Large-print book

Please do not remove from the gallery

Information Age

Contents

Information Age:
Six Networks That Changed Our World

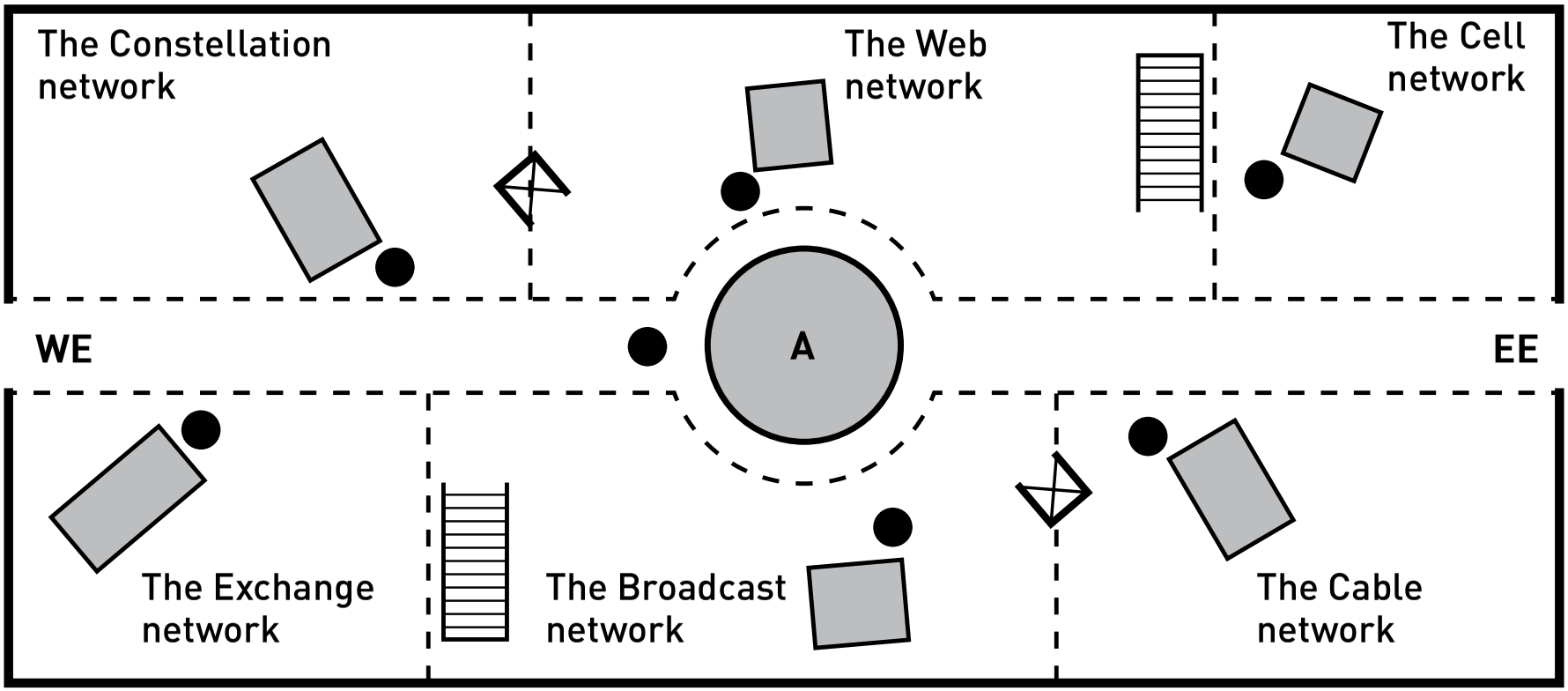
Our messages – from the mundane to the memorable – can be counted, compressed and reduced to fundamental ‘bits’. This is information.

Information Age tells the story of 200 years of information and telecommunication networks.

Across six networks, it reveals the hidden infrastructure and devices that have allowed us to send more information further and faster than ever before.

Through 21 transforming moments, it presents the extraordinary people who have created, used and been affected by each new wave of technology.

Map



Key

Wall	Network room
Network boundary	**A** Aerial tuning inductor
Stairs up to raised walkway	**EE** East entrance/exit
Lift up to raised walkway	**WE** West entrance/exit
Tactile object	

Introduction to accessible features

Gallery layout

The gallery is located on one floor with a mezzanine-level walkway providing additional viewing angles for the objects. The walkway can be accessed within the gallery via two lifts and two staircases. There is an entrance/exit at each end of the gallery, where there are lifts and stairs providing access to the rest of the Science Museum.

The gallery is divided into six zones, three along each side of the gallery. Within each zone there is a large double-heighted room. In the centre of the gallery sits the aerial tuning inductor, the largest object in the gallery.

Features for blind and partially sighted visitors

Seven touchable objects are located around the gallery, including one in each zone. They are accompanied by large-print and Braille labels. Tactile cane detector markers are incorporated into the flooring to help highlight hazards.

Throughout the gallery there is a selection of audio-based exhibits accessed via speakers and headphones.

The Info-Age Audio-Eyes app provides additional audio content for the gallery, designed with and for blind and partially sighted visitors. This includes information on the gallery environment and on the objects, including the tactile objects. The app can be downloaded from the Science Museum website. Please ask at the Information desk on the ground floor for additional information.

Wi-Fi is available throughout the gallery.

Aerial tuning inductor from Rugby Radio Station

At the heart of the Information Age gallery is the aerial tuning inductor from Rugby Radio Station. This enormous structure resembles a gigantic hexagonal spider's web.

On 1 January 1926, Rugby Radio Station began sending messages to the world. Its very-long-wave, low-frequency radio signals could bend around the curvature of the Earth. Long wavelengths can also penetrate water, so Rugby Radio Station became a hub for encrypted military communications with ships and submarines.

Donated by: BT Heritage & Archives
Object No: 2005-733

The Cable

Telegraph networks send information from point to point in the form of electrical pulses.
The telegraph could send information at high speed, over long distances, giving rise to the first global communication network, and radically shrinking our world. Its impact on society was every bit as significant as the development of later information networks, such as the internet.

Globe showing cable routes, 1865–1970

Donated by: GEC-AEI Telecommunications Ltd
Object No: 1970-75

Cable shrinks the world

In 1858 the continents of Europe and North America were linked for the first time by a submarine telegraph cable. Just three weeks later the cable failed and it took eight more years of research and investment before telegraph signals at last crossed the Atlantic. Messages could be sent across the vast ocean in minutes rather than weeks.

Rigged model of SS Great Eastern, 1858

The Great Eastern was the world's largest passenger ship, but it was commercially unsuccessful. Later it was fitted with both paddle and screw engines to become an ideal cable-layer.

Model: 1857, scale 1:96
Lent by: J Scott Russell & Co.
Object No: 1857-101

Kelvin mirror galvanometer, 1858

William Thomson designed an extremely sensitive mirror galvanometer to detect faint telegraph signals. This particular galvanometer was used in 1858 at the Newfoundland end of the Atlantic cable.

Object No: 1876-68

The world runs on time

A practical electric telegraph was first demonstrated in London in 1837. Telegraph and railway networks spread in parallel, bringing the need for a commonly agreed time reference. From the 1850s, time signals sent from Greenwich were used to set clocks all over Britain. By 1884 one-hour time zones were agreed for the globe.

Cooke and Wheatstone double-needle telegraph, 1844

In 1843 William Cooke installed an electric telegraph alongside the Great Western Railway between Paddington and Slough. On 1 January 1845 this instrument sent a message declaring that suspected murderer William Tawell had boarded a train. Tawell was later arrested and hanged.

Object No: 1876-1276

Empire world clock or chronosphere, 1909

The clockwork-driven globe shows the local time anywhere in the world. It makes one complete rotation in 24 hours.

Object No: 1909-199

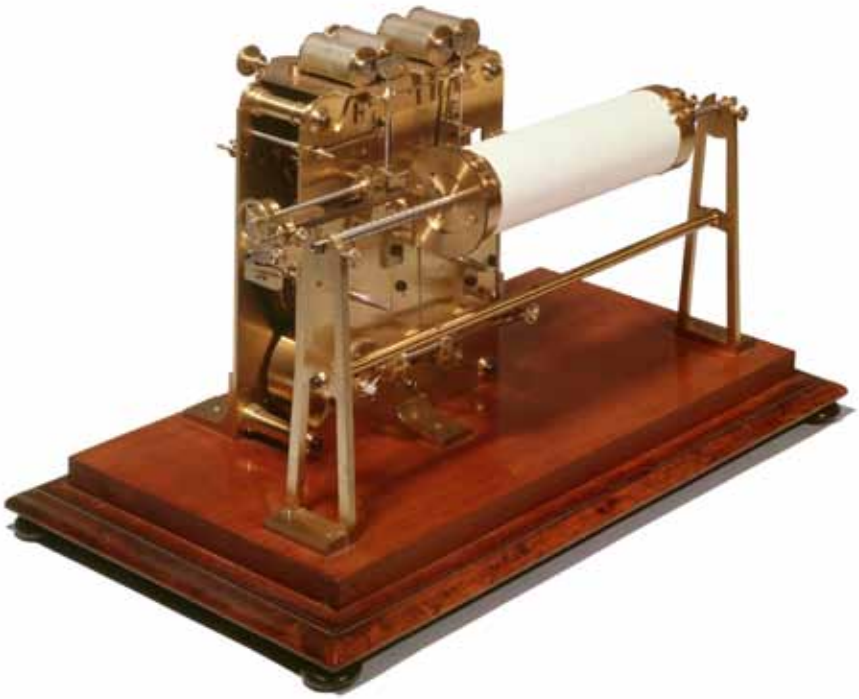
The nervous system of commerce

The development of printing telegraphs accelerated the rate at which information travelled through the network. In October 1929 telegraph lines were overwhelmed with information and stock tickers ran several hours late. The chaos of the Wall Street Crash showed the reliance of business on communication links.

Wheatstone's original printing telegraph, 1841

Charles Wheatstone preferred telegraph systems that did not require specialist knowledge of a code. He developed a printer for his 'ABC' system as early as 1841 – probably the world's first electrical printing machine.

Lent by: King's College London
Object No: 1951-165



Stock exchange printing telegraph, 1907

Sending information on stock and share prices was one of the earliest uses of the electric telegraph. The 'stock ticker' installed in offices printed out details of share price movements in a form easily understood with a few minutes' training.

Donated by: Exchange Telegraph Co. Ltd
Object No: 1960-23

Telegraphy without wires

The dramatic rescue of over 700 survivors from the Titanic disaster in April 1912 was made possible thanks to wireless telegraphy. The event widely publicised the advantages of the new technology.

Ship's radio cabin, 1910

By 1910 nearly all passenger ships on the north Atlantic run had wireless telegraphy installed. The Marconi Company hired its equipment to shipowners and provided a trained operator. Morse code was used, but the range was still restricted and messages from mid-ocean had to be relayed to shore by other ships.

Lent by: Museum of the History of Science, Oxford
Cabin reconstructed by: Science Museum Workshops


MPB

The Broadcast

Television and radio networks use radio waves to carry information from a transmitter to many receivers. Information is transmitted simultaneously, connecting millions of people watching or listening to the same programme at the same time.
Digital broadcast technologies use cable, satellite or internet links to distribute huge quantities of information more efficiently. By providing choice and control, they transformed the way listeners and viewers interact with radio and television.

Model of Shabolovka Tower, 1922

Model: 2013, scale 1:30

Supported by: Vladimir Shukhov (great-grandson of engineer V G Shukhov)

Model built by: Henry Milner
Object No: 2014-105

Britain on the air

In the 1920s amateur radio operators used skills learnt during the First World War to develop small communities of experimenters and listeners.
In 1922 the BBC transmitted its first radio programme, marking the beginnings of official state broadcasting, and a new era for listeners at home.

Marconi 1.5 kW transmitter, used by the BBC London station 2LO, 1922–25

On a foggy November night in 1922, the words 'This is 2LO calling' announced the arrival of the BBC. The BBC's first transmitter, 2LO took words and music from studios in Savoy Hill near The Strand and transmitted them to listeners at home.

Donated by: British Broadcasting Corporation
Object No: 2009-146

Short-wave radio receiver, 1927

This receiver was made by Frederick H Walker, who in 1924 was the first British radio enthusiast to successfully receive radio signals from Australia.

Donated by: F Walker
Object No: 1927-125

On the box

In the interwar years many radio enthusiasts began to experiment with television. By 1953 families and communities gathered around newly purchased television sets to watch the coronation of Elizabeth II. For the first time more people watched an event unfold on their television screen than listened to it on the radio.

Early television receiving apparatus used by John Logie Baird, 1926

This equipment was used in a widely reported public demonstration in Frith Street, Soho.

Lent by: Baird Television Ltd
Object No: 1931-57

The world's first television zoom lens, by Watson & Son of Barnet, 1948

There were serious concerns that television crews would interrupt the solemn coronation ceremony.
The broadcasters worked hard to find solutions, such as this zoom lens, which allowed distant action to be captured without the intrusion of the camera.

Object No: 1995-5018

The digital switchover

In 2005 Britain's communications regulator, Ofcom, announced that the last analogue television transmitter would be switched off in 2012. A huge engineering challenge was undertaken to upgrade Britain's television transmitters. In parallel, a public relations plan was implemented to ensure that users did not lose their television signal.

Freeview adaptor set-top box, 2003

In 2002 owners of the British television transmitter network collaborated with broadcasters to form Freeview. Purchasing a Freeview set-top box allowed viewers to watch new channels free of charge. The numbers of digital television viewers rose rapidly.

Object No: 2009-5080/2

The Exchange

The telephone converts speech into electrical signals, carried through wires and switched across the network by telephone exchanges. Subsequent telephone networks transmit digital signals over fibreoptic cables, radio, microwave or satellite links. The telephone gave rise to new forms of behaviour and social etiquette, transforming working lives and relationships.

Post Office telephone kiosk no. 6, 1936

Object No: 1971-402

Telephones ring the changes

As a teacher of deaf people, Alexander Graham Bell experimented with transmitting speech electrically. Bell was working under considerable personal pressure, determined to gain financial security and marry his former pupil, Mabel Hubbard. His backer and future father-in-law may have tipped him off about a rival design.

‘Gallows frame’ telephone, 1875–77

In June 1875, Bell tried using his ‘harmonic telegraph’ to transmit speech. He fitted one of his ‘tuned reeds’ inside a wooden frame and attached a diaphragm to it. He could distinguish faint sounds, but not intelligible speech. This showed Bell that he might ultimately be successful in inventing a workable telephone.

Donated by: General Post Office
Object No: 1914-817

Liquid transmitter (copy), 1876

Early telephone pioneers needed a way of converting speech into a varying electrical current. The 'liquid transmitter', invented by Elisha Gray, did this but was inefficient and impractical. Bell claimed to have invented the device independently of Gray and it formed part of his successful patent application in February 1876.

Donated by: Bell Telephone Laboratories
Object No: 1958-21

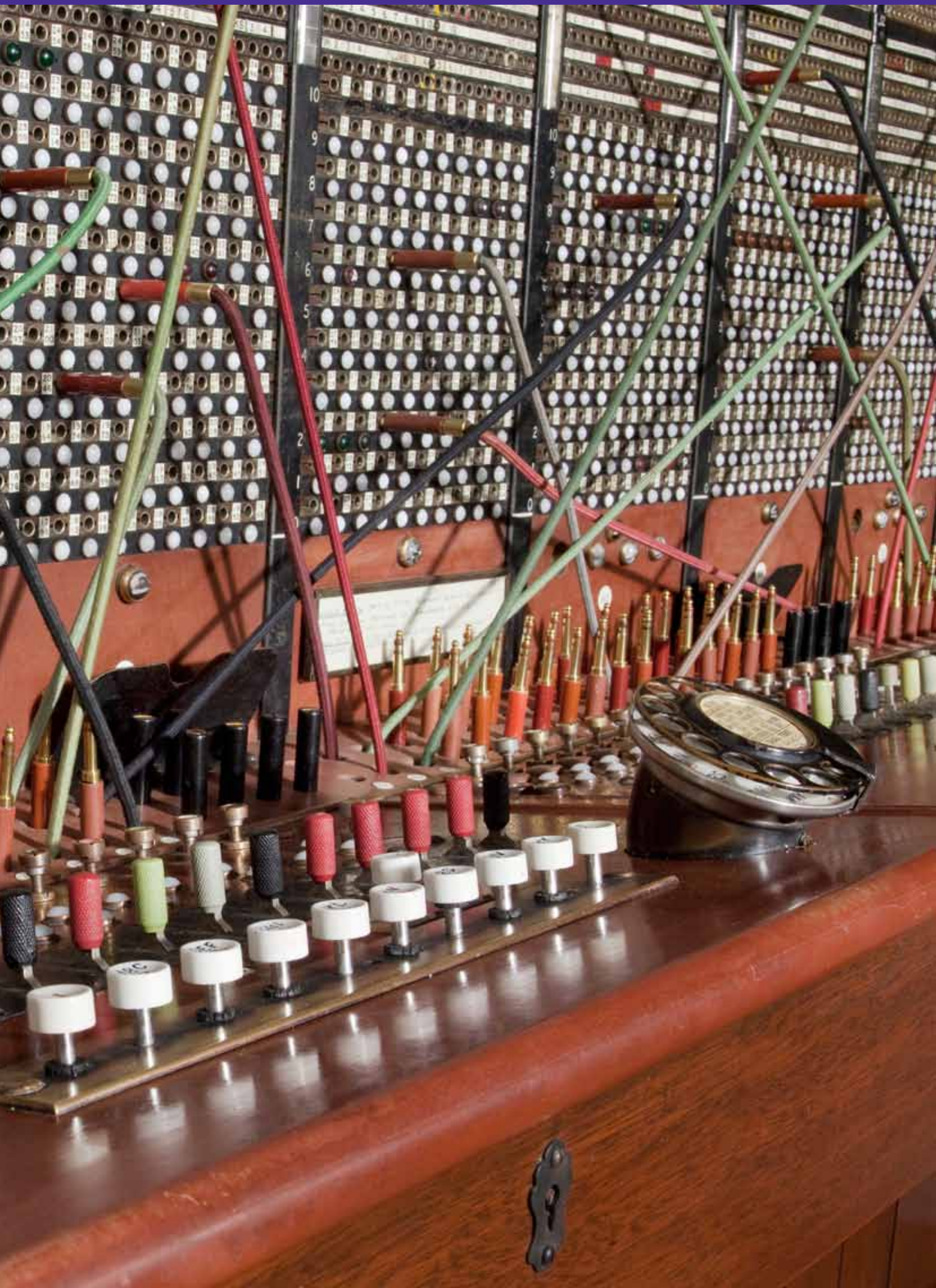
Coming of the dial

Telephones entered homes and workplaces in the early 1880s, transforming social and business relationships. Picking up the receiver connected callers to a switchboard operator, usually a young woman. From 1912 automatic exchanges made it possible for callers to make their own connections.

Section of manual telephone exchange switchboard, 1925

Operators at this switchboard spoke directly to local callers, connecting them to other users by plugging a cord into one of the sockets or ‘jacks’ in the upper part of the switchboard, or forwarding the call to another exchange using other connections.

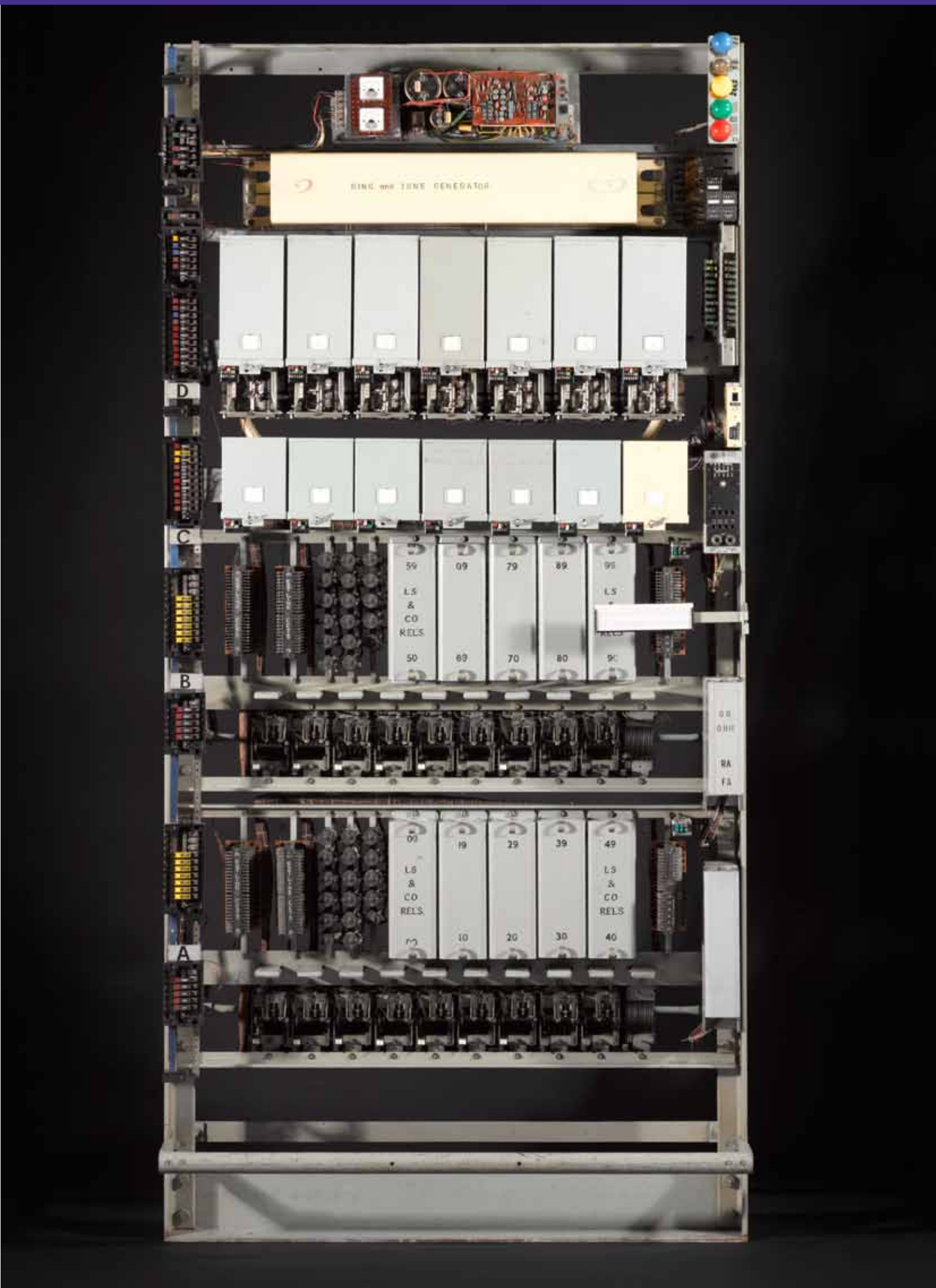
Donated by: General Post Office
Object No: 1961-94



PABX 3 automatic exchange, 1955–56

Electromechanical exchange equipment could be used to serve a very small number or thousands of people. This private automatic exchange from Holmsted Manor, a converted country house in Sussex, connected only about 20 offices.

Donated by: Youth With A Mission – England
Object No: 2012-92


RING and TONE GENERATOR
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Phone calls breach boundaries

On 26 May 1957 the American signer Paul Robeson's distinctive bass-baritone voice filled St Pancras Town Hall. Yet he was in New York: the new transatlantic telephone cable, TAT-1, carried his voice across the ocean.

Part of the original transatlantic telephony transmitter, 1927

The telephone service between Britain and the USA began in January 1927 using long-wave radio transmitters and receivers.

Donated by: BT Heritage & Archives
Object No: 1983-24

Submerged rigid repeater for transatlantic telephone cable, 1956

The first transatlantic telephone cable (TAT-1) provided cheaper and better-quality calls between Britain and America. Submerged repeaters boosted the electrical signals travelling through the cable. Rigid electronic repeaters were laid between Newfoundland and Nova Scotia. Another part of TAT-1 connected the cable to Oban, Scotland.

Lent by: Post Office Engineering Research Station
Object No: 1958-201

An empathetic ear

In 1953 Chad Varah, Rector of St Stephen Walbrook in London, invited the 'suicidal and despairing' to telephone and talk about their distress. The phone number was widely publicised and volunteers listened 24 hours a day, every day. The foundation of the Samaritans heralded a new use of the telephone, unanticipated by its early pioneers

Samaritans direction sign, St Stephen's Church, c. 1950s

The work of 'befriending' began on 2 November 1953. Though the telephone ensured anonymity, personal visitors could be seen too.

Lent by: Central London Samaritans
Object No: L2014-4185


THE
SAMARITANS
ON YOUR
FIRST VISIT
IF
PLEAS
MAN
IF YOU HAVE
BEEN BEFORE
YOU WILL
WE ARE A
MAN.

The Constellation

Satellite networks relay information between Earth and space. Using super-high-frequency waves, they deliver voice, image and data to parts of the world that other communications technologies cannot reach. Although remote in the Earth's orbit, satellites are intimately connected to people's lives.

Eurostar 3000 satellite, 2002

Donated by: Airbus Defence and Space Ltd, Stevenage
Object No: 2014-103

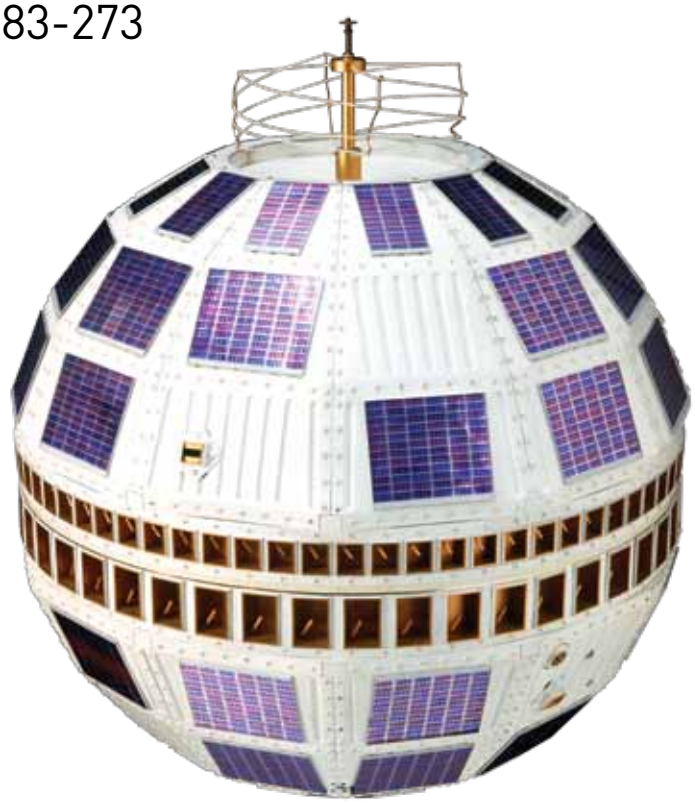
The world is watching

In 1945 Arthur C Clarke predicted that just three satellites could broadcast television images around the world. Twenty-two years later, Clarke's prediction became a reality. Combining contributions from 14 countries, the BBC's 'Our World' television programme was broadcast live to millions of viewers.

Telstar satellite, 1962

In service for only six months, Telstar marked a new era in satellite communication. It transmitted the first live television pictures from the United States to Europe and the first phone call through space.

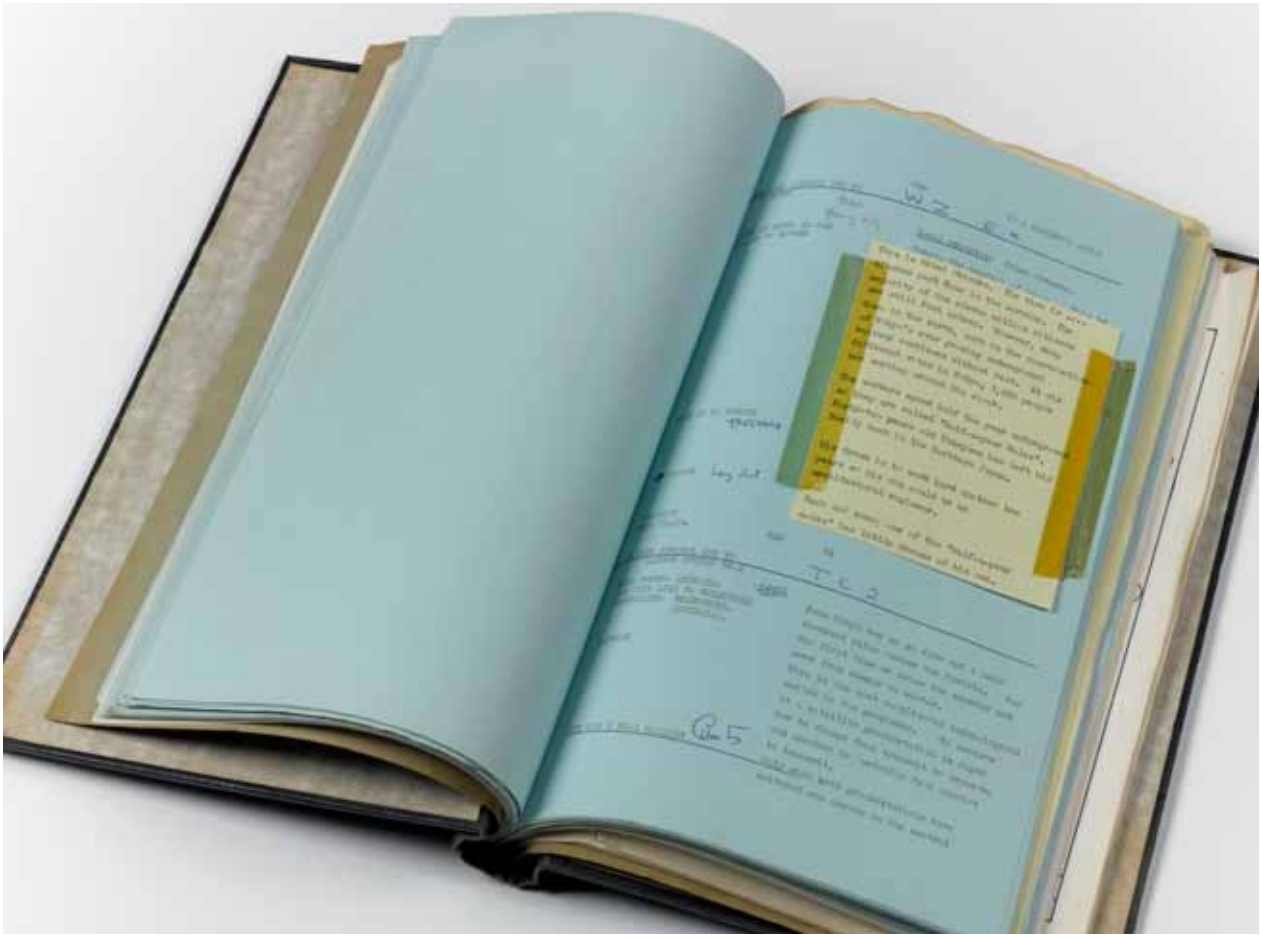
Model: 1983, scale 1:1
Object No: 1983-273



Annotated ‘Our World’ script, 1967

Because of the live nature of the ‘Our World’ broadcast the script was continually changing. This script contains handwritten notes, corrections and last-minute additions to the programme.

Donated by: William Cave
Object No: 2014-113



Satellites show the way

During the first Gulf War in 1991, troops buffeted by sandstorms advanced through an unmapped desert. Coalition forces successfully used emerging satellite navigation technology in the disorientating terrain. The accuracy available to the military was later extended to civilian GPS systems.

GPS Block IIF satellite, 2010

The global positioning system (GPS) is a constellation of satellites, each equipped with an atomic clock, sending accurate time and location information to Earth. The first Block IIF satellite was launched in 2010 as one of 30 satellites in the constellation. During the first Gulf War there were only 14 active GPS satellites in orbit.

Model: 2014, scale 1:1
Object No: 2014-116

Trimble Trans-Pac GPS receiver, 1990–91

This was retrieved from a helicopter shot down during the first Gulf War. Shortages of receivers encouraged donations from GPS manufacturers including Trimble.

Donated by: Trimble
Object No: 1992-837

Earth viewed from space

In 2001 Keyhole, a small computer graphics company, launched a product that could seamlessly stitch together satellite images, aerial photography and geopositioning. Users could fly across the world to see amazing detail of distant landscapes. This product became Google Earth, which gave anyone with a computer a personal eye in the sky.

US Air Force aircraft camera, type K20, 1940–45

This camera enabled Second World War pilots to take low-altitude aerial photographs. They captured images of potential enemy missile launch sites.

Object No: 1977-768

Landsat 5 satellite, 1984

NASA's Landsat 5 took over 2 million pictures of Earth, far exceeding its original three-year mission. Equipped with a range of scanning instruments, Landsat supplied high-resolution images and information about our planet for mapping and environmental projects.

Model: 1986, scale 1:6
Object No: 1986-1011

The Web

Computer networks are vast distributed networks. Information is carried as electrical signals, radio waves or pulses of light. Supporting giant global systems – from transport to economics – they provide unparalleled opportunities for creativity, sharing and collaboration between individuals.

Soviet BESM-6 computer, 1965

Object No: 2014-10/1/2

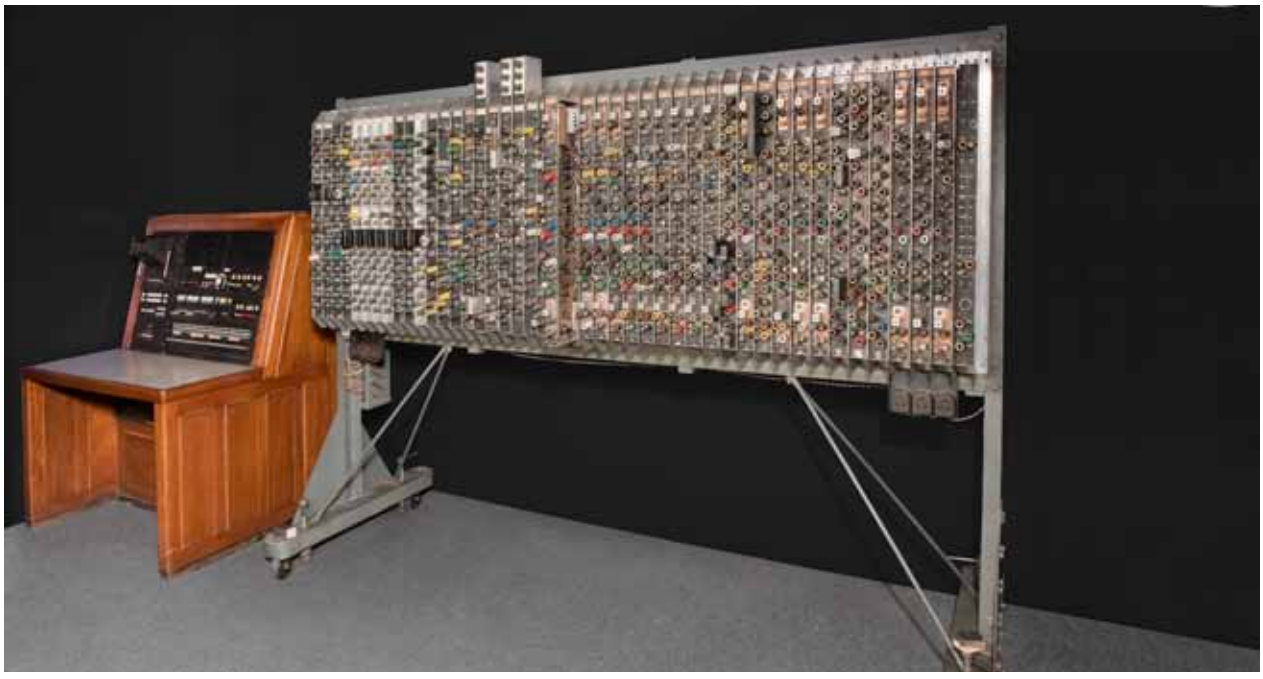
Electronics in the office

In post-war Britain, news of a giant ‘electronic brain’, developed in the US for military purposes, hit the headlines. The image of a ‘machine that thinks’ captured the public imagination. J Lyons & Co. was first to see the potential of electronic computers for business. The Lyons Electronic Office (LEO) went into operation in 1951.

Pilot ACE (Automatic Computing Engine) computer, 1950

Pilot ACE embodied Alan Turing’s idea of a universal machine that could perform any logical task.

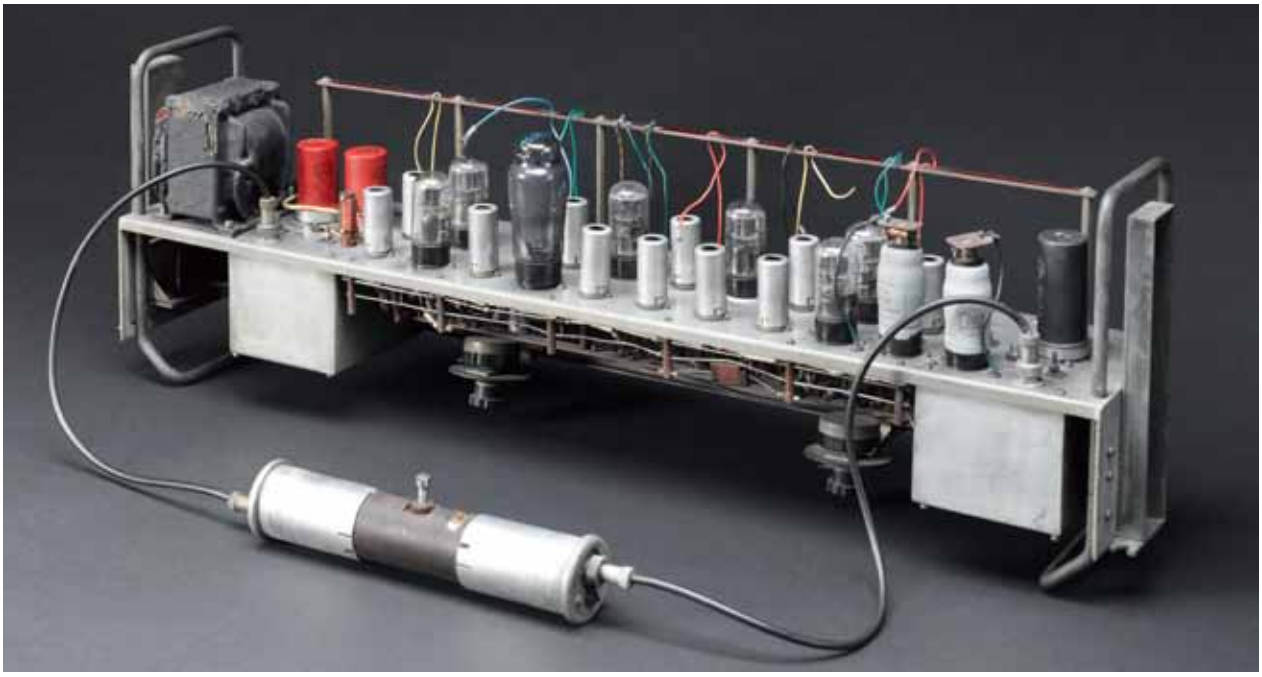
Lent by: National Physical Laboratory
Object No: 1956-152



Storage unit from the LEO I computer, 1951

This is one of the last remaining parts of the original Lyons Electronic Office – the first computer built for ordinary business tasks. This storage unit consists of a regeneration chassis and a short mercury delay line.

Donated by: J Lyons & Co. Ltd
Object No: 1965-33



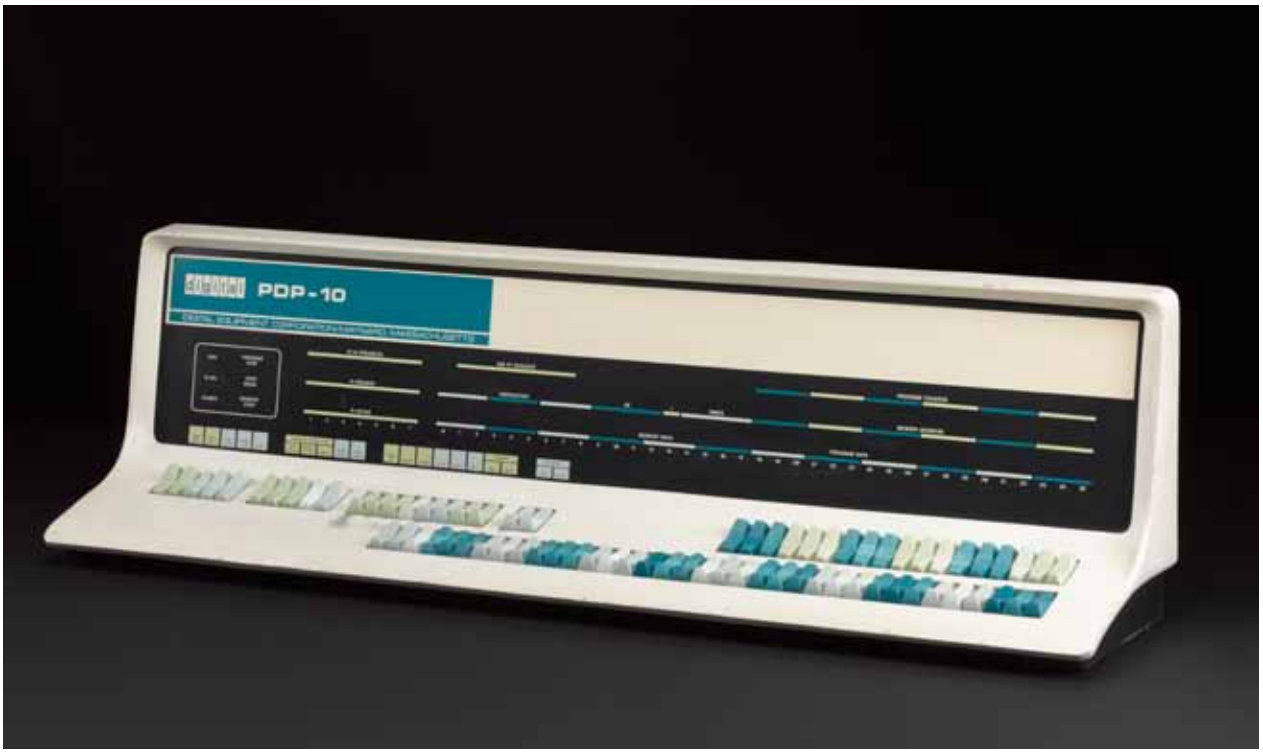
From calculation to communication

On 25 July 1973 a computer at University College London sent packets of data across the Atlantic. This was the first international link on the ARPANET network, the forerunner of the internet. In spite of their origins in the closed world of Cold War politics, computer networks rapidly became a tool for open collaboration.

PDP-10 operator's console, c. 1970

The first e-mail was sent using two PDP-10 computers located side by side and connected through the ARPANET.

Donated by: University of Hertfordshire
Object No: 1999-107



Cisco router, 1986

In 1986 Peter Kirstein connected this Cisco router to the fledgling internet. Routers are the gateways which allow information to flow between computers in a network.

Lent by: Peter Kirstein
Object No: L2013-4149

‘A single, global information space’

In June 1980 Tim Berners-Lee arrived at CERN, Europe’s centre for particle physics research. CERN was a melting pot of people, ideas and information. Within a decade he devised a tool, called the World Wide Web, to ‘link all the bits of information in every computer at CERN and on the planet’.

NeXT computer used by Sir Tim Berners-Lee, 1990

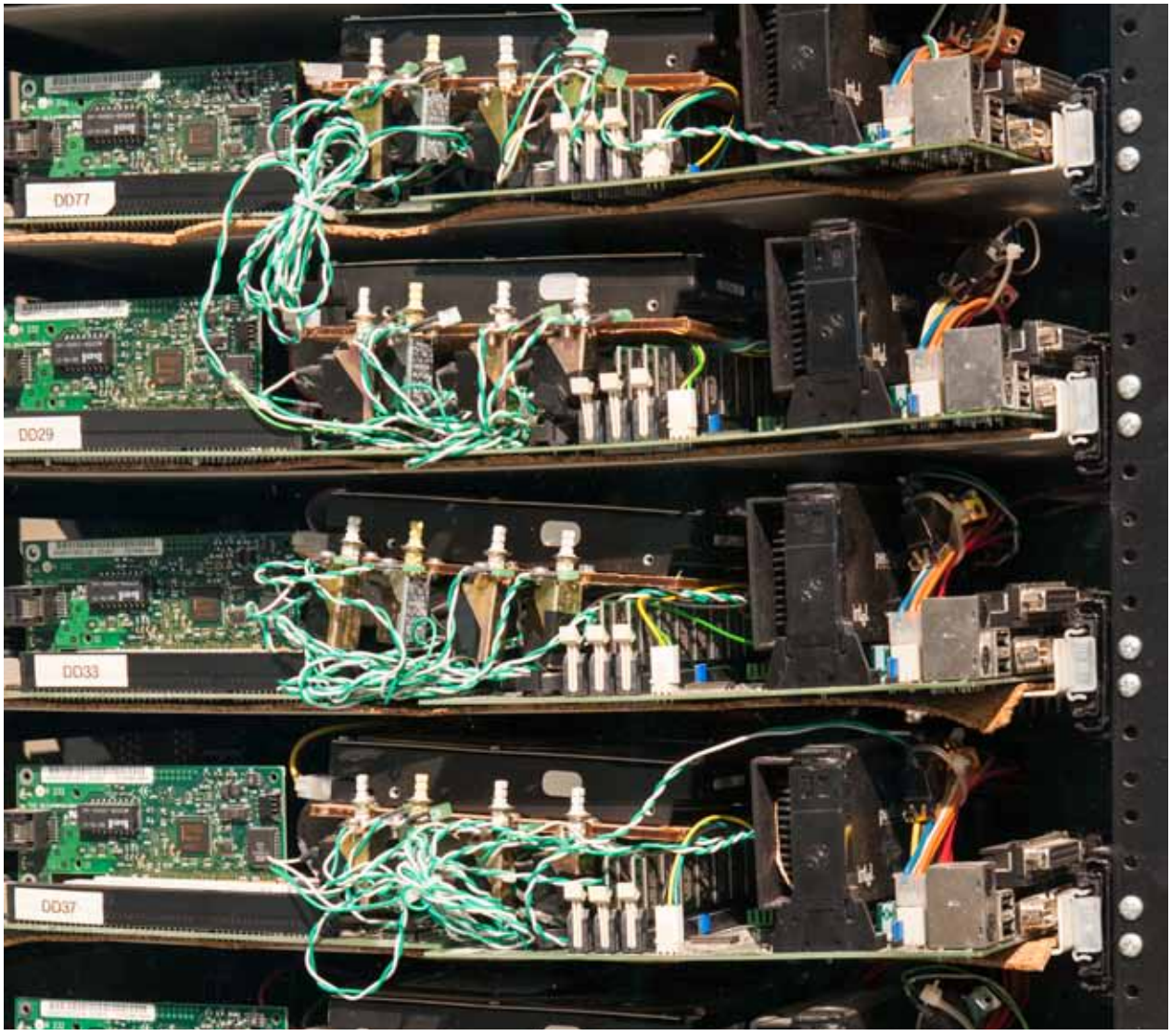
This is the original NeXT computer used by Tim Berners-Lee to design the World Wide Web and host the first web page at CERN on 25 December 1990.

Lent by: CERN – European Organization for Nuclear Research
Object No: L2014-4158

Google corkboard server rack, 1998

This server was an essential component of Google's first search engine. A server responds to requests within a computer network. In 1998 the young company made do with inexpensive materials including off-the-shelf personal computers and thin sheets of corkboard for insulation.

Lent by: Google Inc.
Object No: L2014-4172



Computers get personal

In the 1970s personal computers arrived. At first these machines were wildly popular with hobbyists who had expertise in electronics, but ordinary home users were put off by having to program them with switches and complex commands. It was not until the introduction of the graphical user interface that they were transformed into accessible tools for everyone.

Replica of original computer mouse, 1963

In 1970 Douglas Engelbart was granted a patent for a wooden shell with two metal wheels. This was the first computer mouse.

Model: 2013, scale 1:1
Donated by: Stanford Research Institute
Object No: 2013-85

Apple Lisa personal computer system, c. 1983

In 1983 Apple introduced its first computer with an innovative interface that enabled users to click on recognisable graphic icons and navigate through familiar-sounding pages.

Source: Philips Research Laboratories
Object No: 1993-1086

The Cell

Mobile networks use a series of base stations arranged in a cellular pattern. As users travel across cell boundaries, their mobile devices are seamlessly transferred to the next base station, keeping them in constant touch.

Mobile phone network antenna disguised as a cactus, 2014

Maker: Larson Camouflage, LLC
Object No: 2014-100

Phones on the move

In 1982 the British government licensed two companies, Cellnet and Vodafone, to operate the country's first cellular phone networks. Engineers raced to build a network from scratch, and within three years they had over half a million subscribers. The mobile phone was a luxury item that slotted neatly into the 'yuppie' culture of the mid-1980s.

British Telecom branded portable mobile telephone, 1980–91

Early mobile phones needed large batteries to ensure the signal was powerful enough to communicate with a base station antenna.

Donated by: British Board of Agreement
Object No: 2005-715

Analogue mobile phone base station using the Total Access Communication System (TACS), c. 1982

When Vodafone and Cellnet's networks launched in 1985, base stations like this were at their heart. The cylinders visible on the right are 'cavity resonators'. They give a sense of the scale of the network. Each cavity resonator could only support one mobile phone call at a time.

Donated by: Telefonica UK
Object No: 2013-72

Connecting Africa

Until 1997 few people had access to phones in Cameroon. The land-line network was limited and expensive. From a standing start, mobile phone companies flourished as creative Cameroonians set up businesses giving customers access to handsets and selling discounted call time.

Mobile phone call box from Bamenda, Cameroon, 2012

Cameroonian entrepreneur Emmanuel Bongsunu ran a mobile phone business from this call box for over a decade. Its bright colours and strategic roadside location attracted ever more customers.

Object No: 2013-158

Talking drum from Bafut, Cameroon

Alongside other traditional communication techniques, the talking drum remained important to Cameroonians despite the increased use of mobile phones.

Object No: 2014-43

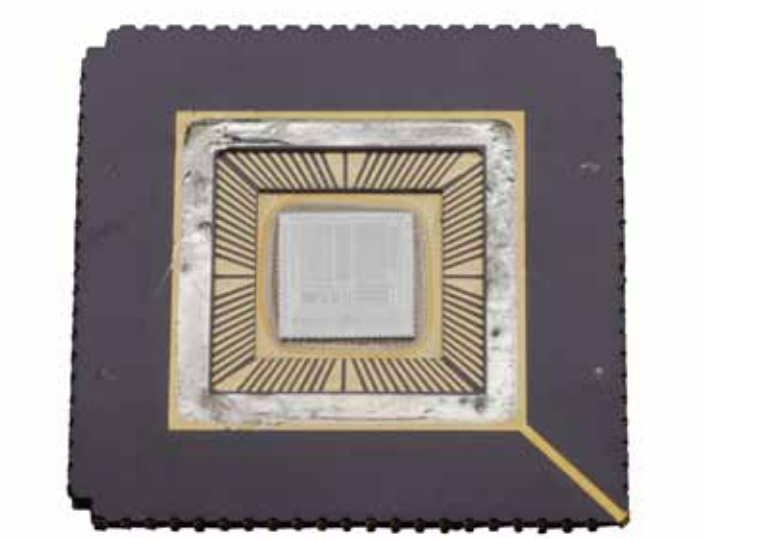
A computer in your pocket

From the 1990s new microprocessor technology began to transform mobile phones. No longer simply tools for making calls, they became versatile computing devices. Third-generation mobile networks, launched in the 2000s, transformed the way we generated, consumed and shared data.

ARM1 RISC processor, 1985

In the 1980s the microprocessor company ARM designed a new kind of RISC (reduced instruction set computing) microprocessor. This required low power, but had high performance. Later versions supported the kind of complicated processing needed for the mobile phone to become a smartphone.

Donated by: ARM
Object No: 2014-91



IBM Simon, 1995

The IBM Simon was the first device that brought together mobile phone technology and personal computing. It could run applications, send or receive faxes, save notes and store diary entries.

Object No: 2013-95