What Trevor Did Next!

Robert Bell, CSIRO

Celebrating Csironet: Service for Science

2024 Nov 14 – Canberra, ACT

Outline

- CSIRO Computing History:

- Themes:
  1. What Trevor did next
     - The C.S.I.R.O. Scientific Computing Network – plan
     - CRS/DCR
     - The C.S.I.R.O. Scientific Computing Network – part 1
  2. Innovation – the DAD operating system
     - Interactive visualisation and the start of on-line data
  3. The C.S.I.R.O. Scientific Computing Network – part 2
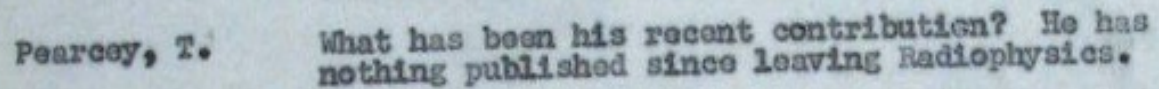 4. The People

What Trevor did next

- Further work on the development of CSIR Mk 1 ceased in 1954
- CSIR Mk1 lent to University of Melbourne, renamed CSIRAC, operated from 1956-64
- Trevor Pearcey took LWOP from 1 July 1957, and returned in August 1957 to his wartime location at the Royal Radar Establishment, Great Malvern, UK

- Others who worked there included:
  - E. G. ("Taffy") Bowen – joined CSIRO in 1943
  - Tom Kilburn, Freddy Williams – Manchester computers
  - Maurice Wilkes – EDSAC
  - Sir Bernard Lovell – Jodrell Bank
- Worked on simplified programming methods, as did G. W. Hill.
  - 'mathematical language' programming systems and their 'compilers'
  - RRE produced the first Algol68 compiler in later years.

What Trevor did next

- Trevor returned to Australia from leave and transferred from Radiophysics to DMS on 10 March 1959

- Located in the Applied Mathematics Department of the University of Melbourne
    - supporting CSIRO users of CSIRAC
    - doing personal research
    - giving lectures and conducting practical work

- 1961/62 estimates:

Pearcey, T.   What has been his recent contribution? He has nothing published since leaving Radiophysics.

Later:

What Trevor did next

Designed a Computing Laboratory for C.S.I.R.O.

Since joining the Division nearly two years ago, Mr. Pearcey has made extremely valuable contributions to the development of digital computing in this country. In the first place he played a prominent part in the design of our original proposal for the Computing Laboratory for C.S.I.R.O., and again at the later stage when the Inter-departmental Committee on Automatic Data Processing requested C.S.I.R.O. to re-design the scheme to take account of all Commonwealth Departments requiring scientific computing. In the second place, on the basis of his expert knowledge, the 'CIRRUS' computer will embody numerous features which will make it technically years in advance of the machines manufactured by reputable manufacturers.

What Trevor did next

1962:

- A proposal from Trevor Pearcey with the support of E.A. Cornish from DMS for the establishment of a 'network' of computing facilities
  - Approved by the CSIRO Executive
  - Approved by the Interdepartmental Committee on Automatic Data Processing
  - Approved by Cabinet
- A £3 million grant (about $100M in today's values) was provided by the Commonwealth for the establishment of a Computing Research Section within the CSIRO.

- 'Network' of compatible machines – a first in Australia

CSIRO and BCS

Network Of Computers To Cost £3,597,000

CANBERRA, Wednesday.—Two major contracts for electronic computing equipment worth £3,597,000 have been given to a United States company, the Treasurer, Mr H. E. Holt, and the Minister in charge of the C.S.I.R.O, Senator J. G. Gorton, announced tonight.

One contract, to cost about £2,097,000, is for a major computer in the new Bureau of Census and Statistics building in Canberra for the bureau and the Treasury, and five smaller satellite computers in mainland State capitals.

The other contract, worth £1,500,000, is for a similar type of major computer in the new C.S.I.R.O. scientific laboratory in Canberra and four subsidiary computers in C.S.I.R.O. research laboratories in Melbourne, Adelaide, Canberra and Sydney.

Both contracts go to the Data Control Corporation, of Minneapolis.

The chairman of the Australian Universities Commission, Sir Leslie Martin, also announced tonight that the commission would propose the acquisition for certain universities of computer satellites to the C.S.I.R.O. system.

International Business Machines (Australia) Pty. Ltd. and Amalgamated Wireless (Australasia) Ltd. will supply punched card and paper tape data preparation equipment for the C.S.I.R.O. system and Amalgamated Wireless and International Computers and Tabulators (Aust.) Pty. Ltd. equipment for the Census Bureau system.

The value of the A.W.A. work for the bureau system is £198,000.

Education Tax Supported By Professor

A special Federal tax earmarked for education would be a good thing, the Vice-Chancellor of the

Ready Next Year In Canberra

The bureau computer is expected to be installed in the early months of next year.

The C.S.I.R.O. computer in Canberra will be installed soon after the completion next April in a new building now under construction on the slope of Black Mountain.

C.S.I.R.O. Computing Network

- Organisation, staff, buildings, equipment - tenders
- C.S.I.R.O. Computing Research Section
  - 1 January 1963 in Canberra
  - Dr Godfrey Lance appointed as OIC
  - Geoff Hill, Trevor Pearcey, Terry Holden and others joined
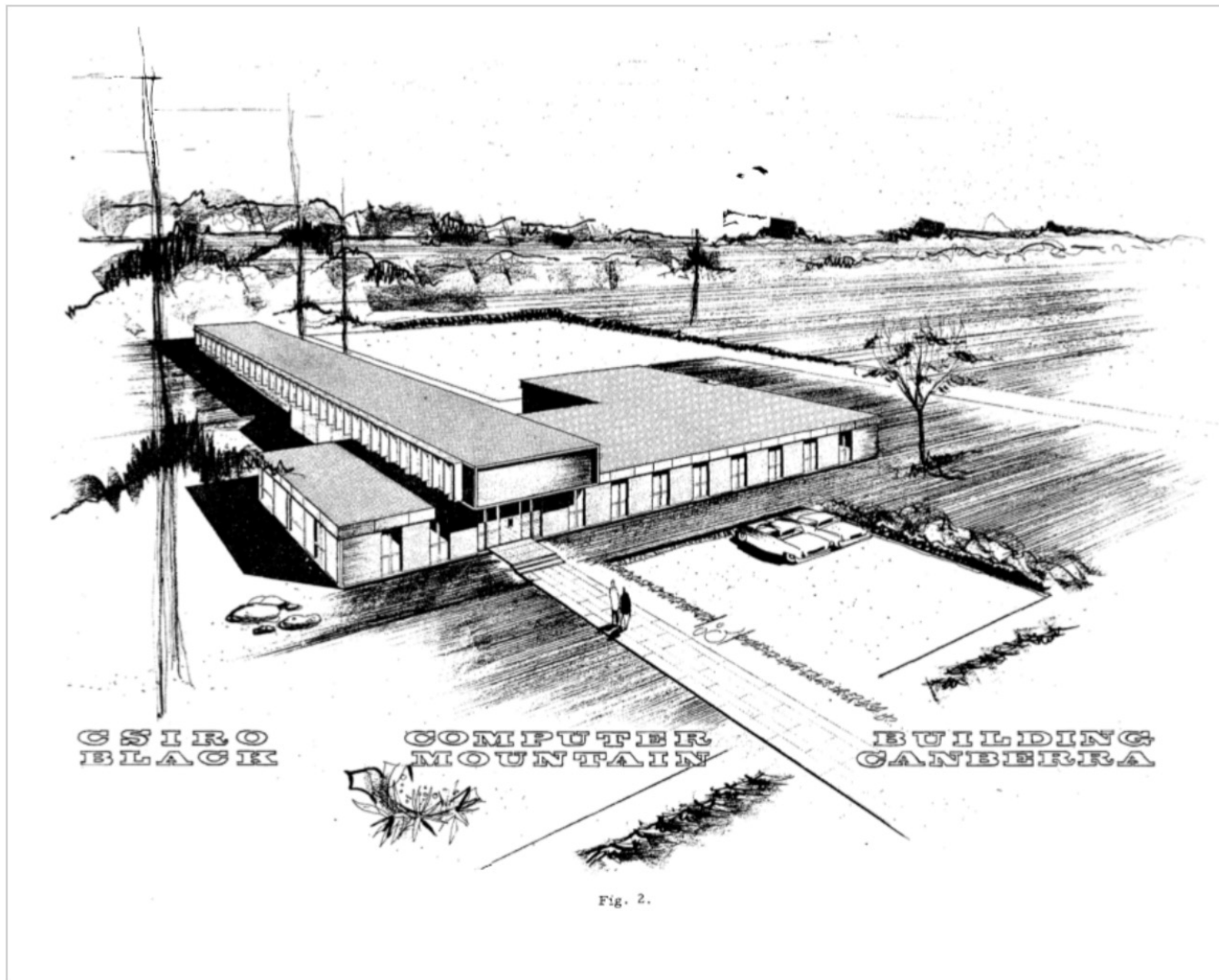- New building (demolished in 2019)

CSIRO BLACK COMPUTER MOUNTAIN BUILDING CANBERRA

Fig. 2.

C.S.I.R.O. Computing Network

- Tenders for supply of equipment:

  - CDC 3600 in Canberra

  - Satellite CDC 3200 systems in 3 state capitals ('paper' machines – E. T. Robinson's account)

  - Remote batch processing – cards and printouts – couriers and air-freight of magnetic tapes - jobstack

CDC 3600

Technical, Business and Economic Organizations, World-Wide, Order...

CONTROL DATA® 3600...The International Computer

- Lawrence Radiation Laboratory, U.S.A.
- University Corporation for Atmospheric Research (NCAR), U.S.A.
- Norwegian Defence Research Establishment & Institutt for Atomenergi, Kjeller, Norway
- Societé d'Informatique Appliqué, Paris, France
- Michigan State University, U.S.A.
- Commonwealth Scientific & Industrial Research Organization, Canberra, Australia
- Commonwealth Bureau of Census, Melbourne, Australia
- Argonne National Laboratory, U.S.A.

Setting the standard of excellence in large-scale problem-solving and data processing, **Control Data** 3600 Computers are installed in the U.S. today and are being placed in operation on an international scale.

3600's have been selected by leading nuclear and other scientific laboratories in the U.S. and abroad for the solution of the largest, most complex scientific problems. **Control Data** 3600 Computers are to be used for some of the world's largest economic and industrial Operations-Research problems; for processing data on population, trade, and related statistics; and for socio-economic accounting.

Control Data will be pleased to put you in touch with scientists and economists, worldwide, who are engaged in applying the 3600 Computer to economic and technical problems similar to your own.
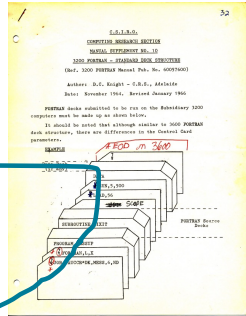
CONTROL DATA
CORPORATION

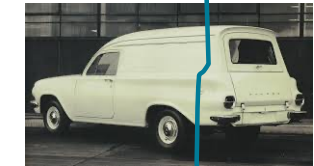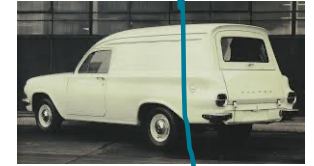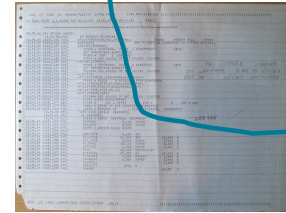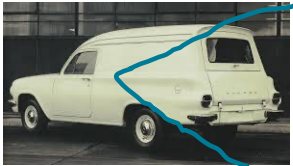AMSTERDAM, BAD HOMBURG, LUZERN, MELBOURNE, MINNEAPOLIS, PARIS, STOCKHOLM, TORONTO

8100 34th Ave. S., Minneapolis 20, Minn.

CSIRO

CDC 3600

Theme 2: Innovation – the DAD operating system

- Critical issues – systems did one task at a time

  - For example: no overlap of card reading with computation, nor printing with computation

  - Only magnetic tape for working storage – compilers were on tape, wrote binary code to tape, then the loader had to read tapes to load programs

- 1966: DAD Operating system – Drums And Display

  - Written by CSIRO and CDA staff

  - Overlapping operations

  - On-line system – visualisation, interactive document management, TED (Henry Hudson), INTERP, WORDPLAY (Peter Hanlon)

  - Document Region

Example Magnetic Drum
http://forpresentation12.blogspot.com/2015/01/magnetic-drum.html
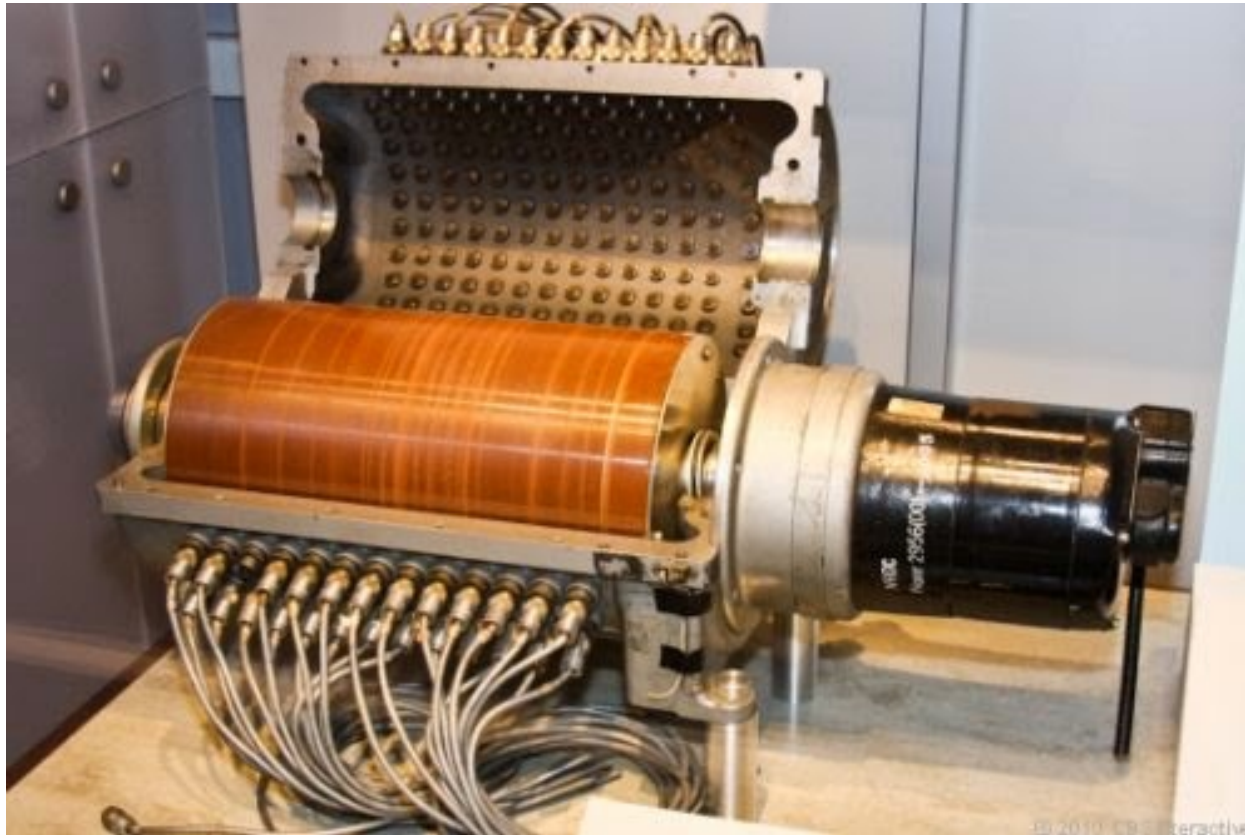
Example Display Usage

Theme 2: Innovation – the DAD operating system
The start of on-line data

- March 1966: Drum storage
- 2 units, each holding 3 Mbyte
  - Transfer speed of 1.5 Mbyte/s per unit
  - Read entire contents in 2 seconds
  - (c.f. half a day to read the entire contents of a modern disc)
- First on-line storage for CSIRO – concept of a Document
- Used primarily for systems and libraries, small amount for users
- Grew into a full-fledged HSM – drum/disc/tape – automatic!!!

Theme 3: The C.S.I.R.O. Scientific Computing Network – part 2 Pearcey, 1988

The network scheme operated well and comprised the first system of computers to operate as a network, at least in this country, based upon the principle of upward compatibility of both function and program language. From the outset the concept of physical transmission of tape between components of the system was considered a temporary expedient while the reliability of digital communications over long distances remained unsure, although improving, as was reported at the 1960 conference (Harris, M.L., and Kerr, R.D., 1960. Smart, K.J., 1960). Studies were then being made by the telecommunications authorities and equipment suppliers which showed that the major problems in digital communications for computer use lay in lack of standardisation and in high error rates.

Theme 3: The C.S.I.R.O. Scientific Computing Network – part 2

- 1966: DAD: interactive access in building, including graphical displays
- April 1968 – PDP-8 installed at Canberra – teletype access

New Equipment

A PDP-8 computer has now been installed in Canberra. It is currently being adapted to function as a controller to enable five teletypes to be connected to the Control Data 3600. The design and construction of the interface has been carried out as a research project within the Division. It is anticipated that eventually a number of new devices will be linked to the 3600 through the PDP-8 and the interface.

Teletypes

Teletype:
Paul G. Allen collection

LOT 110

A TELETYPE ASR 33
TELETYPE CORPORATION, 1963

Estimate
USD 500 - 800

Price realised
USD 23,940

Closed

Theme 3: The C.S.I.R.O. Scientific Computing Network – part 2

- The 1967-68 annual report contained:

The direct access capabilities previously available through six keyboard display consoles have been extended by the addition of five teleprinters, one of which is located in the Division of Land Research. The teleprinters are connected to the 3600 by means of a Digital Equipment PDP-8 computer and a special interface. The PDP-8 has also enabled the performance of off-line transcription from a picture scanner and an analogue-to-digital converter.

Theme 3: The C.S.I.R.O. Scientific Computing Network – part 2

- Peter Heweston (private communication February 2020) reported being a user of the terminal at Land Research.
- A request on CSIRO Yammer's provided information that there was a door at the lab, with a sign saying that the room being the site of the first computerised connection to the 'outside world' or something akin to that.
- Peter Hanlon (private communication February 2020) added:
  - There was a teletype (ASR33 probably) set up at the Division of Land Research on the Black Mountain campus which ran by cable along the Botanic Gardens fence into a DEC PDP-8 thence into the CDC 3600.
  - It operated for several weeks or months until lightning intervened, frying parts in the PDP-8 before damaging the CDC 3600.
  - Control Data generously fixed the machine out of spares, rumoured to be $80K-120K. DCR then considered optical isolators.

Theme 3: The start of the on-line network – linked computers

The 1970-71 annual report contained an announcement of a project to link computers in state capitals to Canberra:

Network
Project

T.S. Holden

The largest single system project since the development of the DAD monitor for the Control Data 3600, to link computers in other Branches of the Division in Adelaide, Brisbane, Melbourne and Sydney to the 3600 via interstate telephone lines, was started during the year.

Theme 3: The start of the on-line network

Linked computers – Remote job entry and printing to be provided

The 1970-71 annual

report contained:

The project, a collaborative one involving officers in most of the Division's Branches under direction from Canberra, will result in big savings in turnaround time for jobs submitted to the 3600 computer from Branch areas. (At the moment these jobs are sent by air express between the Branches and Canberra). A job submitted through a card reader at a Branch will be accepted and processed by the 3600 in the same way as a job submitted to the 3600 by the computer operators in Canberra. Output from the job will be directed back to the Branch or to any appropriate output device anywhere in the Network if so desired.

Theme 3: The start of the on-line network
 Linked computers – remote interactive to be available.

The 1970-71 annual
 report contained:

Not only will job turnaround be greatly improved, but the advantages of interactive computing will be extended to all programmers in the Network and not limited to the Canberra area only. Fast response from the 3600 may be expected by a user anywhere in the Network. A programmer in Adelaide, for example, will be able to make corrections to a program; direct the 3600 to run the modified program immediately; and have his program results displayed on the console he is using.

Theme 3: The start of the on-line network
Linked PDP-11 computers
The 1970-71 annual
 report contained:

A Digital Equipment PDP-11 computer at each Branch will perform the message switching operations between the incoming and out-going lines, the local peripheral equipment, and the local Control Data 3200 computer (in Adelaide, Melbourne and Sydney). The software and interface units for these 'nodes' are currently being developed by the Division. Operation is expected to commence at the end of 1971 when the interstate lines become available.

Theme 3: The start of the on-line network

CoResearch April 1972 contained:

- Start of operation of SIRONET

- Links to Adelaide, Melbourne, Brisbane, Sydney and Canberra

SIRONET

Completion of an Adelaide-Melbourne link last month marked the start of operations of SIRONET (CSIRO Computing Network), with the CSIRO computers in Adelaide, Melbourne, Brisbane, Sydney, and Canberra linked by voice-grade telephone lines.

Providing scientists working in these cities with immediate access to the major machine of the Network in Canberra, SIRONET will extend the interactive computing facilities enjoyed in Canberra to users at laboratory locations.

Access by telephone is also available from other locations in Australia through Subscriber Trunk Dialling.

A user sitting at any console may now enter his program and data directly through the keyboard and have the results returned promptly.
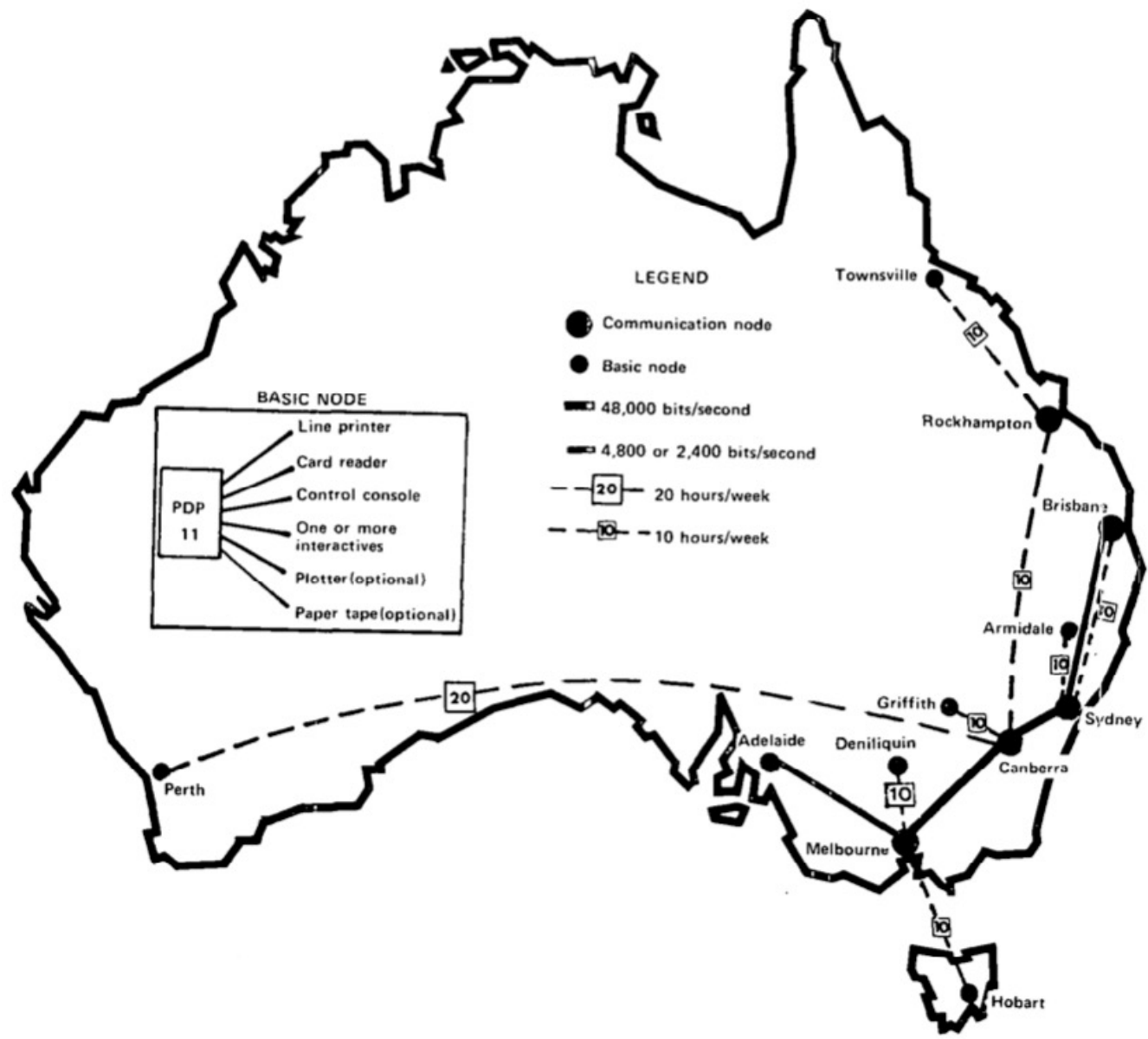
He may also request computer jobs to be run at a later time, after which volume output will be transmitted to his local branch site and printed there.

Small Digital Equipment computers installed at each branch site by the Division of Computing Research handle information transfers in the network and provide files to the larger Control Data computers owned and operated by the Division.

Theme 3: The start of the on-line network

- By 1975, Csironet was well established. A paper by Colin D. Gilbert, The Evolution of Csironet, noted that:

The CSIRO computing network, CSIRONET has evolved from a few interactive terminals in Canberra, to over 250 interactive terminals and about 50 PDP-11 nodal computers scattered throughout Australia.

LEGEND

● Communication node

● Basic node

▭ 48,000 bits/second

▬ 4,800 or 2,400 bits/second

--[20]-- 20 hours/week

--[10]-- 10 hours/week

BASIC NODE

PDP 11
- Line printer
- Card reader
- Control console
- One or more interactives
- Plotter (optional)
- Paper tape (optional)

Townsville
Rockhampton
Brisbane
Armidale
Griffith
Sydney
Adelaide
Deniliquin
Canberra
Perth
Melbourne
Hobart

CYBER 76

6 000 000 bits/sec

3600

600 000 bits/sec

First level machines
Canberra

PDP 11

spare

PDP 11

spare

MELBOURNE

spare

CANBERRA

spare

SYDNEY

spare

Fan-out machines

PDP 11

PDP 11

spare

Lines to other nodes

spare

MELBOURNE
DCR NODE

PDP 11

Interactives

Node peripherals
(Directly connected)

Card reader
Line printer
Plotter(s)
Paper tape

LEGEND

48 000 bits/sec

12 000 bits/sec

2 400 or 4 800 bits/sec

110 or 300 bits/sec

CSIRONET NODES

Canberra

CBR	DCR, Black Mountain
CD·	Bureau of Agricultural Economics, Braddon
CF·	Forestry Research, Yarralumla
CG·	Wildlife Research, Gungahlin
CH·	DCR, AMP Building, Canberra City
CK·	Industries Assistance Commission, Barton
CL·	Land Use Research, Black Mountain
CN·	Entomology, Black Mountain
CP·	Bureau of Mineral Resources, Parkes
CQ·	RAO/Head Office, Canberra City
CT·	Plant Industry, Black Mountain
CW·	Environment & Conservation, Canberra City
CX·	DCR, Black Mountain ‡

Adelaide

ADL	DCR, Adelaide

Armidale

EA·	DCR, Armidale

Brisbane

BNE	DCR, St Lucia
BL·	Long Pocket Laboratory, Indooroopilly †
BP·	Department of Primary Industry, Brisbane
BQ·	RAO, Brisbane

Deniliquin

ON·	Land Resources Management †

Griffith

GR·	DCR, Griffith

Hobart

HH·	Tasmanian Regional Laboratory

Melbourne

MA·	Atmospheric Physics, Aspendale
MD·	Mineral Chemistry, Port Melbourne
MEB	DCR, East Melbourne
MF·	Applied Organic Chemistry, Fishermen's Bend
MH·	Building Research, Highett
MI·	Mechanical Engineering, Highett
MN·	Chemical Physics, Clayton
MP·	Protein Chemistry, Parkville
MQ·	RAO, East Melbourne
MS·	Applied Geomechanics, Syndal
MU·	Tribophysics, Parkville

Perth

PER	DCR, Floreat Park

Rockhampton

ROK	DCR, Rockhampton

SYDNEY
Sydney

SC·	Fisheries & Oceanography
SE·	Radiophysics, Epping
SM·	Mineral Physics, North Ryde
SP·	Animal Physiology, Prospect
SQ·	RAO, Sydney
SR·	Animal Genetics, North Ryde
SYD	DCR, Chippendale

Townsville

TW·	DCR, Townsville

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† Not yet operational ‡ Developmental purposes only

Theme 3: The start of the on-line network

- So, 1968 to 1970 marks the beginning of CSIRO's packet-switched network
  - Within a year after DARPANET started
- Spread to all capitals, many regional towns, most CSIRO sites.
- Later developments
  - Micronodes based on Motorola 68000
  - Multi-host/multi-service capabilities
  - Unix workstation
  - X.25 support
  - Commercial users, e.g. SA Justice Department
  - E-mail in early 1980s

Csironet

- By the mid-1980s, Csironet provided access from 2000 terminals to 53 host computers and services through a network with 190 basic nodes across and outside Australia. It provided interconnections to University and Research networks.

CSIRONET SERVICES

CSIRONET
Network
June 1985
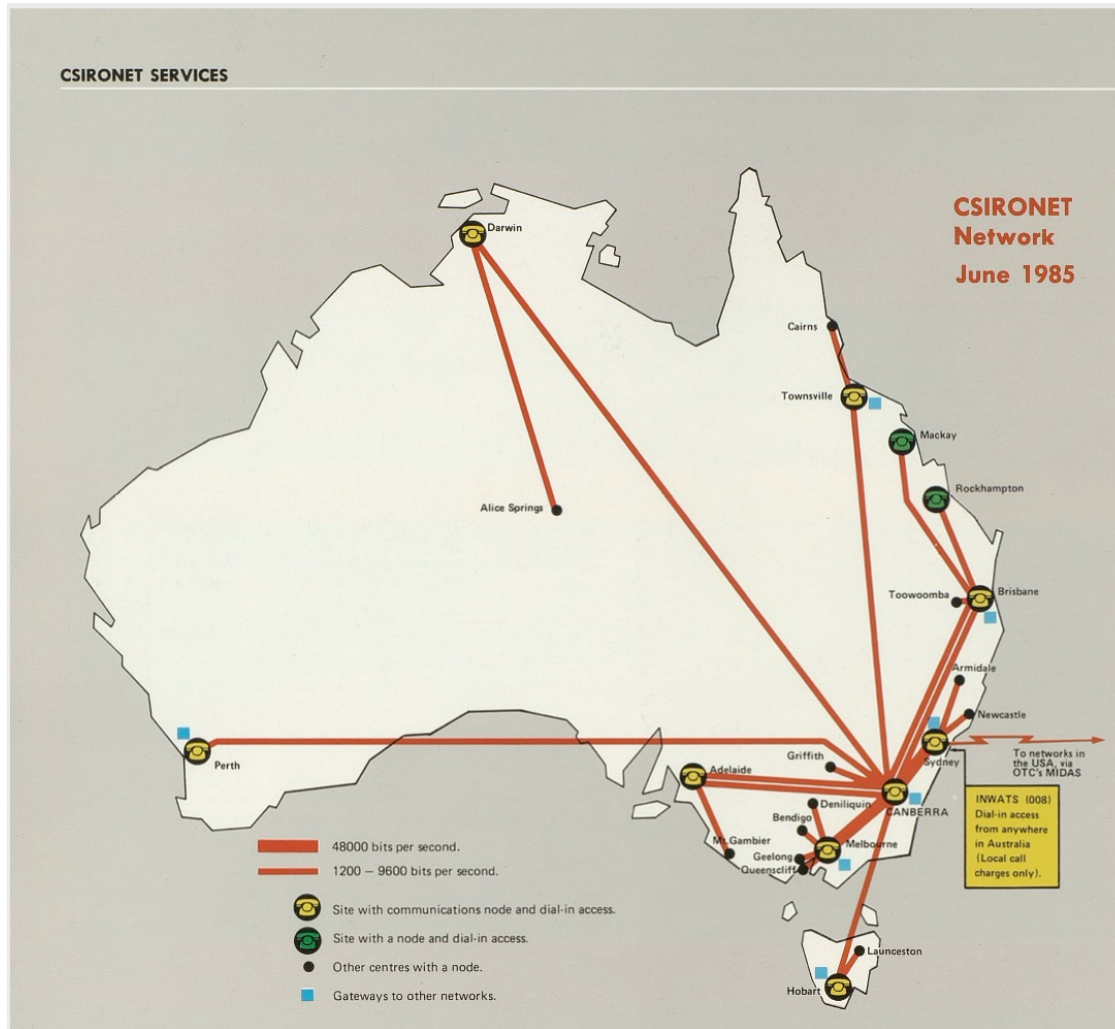
DCR Machine room 1983

DCR Machine room 1983

Theme 4: the people

- By the mid-1980s, Csironet had a staff of 150.
- Supported CSIRO science by providing facilities and services
- All the CSIRO computing was done on the DCR/Csironet systems until mini-computers arrived: scientific computing, finance, payroll, library, information services, typesetting, graphics
- People to be applauded – missed out on this when Csironet was outsourced.
- Many here today, or family members – thank you

Theme 4: Csironet people

- Helen McHugh
- John O'Callaghan
- Peter Heweston
- Ian Munro
- Peter Hanlon
- Jan Lee
- Harris Hudson
- John Morrissey
- John Smith
- Peter Milne
- Heather Hudson
- David Hudson
- Jessica Hudson
- Marjorie Henzell
- Tony Henzell
- Haidee Hudson
- Hoa Diep

CSIRO CRS/DCR/Csironet Staff Numbers
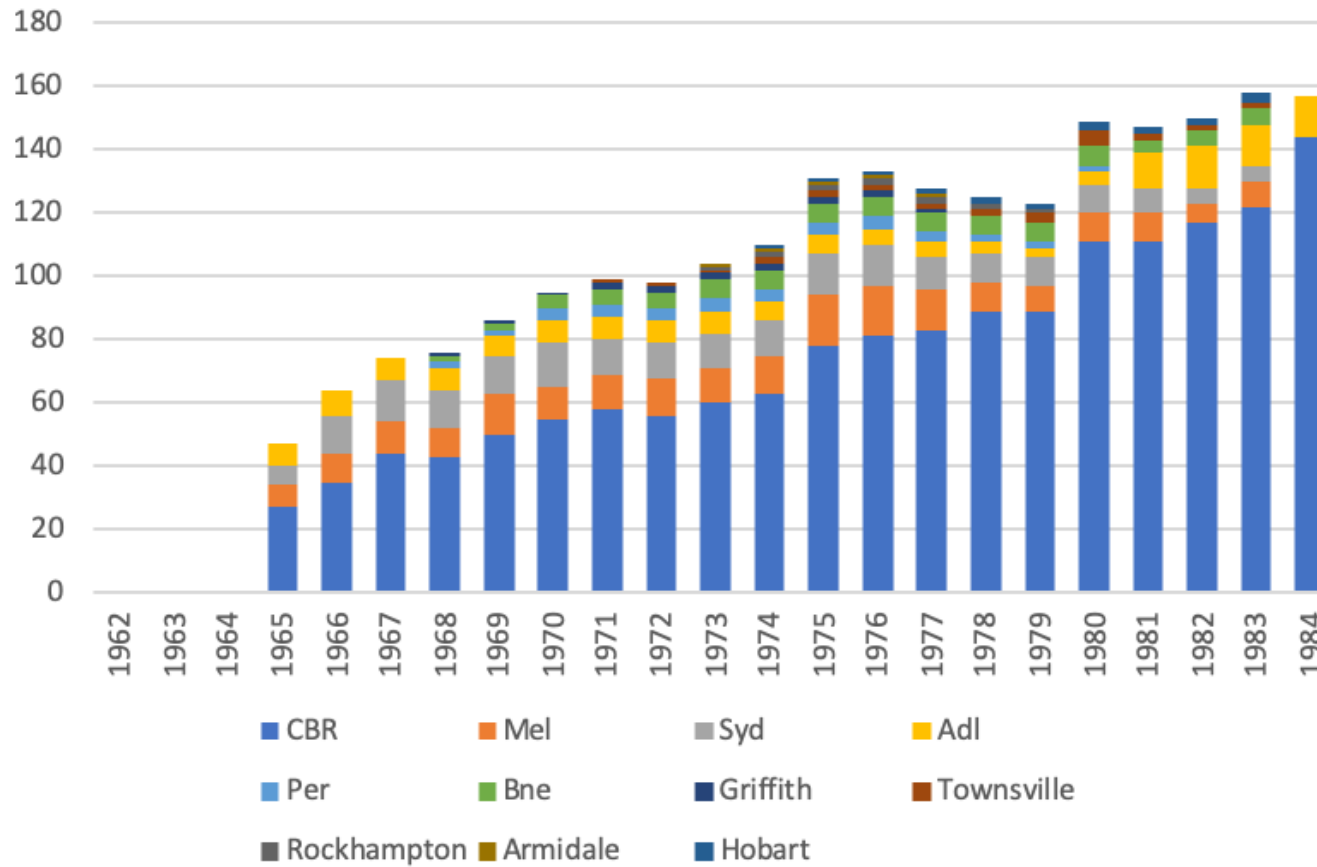
Other topics

1. The start of on-line data
2. The Cyber 76
3. Printing and microfiche
4. The growth of the service
5. What happened to Csironet, and why?
6. The policy framework
7. Decline
8. The lessons
9. Csironet – critical factors
10. Today – critical factors for computing services providers
11. Trends

Some covered in Computing History pages: https://csiropedia.csiro.au/csiro-computing-history/

Thank you

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CSIRO

Spare

CSIRO Peak Available Computing Systems