High bandwidth applications development using the CeNTIE networks

Presented by: Craig Russell and Jim Argyros
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is supported by the Australian Government through the Advanced Networks Program (ANP) of the Department of Communications, Information Technology and the Arts

What is CeNTIE?

www.ict.csiro.au

- CeNTIE (The Centre for Networking Technologies for the Information Economy) is one of three advanced network projects funded by the Australian Government's Advanced Networks Program (ANP)
- the CSIRO ICT Centre is the lead organisation in CeNTIE, hosting the project and providing matching funding

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What is CeNTIE?

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- the aims of CeNTIE are to:
  - stimulate a partnership with industry, universities and the research community to carry out R&D in the full range of communications services and applications, particularly internet technologies,
  - showcase Australian technologies, applications and services and
  - provide the foundations to build a national, sustainable, high performance research and engineering network

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What is CeNTIE?

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- CeNTIE has established links (via focus groups) between technologists and industry-based representatives in five key areas of the Information Economy
  - eHealth
  - Media
  - Enterprise Systems
  - Regional Australia
  - First Mile Forum (in conjunction with ATUG)

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What is CeNTIE?

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- CeNTIE has built a high performance network as part of a national backbone with which to develop showcase business systems in these areas
- the focus groups act as a link between users and researchers – a process that ensures the network and applications research matches end-user requirements

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The CeNTIE Network(s) - national

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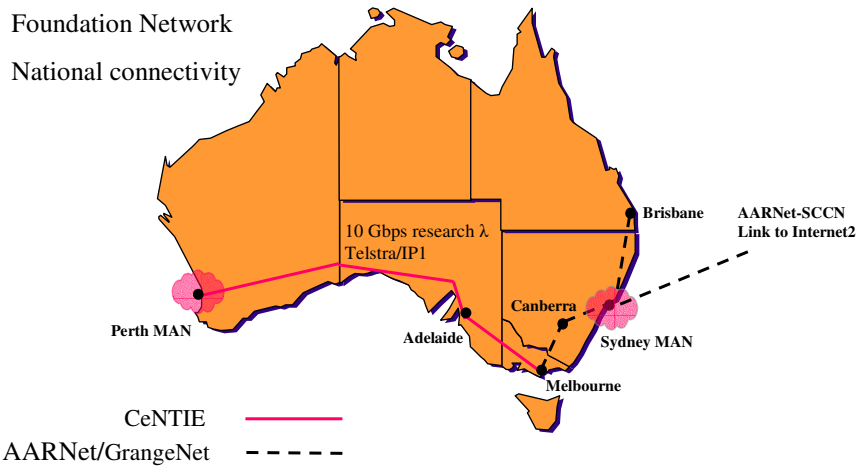

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The CeNTIE Network(s) - Sydney

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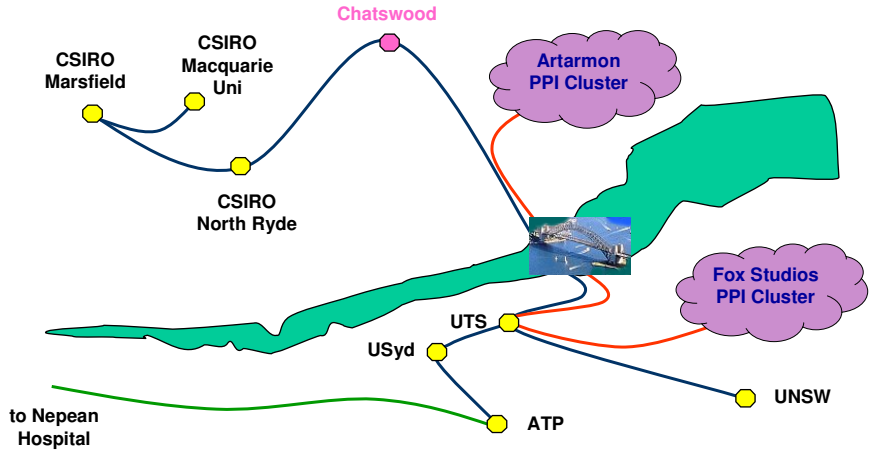

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PPI cluster

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- the PPI (Post Production Industry) cluster is a dedicated high performance network connecting six leading digital media post production companies
  - Omnilab
  - Ambience Entertainment
  - Digital Pictures
  - Atlab
  - Rising Sun Pictures
  - Animal Logic

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Advanced Applications

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- Telepresence
  - virtual tea room
    - staff in a large company collaborating via a virtual office
  - Virtual Critical Care Unit (ViCCU®)
    - medical specialists treating patients in a remote rural hospital
  - expandable to virtual anything that requires human interaction???
- Extranet-on-Demand (EoD)
  - media post production companies doing remote colour grading and sound mixing

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Telepresence

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- What is it?
  - the concept of collaborating synchronously at a distance
  - creating the perception that the person you are communicating with is in the same room as you
- Isn't this just videoconferencing?
  - No!! Much higher quality audio and video required to achieve above goal
    - 25 interleaved video/audio frames per second (approx. 30 Mb/s data stream)
  - enables more complex human interactions

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Virtual Tearoom

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- an application featuring:
  - feature-rich video/audio conferencing
  - distributed PowerPoint
  - generalised file transfer
- currently used between CSIRO ICT Centre offices in Perth, Sydney and Canberra via the CeNTIE network
- soon to be used to Brisbane office also (via CeNTIE and GrangeNet)
- used for demonstration events that require high quality video and audio interaction

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Telepresence - components

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- hardware components
  - DV or analog camera
  - PC with firewire interface or canobus card (analog to DV converter)
  - projectors, screens, microphones, echo cancellers, etc useful for large production but not necessary
- software components fall into three main categories
  - signalling
  - codecs
  - user interface
- network infrastructure capable of at least 30 Mb/s bidirectionally with low latency

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Telepresence - signalling

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- session signalling uses unicast IP for establishment/joining/leaving and multicast IP at all other times
- new endpoint joins session using unicast then is connected with all other participants via multicast
- session content advertised using multicast, user selects which content to accept
- rich content description semantics allow a variety of content types and relationships between them, e.g. related video and audio streams, or an audio stream and related text
- no multipoint control unit (MCU) required
- more lightweight and experimental than standard signalling protocols

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Session Meshing

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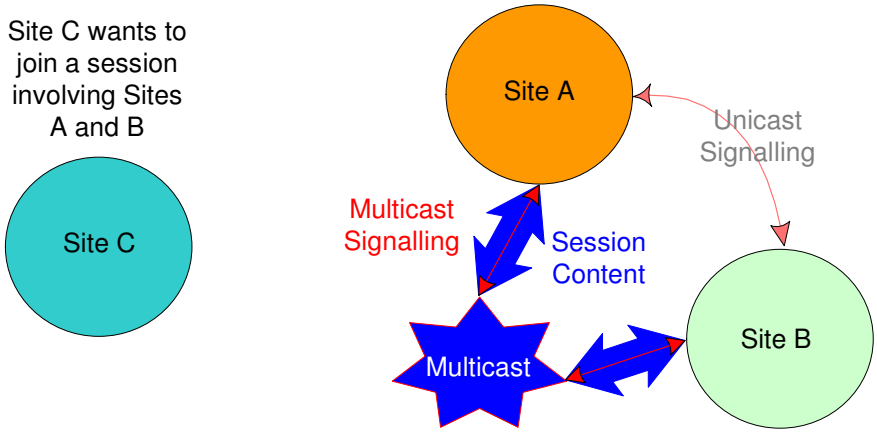
Site C wants to join a session involving Sites A and B



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Session Meshing

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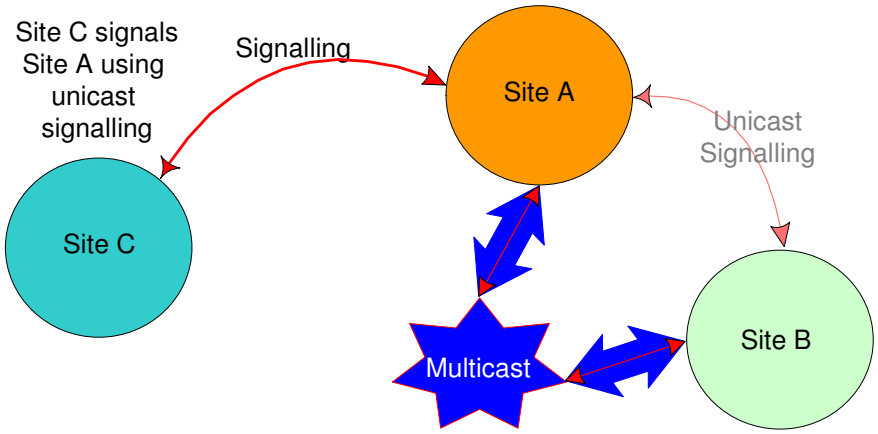

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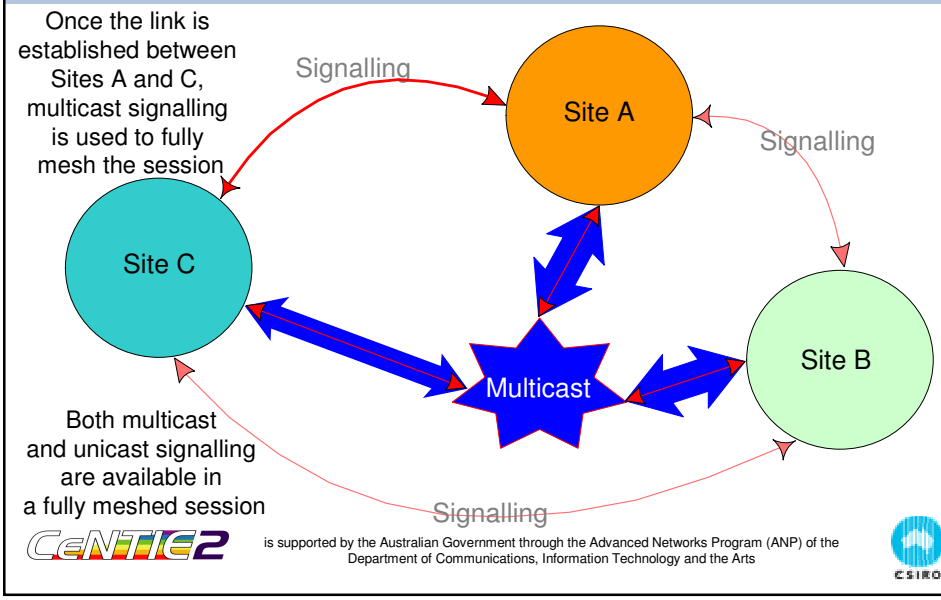

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Telepresence - codecs

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- broad use of the term “codec” to include all types of data
- codecs currently implemented:
  - video/audio – DV (digital video) over IP
  - distributed PowerPoint
  - file transfer
- multicast used to distribute content
- design philosophy: pull, don’t push

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Telepresence - User Interface

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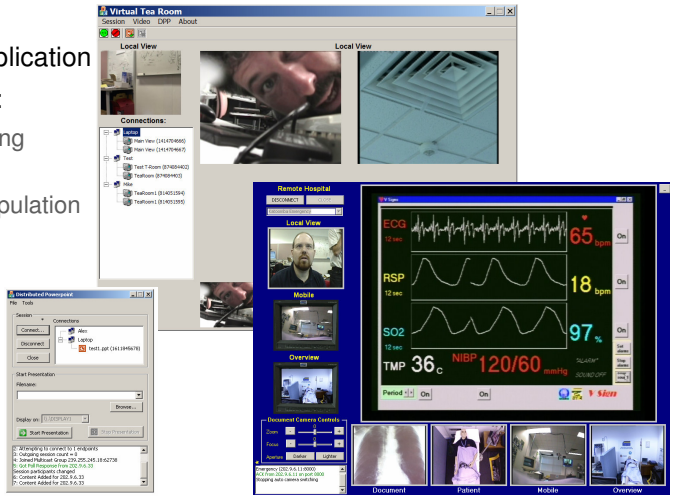
- tailored to each application
- two main functions:
  - access to signalling components
  - display and manipulation of content



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Telepresence - Distributed PowerPoint

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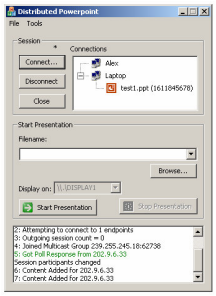
- useful for Virtual Classroom application
- replicate the slide (and associated files) to all participants
- send “PowerPoint's events” from the lecturer to the audience to keep presentations in sync
- is able to work with embedded multimedia and PowerPoint animation scheme
- better quality than the generic solution of using some sort of remote control software, like VNC or PCAnywhere



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Telepresence - software availability

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- the core telepresence software will soon be available under an open source licensing arrangement
- for details contact

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Virtual Critical Care Unit (ViCCU®)

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- telepresence technology has made possible new critical care telehealth applications not achievable at ISDN bandwidths
- these applications are characterised by:
  - complexity
  - time-criticality
  - complex, multimedia information space
  - several members of a team working simultaneously
  - interrupt driven mode of working
  - focus on patient, not technology

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Virtual Critical Care Unit (ViCCU®)

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- in collaboration with Sydney West Area Health Service and NSW Health, CSIRO has developed and installed a "Virtual Critical Care Unit" (ViCCU®)
- this allows a specialist intensivist located at one hospital to supervise a resuscitation team located at a peripheral hospital

- the ViCCU® Project at Sydney West Area Health Service has been funded by a $1.2 million grant from NSW Health with additional support from CSIRO.

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Virtual Critical Care Unit (ViCCU®)

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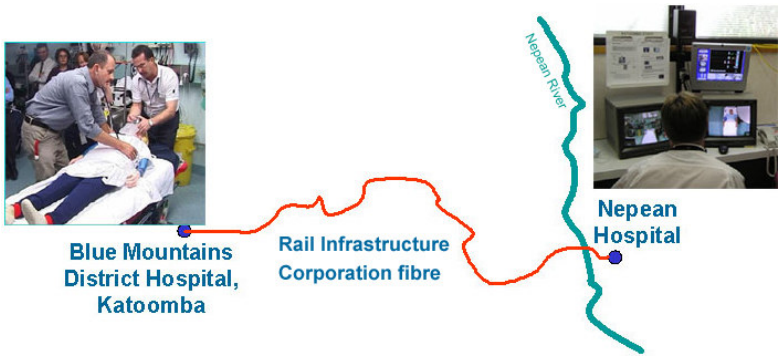

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Virtual Critical Care Unit (ViCCU®)

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- ViCCU® is designed so that all information required by the intensivist to make judgements on patient treatment is available in real time, as if he or she were present at the peripheral hospital
- this is achieved by transmitting several high quality digital video channels, high quality audio, vital signs data, written notes and medical images thereby enabling natural, low-latency "telepresence" interaction
  - full frame rate 30 Mb/s, thumbnails 5 Mb/s
- the system is designed to be robust, fault-tolerant and easy to use in the highly stressful environment of an Emergency Department

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ViCCU® - system components

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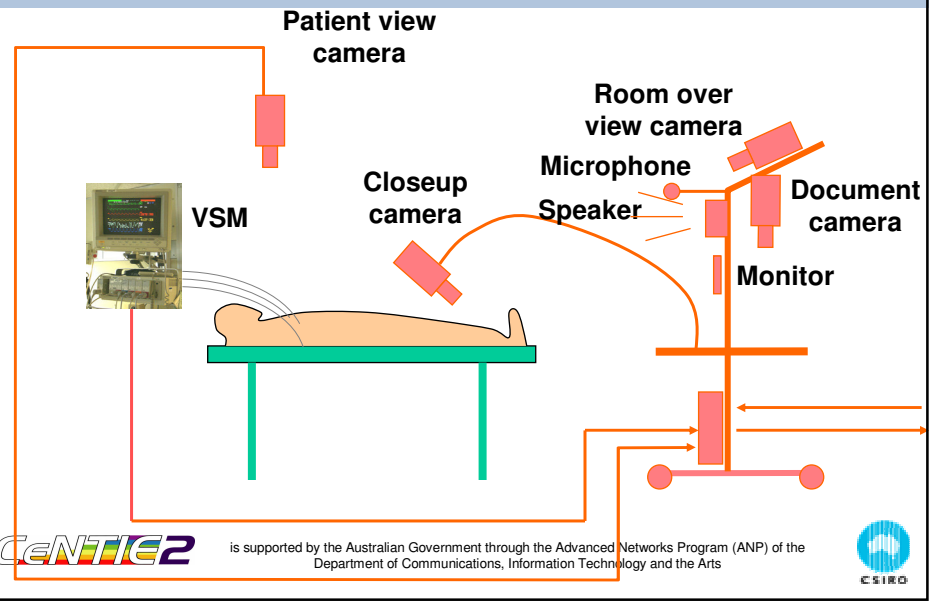

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ViCCU® at Katoomba

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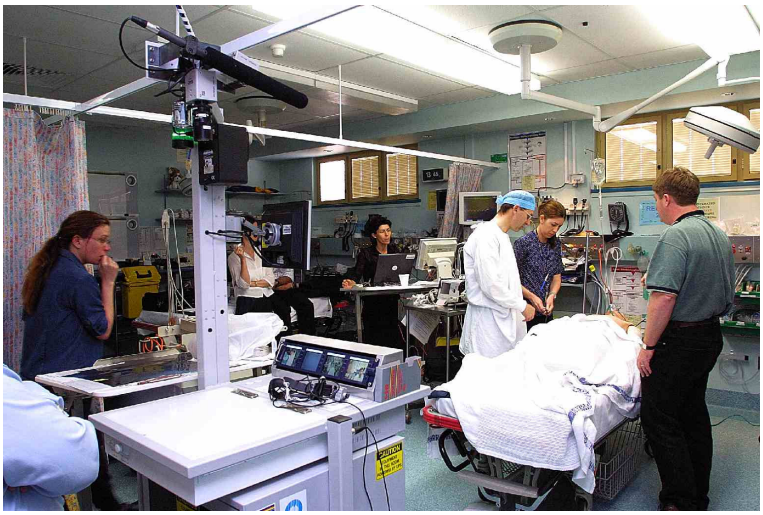

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ViCCU® at Nepean

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Vital Signs Monitor and view selector

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ViCCU® at Nepean

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Room View

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ViCCU® at Nepean

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ViCCU® - successful operation

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- ViCCU® operational at Nepean and Blue Mountains District Hospitals since December 2003
- 283 recorded activations during 2004
- significant reduction in number of patients transferred to Nepean Hospital
- activations are unplanned and system operates without onsite technical support

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ViCCU® - reaction

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- system has performed exceptionally well
- “always on” mode facilitates
  - unforeseen uses
  - easy and quick adoption into procedures
- better outcomes for patients
- reduction in unnecessary transfers and better coordination of transfers
- hospital staff are extremely enthusiastic
  - “There’s no feeling of working with technology!”

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ViCCU® - key success factors

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- high bandwidth enables “telepresence”
- system was designed around the application – we could not change emergency protocols
- careful management of
  - process change
  - staff training
- the real value of the new application is the understanding of the process change
  - “one hospital over two sites”

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ViCCU® - recognition

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- the Virtual Critical Care Unit (ViCCU®) won the iMPLEMENTATION: TELECOMMUNICATIONS category in the 2004 Australian Information Industry Association (AIIA) Awards
- currently under commercial trials with a major telecommunications carrier

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Telepresence – significant events

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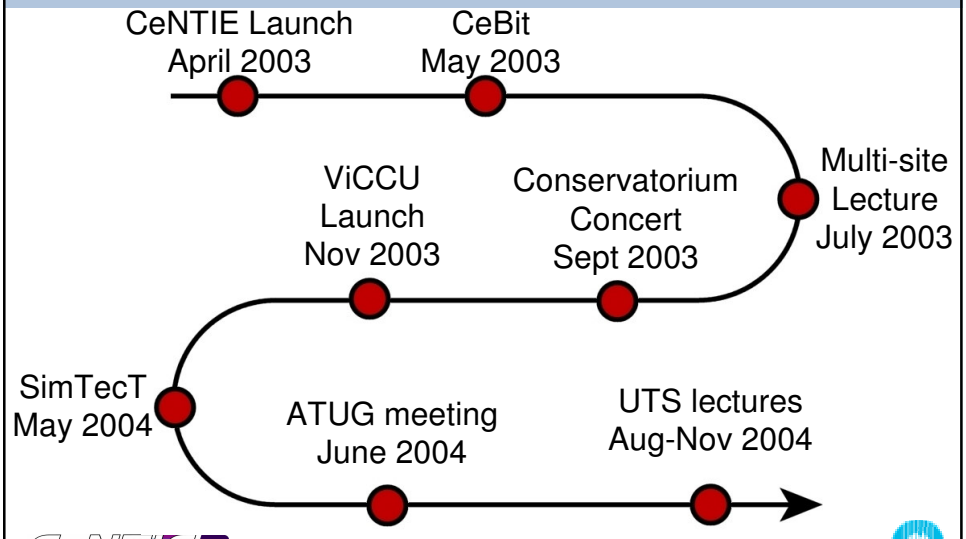

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Music Concert – September 2003

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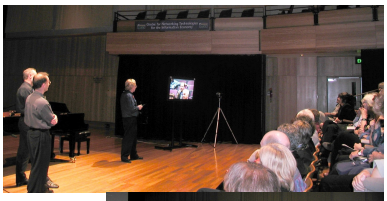
- three sites, Sydney, Perth and Armidale (UNE)
- content included:
  - speeches and discussion
  - music concert



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Music Concert

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SimTecT conference – May 2004

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- three sites, Canberra, UWA surgical training centre and Stanford University
- content included:
  - speeches
  - shared haptovisual environment
  - telementoring demonstration
- lessons:
  - multimodal interactions can be enriched by video/audio
  - global linkups are feasible

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Telepresence - future work

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- develop more virtual “things”
  - virtual media post production
    - first target: remote sound mixing
    - extend to further applications: colour grading, review of daily rushes
  - specialise existing implementations for specific situations
    - e.g. the virtual classroom with instant replay
- investigate MJPEG 2000 video codec
  - looking at scaling beyond just frame rate
- tearoom as a research platform
  - a framework to conduct telepresence research, in particular the role of human factors

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Extranet on Demand (EoD)

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- developed in conjunction with Nortel Networks research laboratory in Wollongong, this is essentially a concept demonstrator for the PPI cluster
- PPI companies compete and collaborate with each other on a project by project basis
- want a (simple) way of creating an extranet for the duration of a project without the need for a third party (network operator)
- this is the problem that the virtual network operator (VNO) concept that Glynn Rogers spoke about yesterday is trying to solve

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EoD

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- the EoD application is essentially a GUI that allows the PPI companies to create dynamic collaborative contexts
- the underlying mechanism of how it does this is “smoke and mirrors” at present
- EoD is currently in use by PPI companies and the feedback is positive i.e. simple to use and solves a business problem

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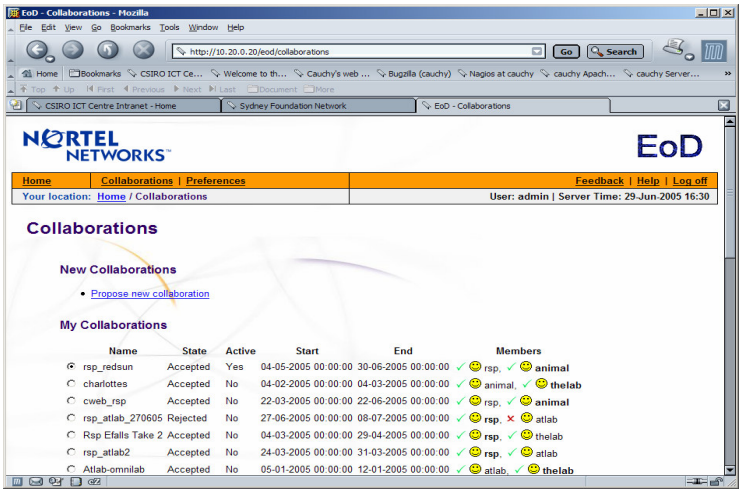
EoD – user interface



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EoD - future

- CeNTIE's networking research group is pursuing a Virtual Private Extranet Services (VPXS) project that aims to support collaborative virtual enterprises by allowing participants to provision and manage their own extranet services, and a number of other initiatives which facilitate the rapid and simple deployment of such services. Refer to presentation given by Glynn Rogers (yesterday)

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