



The Australian Society for Operations Research
ACT CHAPTER

2015 ASOR-ACT Seminar Series

Can mathematics help save energy in computing?

Prof. Markus Hegland

MSI/ANU

Abstract

Recent development of computational hardware is characterised by two trends:

1. High levels of duplication of computational capabilities in multicore, parallel and GPU processing
2. Substantially faster development of the speed of computational technology compared to communication technology

A consequence of these two trends is that energy costs of modern computing devices from mobile phones to supercomputers are increasingly dominated by communication costs. In order to save energy one would thus need to reduce the amount of data movement within the computer. This can be achieved by recomputing results instead of communicating them. The resulting increase in computational redundancy may also be used to make the computations more robust against hardware faults. Paradoxically, by doing more (computations) we do use less (energy).

This talk will first discuss for a simple example how a mathematical understanding can be applied to improve computational results using extrapolation. Then the problem of energy consumption in computational hardware will be considered. Finally some recent work will be discussed which shows how redundant computing is used to mitigate computational faults and thus to save energy.

Bio

Markus Hegland has a diploma in mathematics from the ETH in Zurich, Switzerland and worked there for 5 years in mechanical engineering. He then received a PhD with Silver Medal in mathematics from the ETH in 1988. He was one of the inaugural research fellows at the newly formed Interdisciplinary Project Center for Supercomputing for three years.

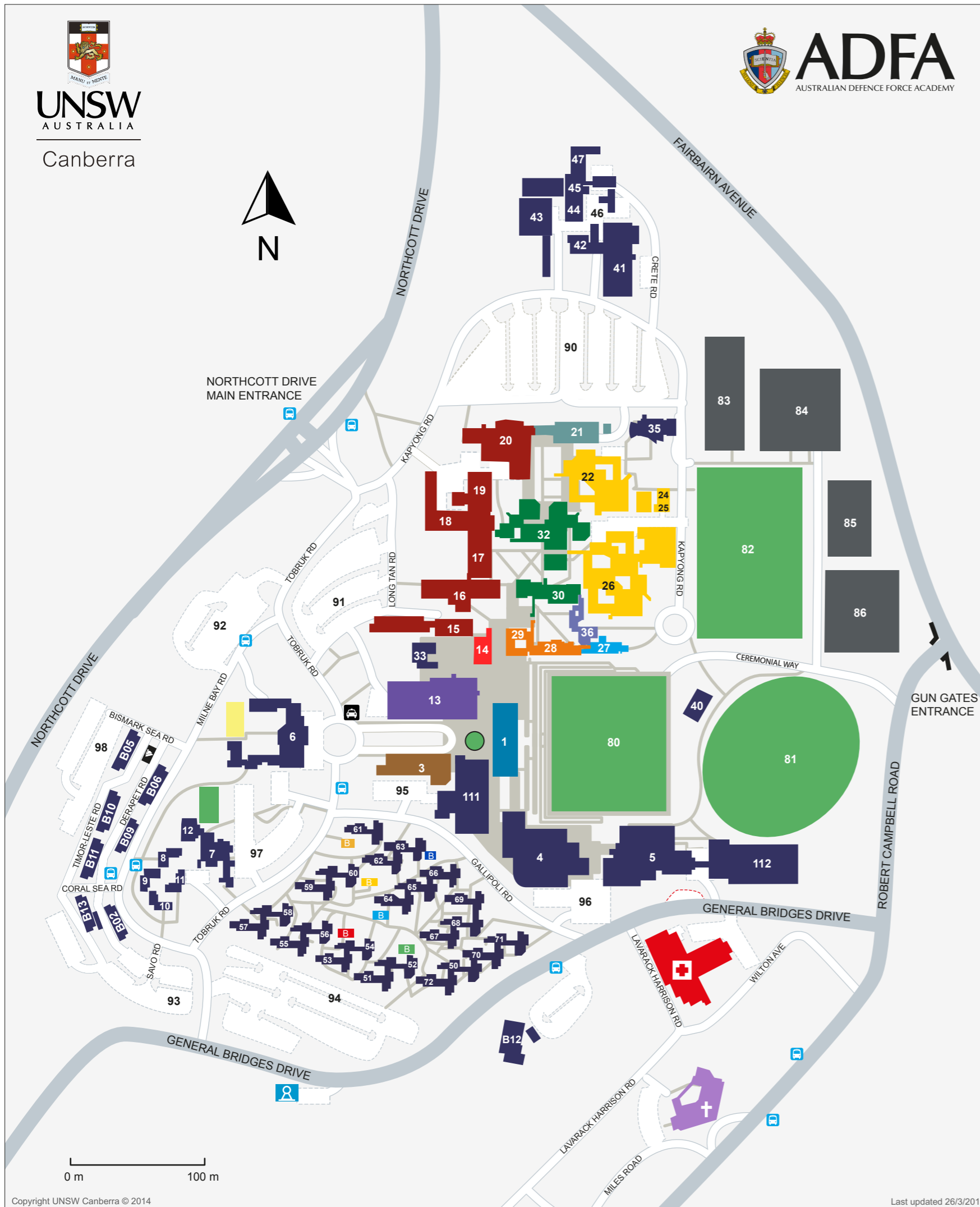
He came to ANU in 1992 on a one year stint in supercomputing after which he was supposed to continue at ETH. However, after a year his ANU contract was extended by one year and he resigned from ETH to stay at the ANU until now. Except for a short break of 7 years in computer science he has been a member of the MSI where he currently holds a professorial position. He has been awarded a Senior Hans Fischer Fellowship at the IAS of the Technical University of Munich from 2011-2013. He is still a member of the IAS Focus Group in High Performance Computing in computer science. Markus has been attracted to problems which appear to be computationally intractable due to the curse of dimensionality, ill-posedness and dependency in parallel computing.

Location: UNSW-Canberra, R152 Bldg 15 (See attached map)

Date: Monday, 31st August, 2015

**Time: 5:30 pm (Refreshment),
5:50 pm (Guests Seated),
6pm-7pm (Seminar)**

RSVP: By: COB Friday, 28th August, 2015 To: S.EISawah@adfa.edu.au



BUILDING LEGEND

Military Facilities / Academic Buildings

- 1** Administration / Finance / Relationship Management Team (RMT) / HS & Facilities
- 3** Military Building
- 4** Academy Cadets Mess
- 5** Indoor Sports Centre
- 6** Officers Mess
- 7** SNCO Mess
- 12** Junior Ranks Mess
- 13** Academy Library
- 13** Creative Media Unit (CMU)
- 13** Human Resources (Located at the end of the corridor)
- 14** Information Communication Technology Services (ICTS)
- 15-21** School of Engineering & Information Technology (SEIT)
- 21** Research and International Office (RIO) / Equity Office
- 22** School of Physical, Environmental & Mathematical Sciences (PEMS) North
- 24** Physical Plant Equipment
- 25** East Plant Room
- 26** School of Physical, Environmental & Mathematical Sciences (PEMS) South
- 27** School of Business (BUS)
- 28-29** School of Humanities & Social Sciences (HASS)
- 30** Lecture Theatre South
- 32** Lecture Theatre North
- 33** ADFA Café / Banks / Hairdresser / Coop Bookshop
- 35** Capability & Technology Management College (CTMC)
- 36** Learning and Teaching Group (LTG)
- 36** Defence Force Chaplains College (DFCC)
- 40** Grand Stand
- 41** ACT Defence Clothing Store / University Main Store
- 42-44** Australia's Federation Guard (AFG)
- 45-47** Maintenance Contractor / Maintenance Contract Office
- 111** Student Administrative Services (SAS) / Research Student Unit (RSU)
- 111** Adams Auditorium / Bandroom
- 112** Indoor Sports Centre Annex
- B12** Weapons and Training Simulation System (WTSS)

Accommodation

- 7** SNCO Accommodation
- 8-11** AFG Accommodation
- 50-72** Cadet LIA
- B02-B13** SL Officer Accommodation

Outdoor Facilities

- 80** Main Parade Ground
- 81** AFL Oval
- 82** Dowsett Rugby Field
- 83** Tennis Courts
- 84** Hard Stand Upper
- 85** Tennis Courts
- 86** Hard Stand Lower

Carparks

- 90** Carpark
- 91** Carpark
- 92** Officers Mess Carpark
- 93** Carpark
- 94** Cadet Carpark
- 95** Military Carpark
- 96** Indoor Sport Centre Carpark
- 97** Carpark
- 98** Carpark

Key

- Pedestrian Area
- Minor Road
- Major Road
- Carpark / Service Roads
- Emergency Vehicle Parking
- Bus Stop
- Taxi Rank
- General Bridges Grave
- ANZAC Memorial Chapel of St Paul
- Duntroon Health Centre
- Bike Shelters
- Beach Volleyball Court
- SL Accommodation Concierge

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