



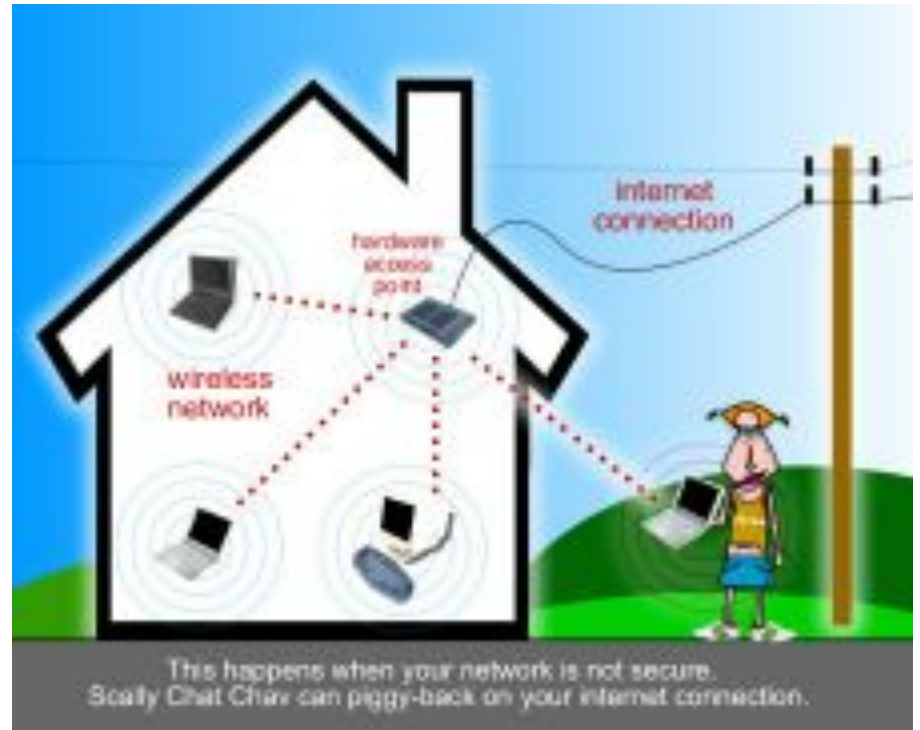
ICO proposal for mainly service to the Americas

Satellite relay of mobile phone user.

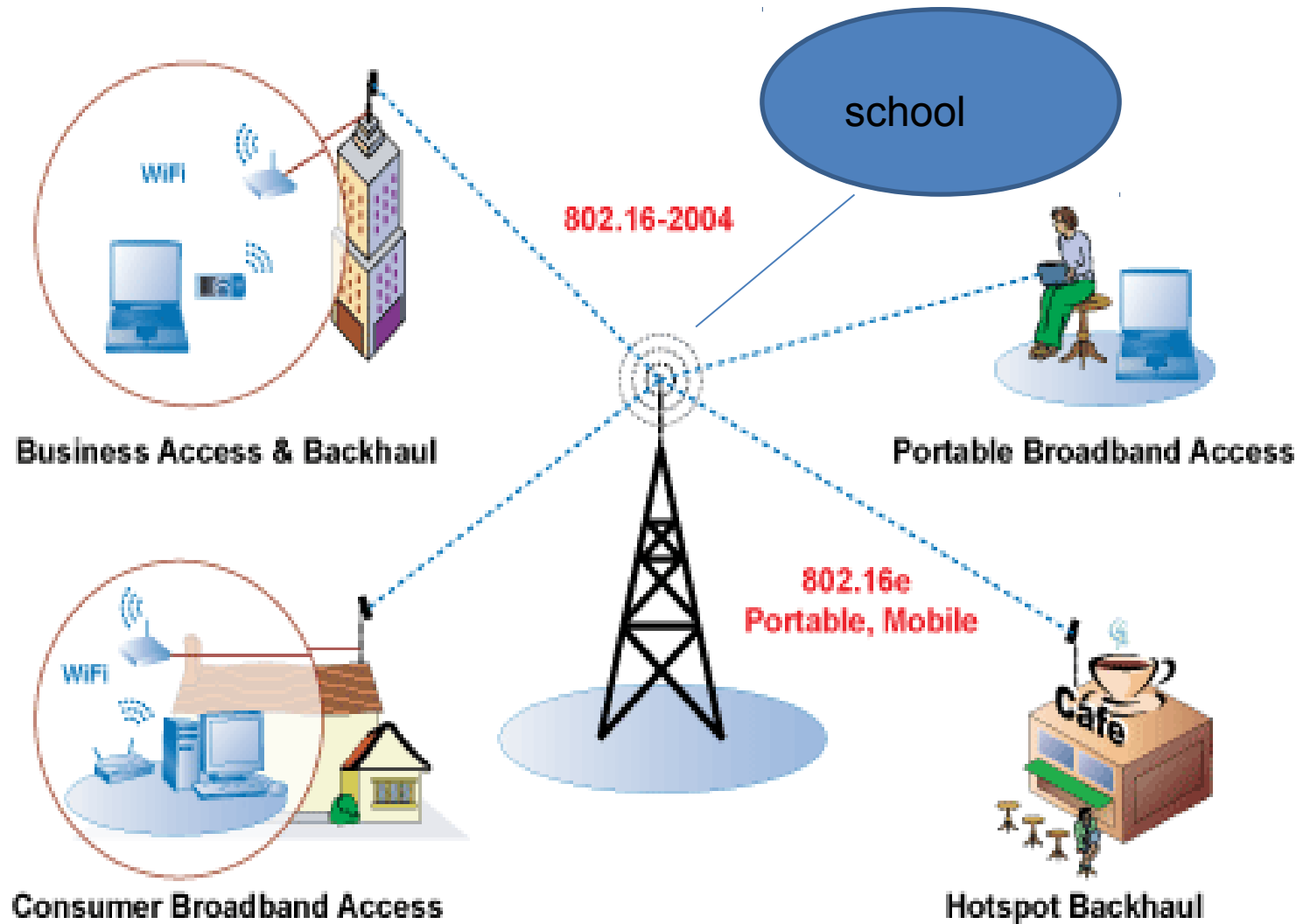


Transmission units
on ground, antenna
pointed to satellite.

Typical future use of domestic connectivity



The 4th Generation vision home, work, learn, play,



Yet to be implimented

Mobile phones -social benefits

- Improved personal lives, and safety,
- Relief of poverty,
- Improved employment and performance in work,
- Gov't taxation yield, for social benefit if spent wisely,
- Education benefit, remote medicine,
- Entertainment. Safety, rescue.