Sustainable Built Environment National Research Centre

Building BIM in Australia: A Retrospective and Prospective Analysis

Professor Keith Hampson

Sustainable Built Environment

National Research Centre, Australia

Co-author:

Professor Robin Drogemuller

Professor of Digital Design, QUT

International Workshop on
Integrated Design & Delivery Solutions (IDDS)

18 April 2012, Washington DC

Presentation Structure

1. Background to Australia's SBEnrc
2. Current BIM/IDDS initiatives
3. Future collaborations and goals

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Australia's Construction Industry

- A$160B = US$160B = €120B pa turnover
- Employs 1 million people
- 250,000 firms  many small firms …
- Growing and slowing at same time …
  - Residential, Commercial, Industrial
  - Resources & Mining, Infrastructure

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- Slower in productivity growth than others
  - nationally and internationally
- Safety remains an issue
- Strong growth in *green* construction
- Declining public support for R&D as private support grows

Sustainable Built Environment National Research Centre

Our Mission

To be an enduring world-class research and knowledge broker in sustainable infrastructure and building design, construction and management

Growth of Collaborative Research through Australia's SBEnrc

QUT/CSIRO Construction Research Alliance

1996

2001

CRC Construction Innovation
BUILDING OUR FUTURE

2009

2010

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2012

2015

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National Research Centre

Program 1 - Greening the Built Environment

Program 2 – People, Processes and Procurement

Program 3 - Productivity through Innovation

- A nation-wide collaborative research centre
- Industry, government and research partners
- Applied research and industry outreach across three integrated themes

Core Members

QUT

John Holland

SWINBURNE UNIVERSITY OF TECHNOLOGY

Queensland Government
Department of Transport and Main Roads

Queensland Government
Department of Public Works

Queensland Government
Infrastructure and Planning

NSW GOVERNMENT
Transport Roads & Maritime Services

GOVERNMENT OF WESTERN AUSTRALIA

Department of Treasury and Finance
Building Management Works
Office of Strategic Projects
Main Roads Western Australia
Department of Commerce

PB PARSONS BRINCKERHOFF
100 YEARS

Curtin University

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Collaborating Partners

Collaborating Partners

International Council
for Research and Innovation
in Building and Construction

Home | About Us | Research | Partners | Publications | Media | Links | Contact Us

Research Program 1: Greening the Built Environment

Research Program 1 will deliver improved environmental performance by the built environment through enhanced ecological efficiencies, including carbon emission reductions and climate change adaptation…

Read more...

Projects

- Design and Performance Assessment of Commercial Green Buildings
- The Future of Roads: The Role of Road Building in Reducing Environmental Pressures and Both Mitigating and Adapting to Climate Change
- Harnessing the Potential of Biophilic Urbanism in Australian Cities
- Sustainable Infrastructure Procurement

Research Program 2: Developing Innovation and Safety Cultures

Research Program 2 will deliver improved social outcomes for built environment workers and the Australian community through increased uptake of sustainable practices and minimising…

Read more...

Projects

- Safety Impacts of Alcohol and Other Drugs in Construction
- Offsite Fabrication and Links to Product and Process Innovation
- Leveraging R&D for the Australian Built Environment

Research Program 3: Driving Productivity Through Procurement

Research Program 3 will deliver economic, environmental and social benefits to the built environment industry through reductions in risks and costs and improved productivity…

Read more...

Projects

- Collaborative Object Libraries Supporting the Facility Lifecycle
- Supporting Infrastructure Management by Combining Sensors and Asset Information Models

Prior Research Program: CRC for Construction Innovation

CRC Construction Innovation
BUILDING OUR FUTURE

Our Research

Publications and information on research undertaken by the CRC for Construction Innovation is available at: www.construction-innovation.info

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National Research Centre

www.sbenrc.com.au

SBEnrc = Public-Private Partnership in R&D

- Build innovative networks of industry, government and researchers to deliver applied outcomes
- Attract and mobilize resources globally
- Research skills training for industry

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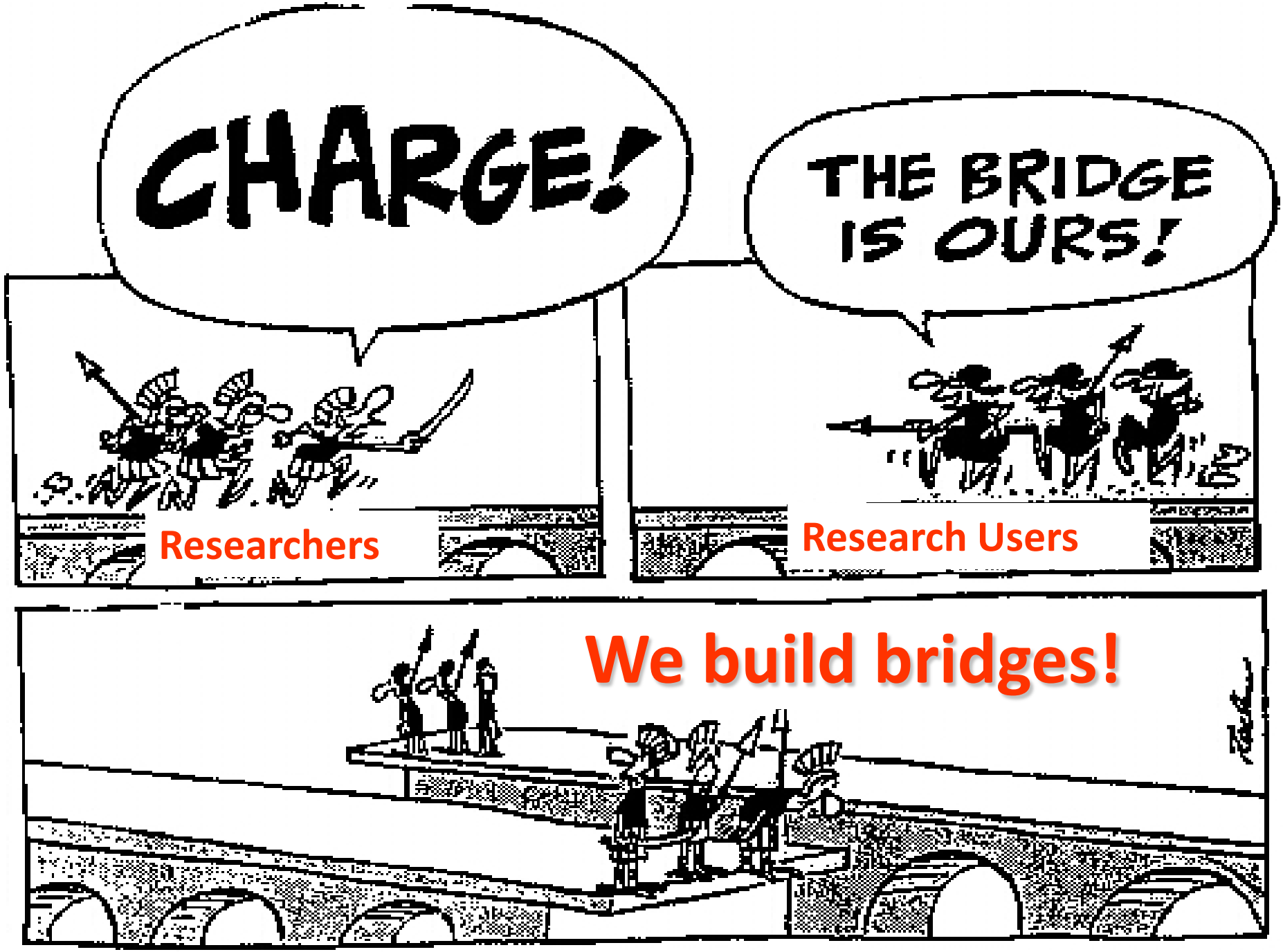
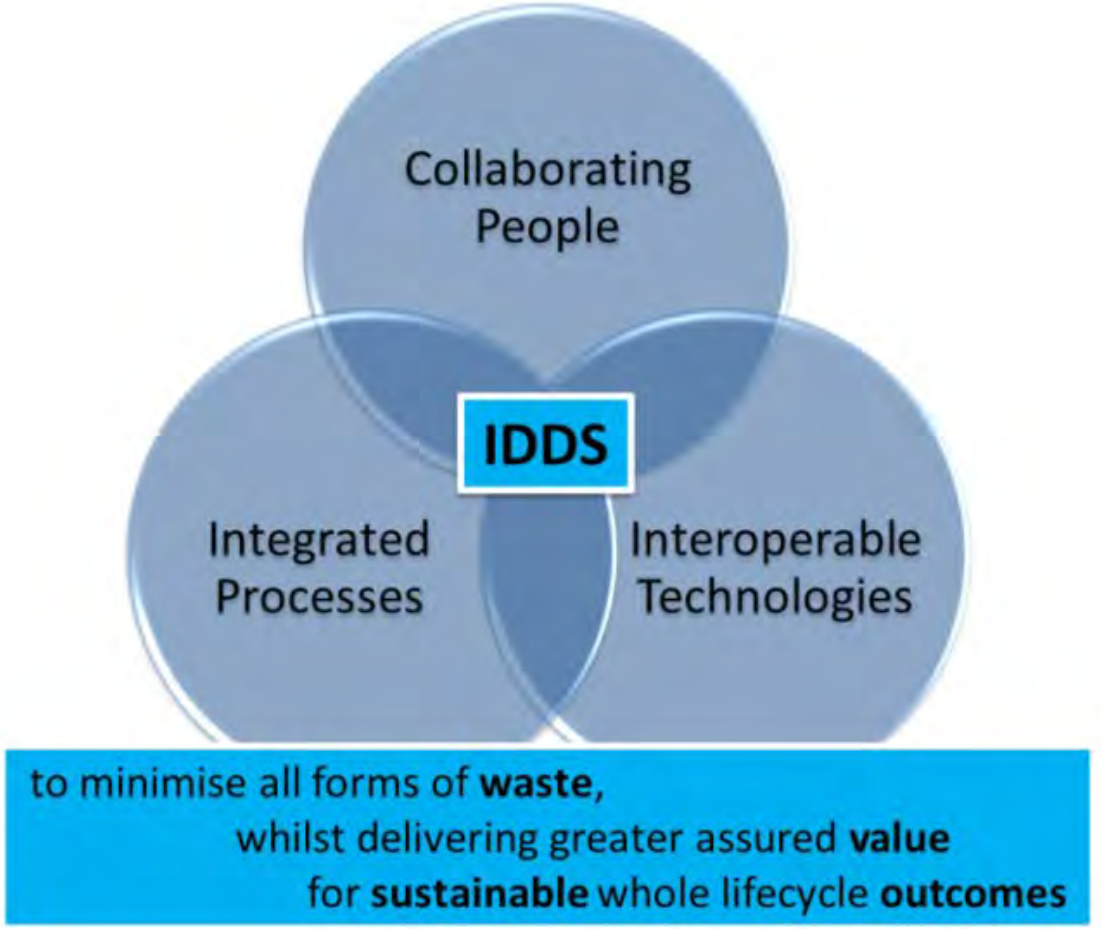

CHARGE!
THE BRIDGE IS OURS!
Researchers
Research Users
We build bridges!

International Council
for Research and Innovation
in Building and Construction

The Three IDDS Imperatives



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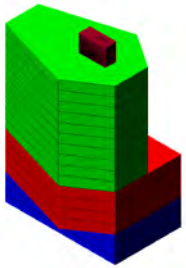
Australian CRC for Construction Innovation

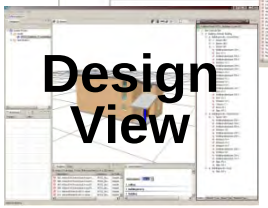
(2001-2009)

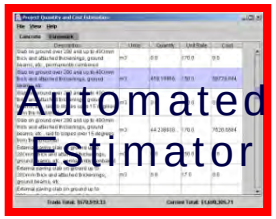
IDDS Projects Timeline

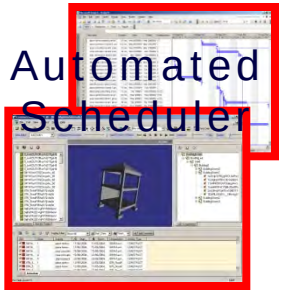
Early Design | **Detailed Design** | **Pre-construction** | **Construction** | **Facilities Management**



Parametrics For Massing Studies

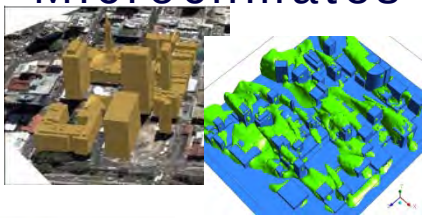


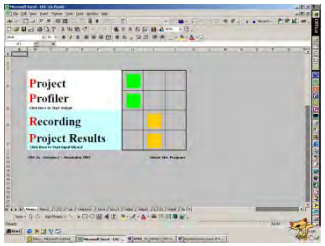




Integrated FM

Microclimates





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CRC Construction Innovation
BUILDING OUR FUTURE

IDDS models help us improve

- Environmental, Social and Economic Aspects of
  - *Where we build*
    - Landform modelling under various conditions
  - *What we build*
    - Options, Scenarios
  - *How we build*
    - Visualisation, Fabrication, Coordination, Scheduling, Costing

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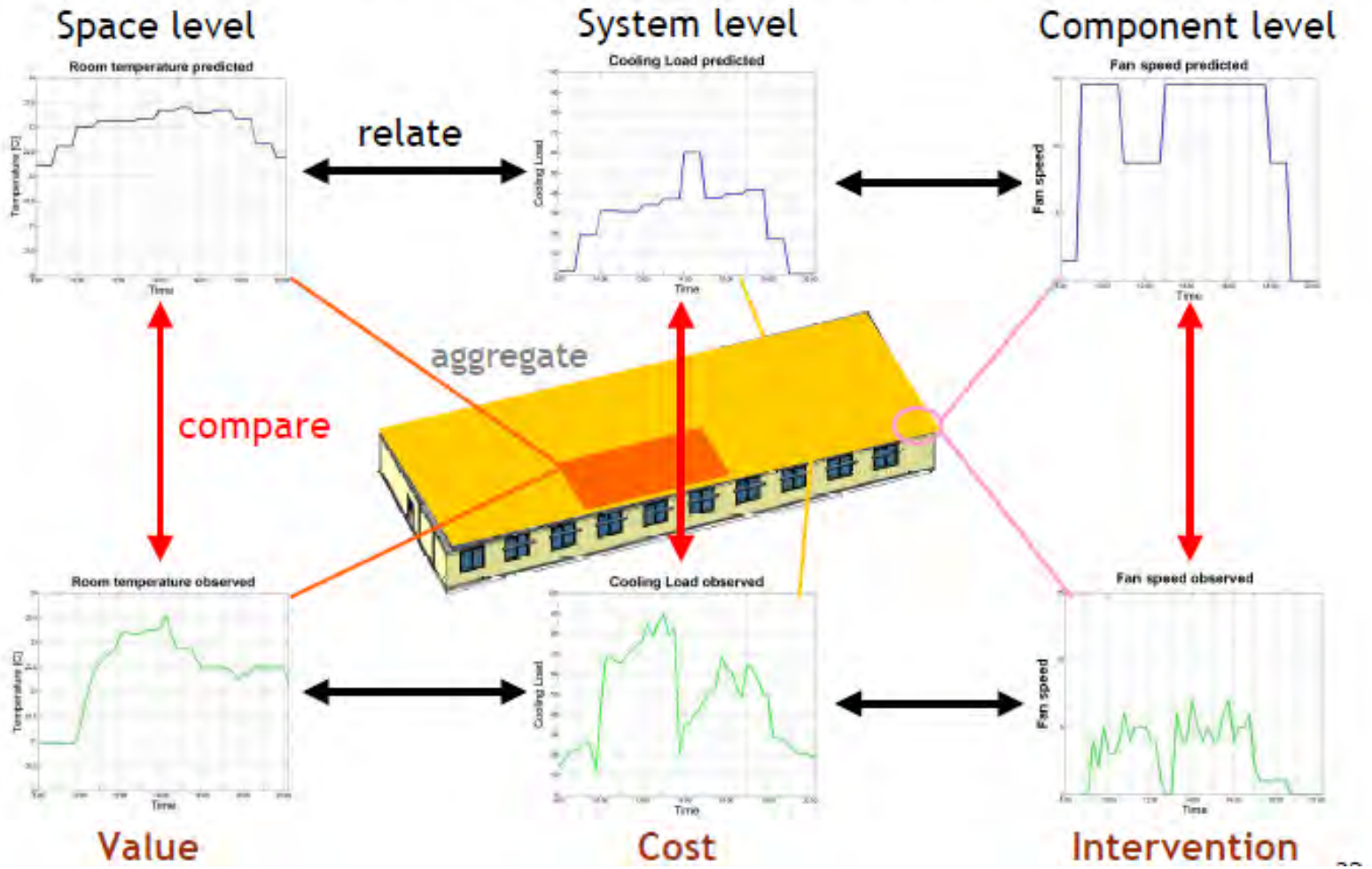
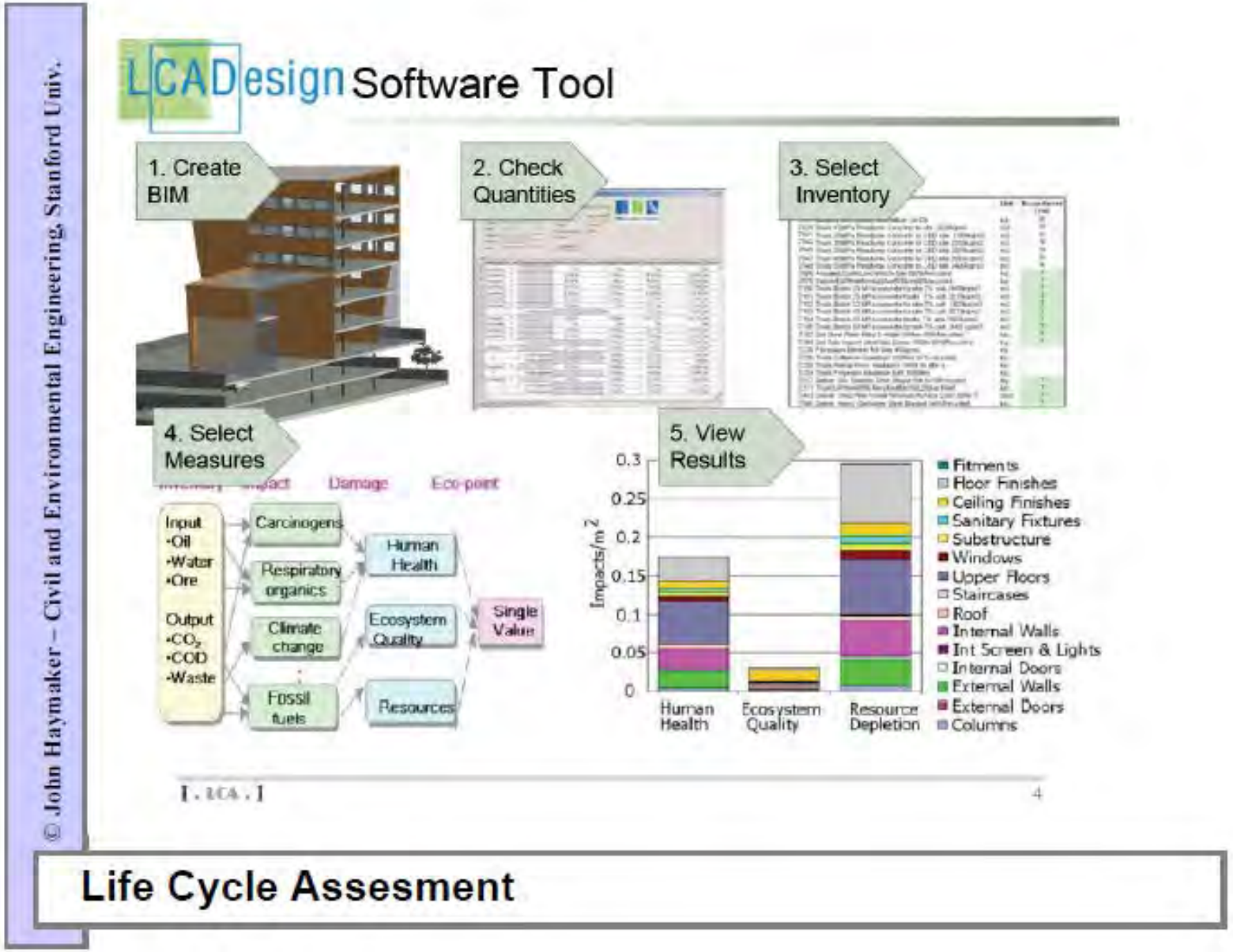
Relate and Compare Performance Data



Source: Martin Fischer, Stanford University



Life Cycle Assesment

Source: Martin Fischer, Stanford University


“An Exemplar Project”

NIST GCR 04-867

NIST
U.S. Department of Commerce
Technology Administration
National Institute of Standards and Technology

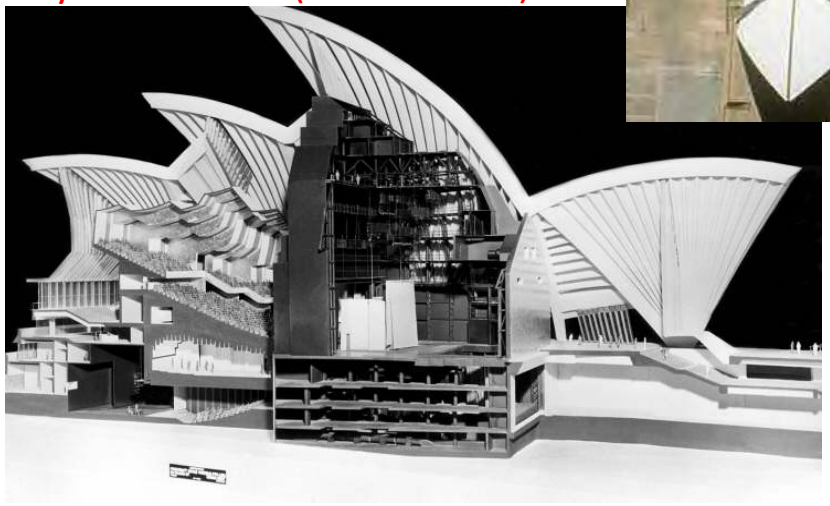
Advanced Technology Program
Information Technology and Electronics Office
Gaithersburg, Maryland 20899

Cost Analysis of Inadequate Interoperability in the U.S. Capital Facilities Industry

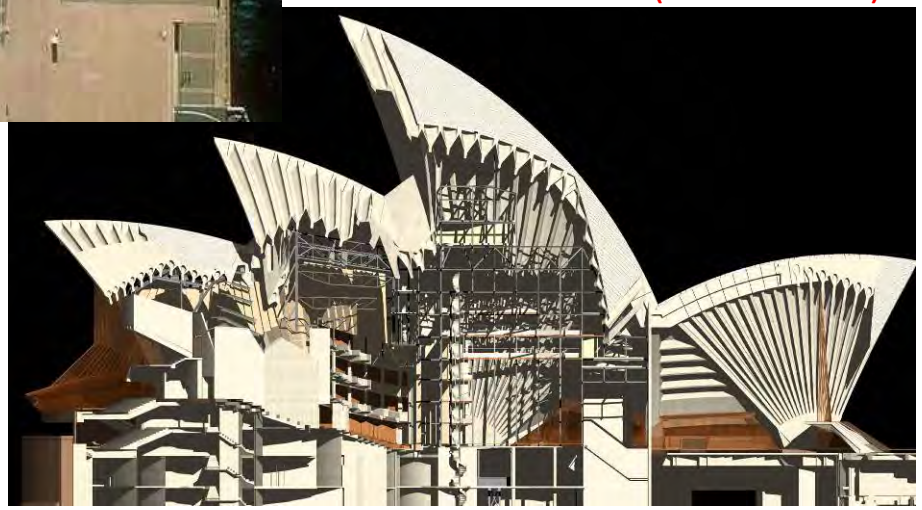
Michael P. Gallaher, Alan C. O'Connor, John L. Dettbarn, Jr., and Linda T. Gilday

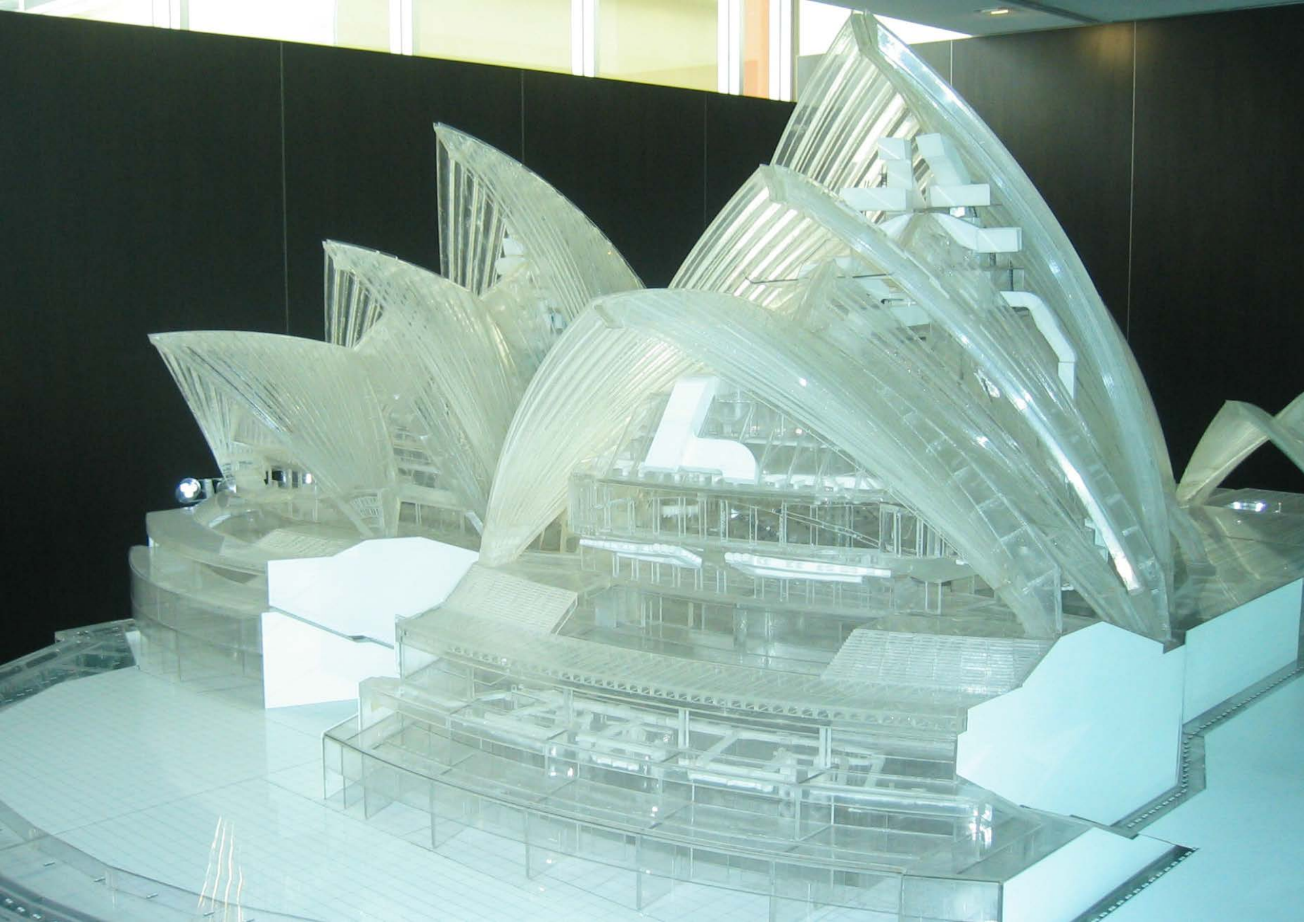
Modelling the Opera House
1952 to 2008

Physical models (1952 – 1972)



BIM models (2003 - 2008)





1:48 Scale Physical Model made in 1972

All in the one building

- Commenced 1958
- Opened 1973
- Cost $100M
- Value $2bn
- 1,000+ rooms
- 7 performance spaces
- 60 dressing rooms
- 5 restaurants & bars

- 1,500 performances
- 1,000 other events
- 1,100,000 patrons
- 4,500,000 visitors
- $85M business
- $21M FM budget

all in year …

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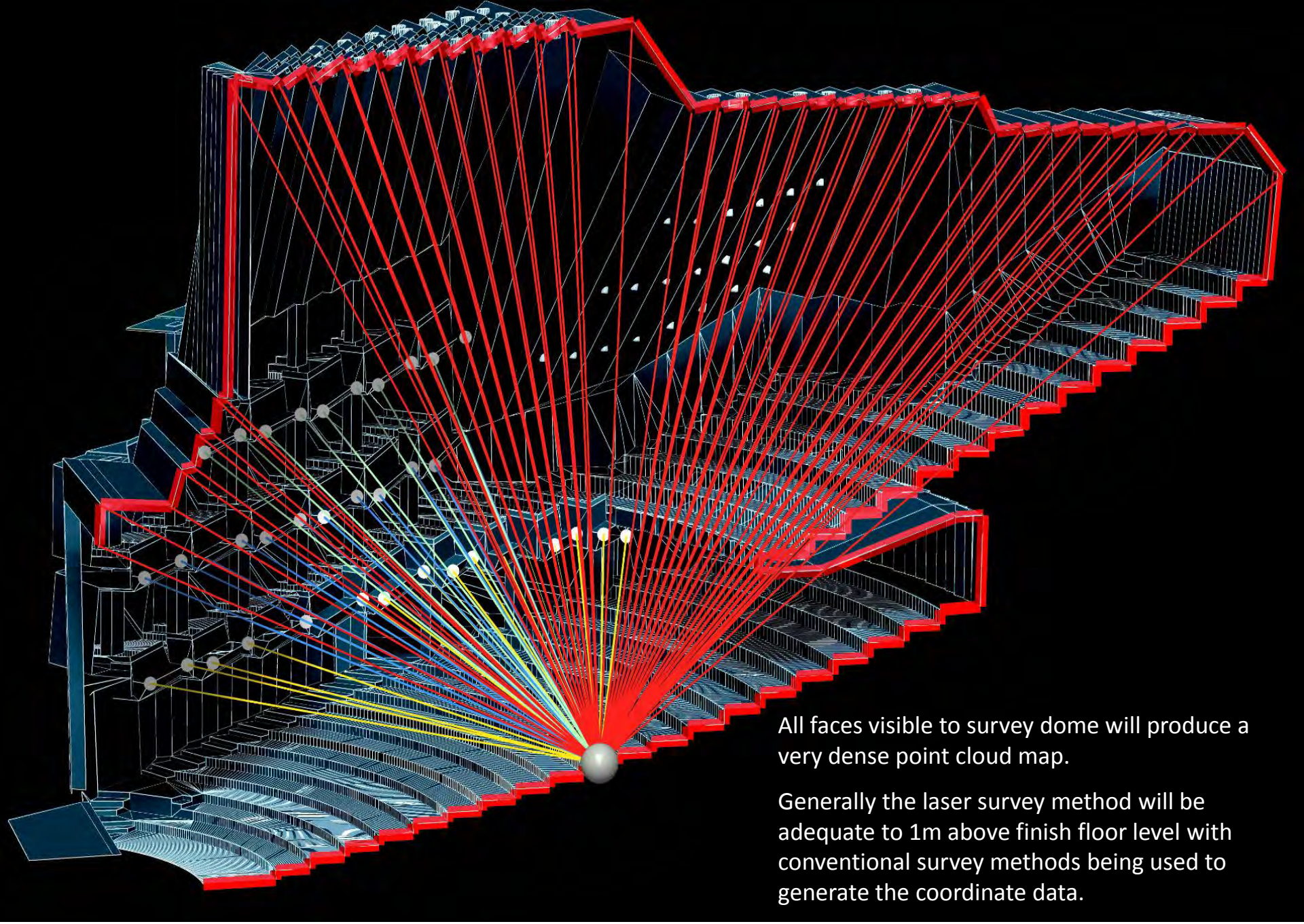
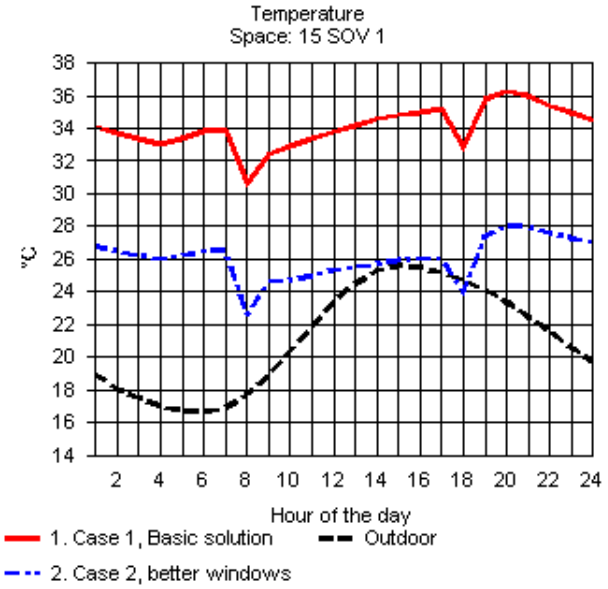
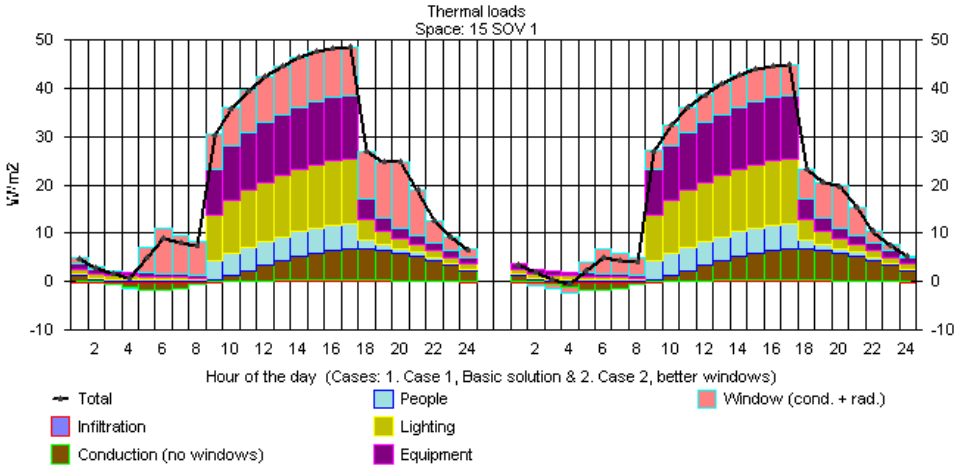


3D surface laser scanning method

Comfort and Energy Simulation





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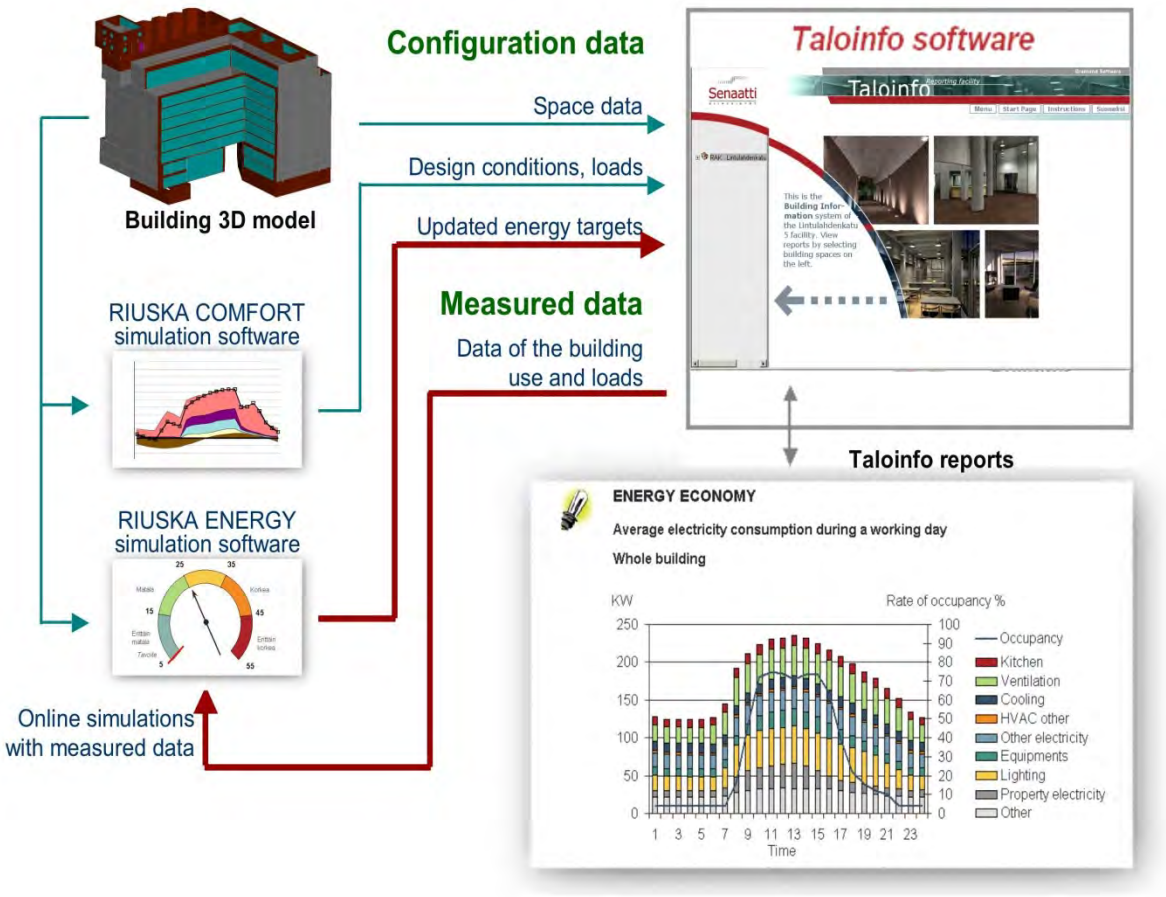
FM Energy Monitoring



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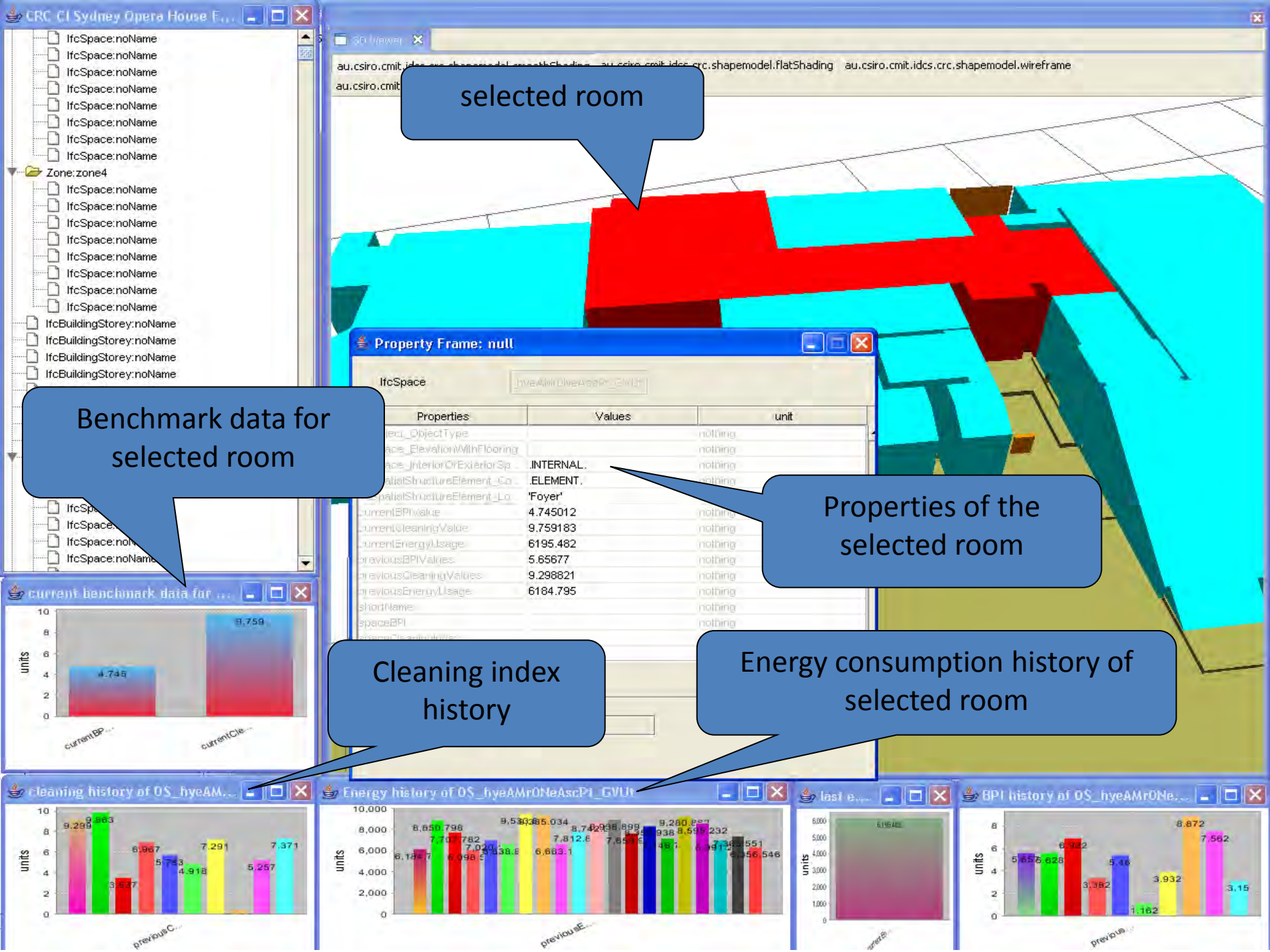
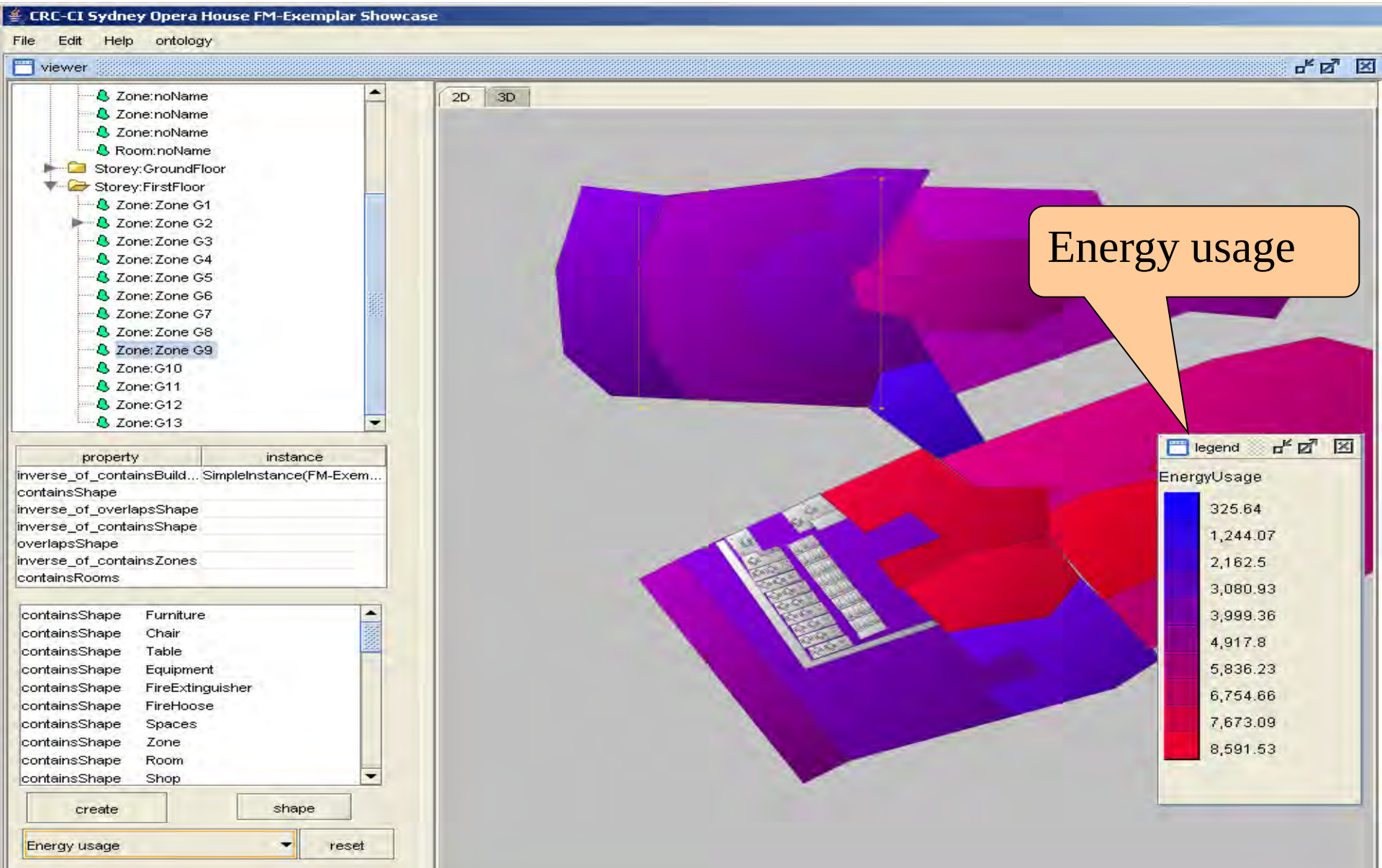
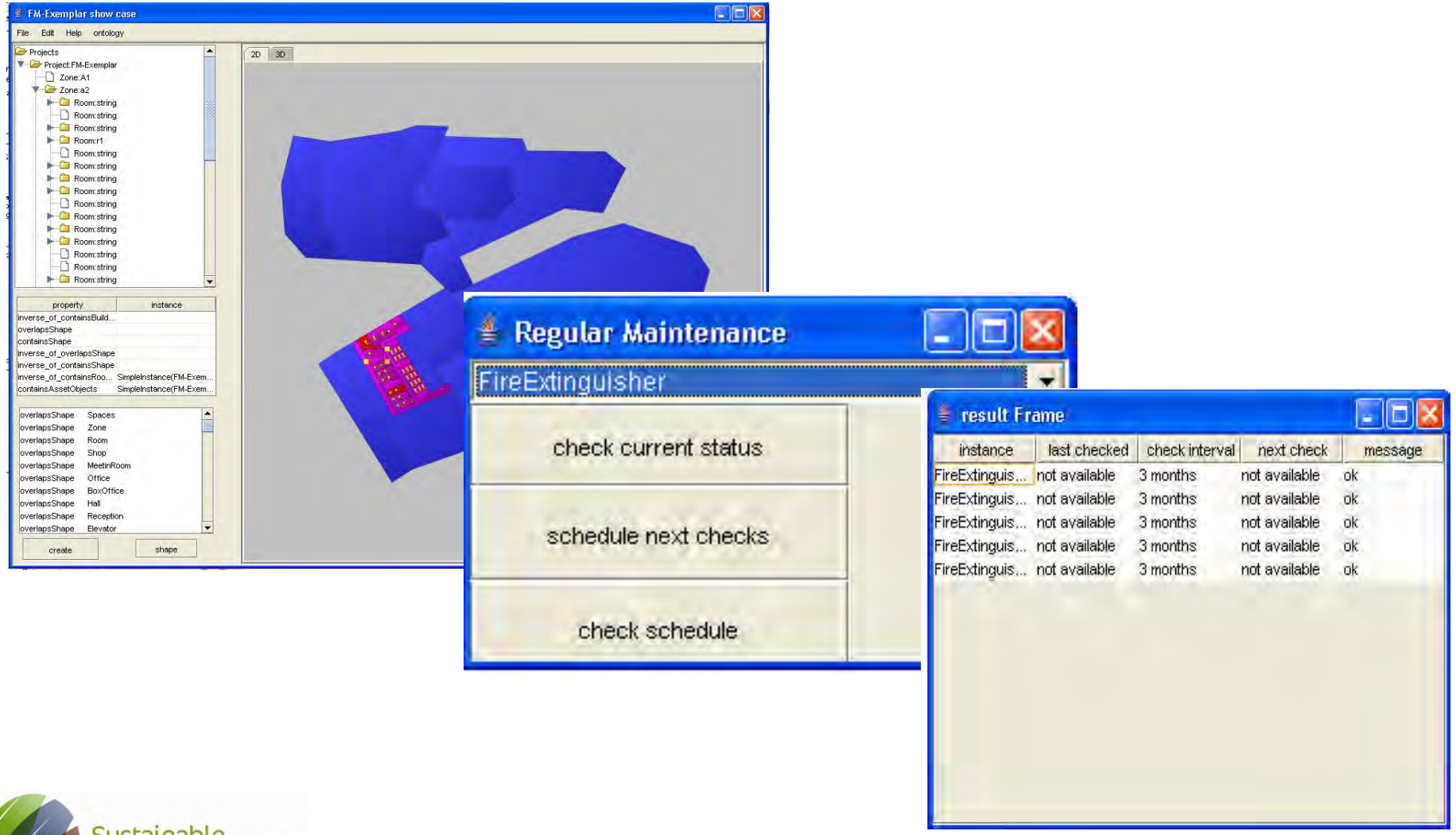
Finnish Building Services system Ryhti


CRC CI Sydney Opera House F...
IfcSpace:noName
Zone:zone4
IfcBuildingStorey:noName
3D Viewer
au.csiro.cmit.idcs.crc.shapemodel.flatShading
au.csiro.cmit.idcs.crc.shapemodel.wireframe
selected room
Property Frame: null
IfcSpace
Properties
Values
unit
.INTERNAL.
.ELEMENT.
'Foyer'
4.745012
9.759183
6195.482
5.65677
9.298821
6184.795
Benchmark data for selected room
Properties of the selected room
current benchmark data for ...
9.759
4.745
units
Cleaning index history
Energy consumption history of selected room
cleaning history of OS_hyeAM...
Energy history of OS_hyeAMr0NeAscPi_GVUt
last e...
BPI history of OS_hyeAMr0Ne...

Integrated information: Energy usage



Integrated information: Fire safety



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Industry dissemination

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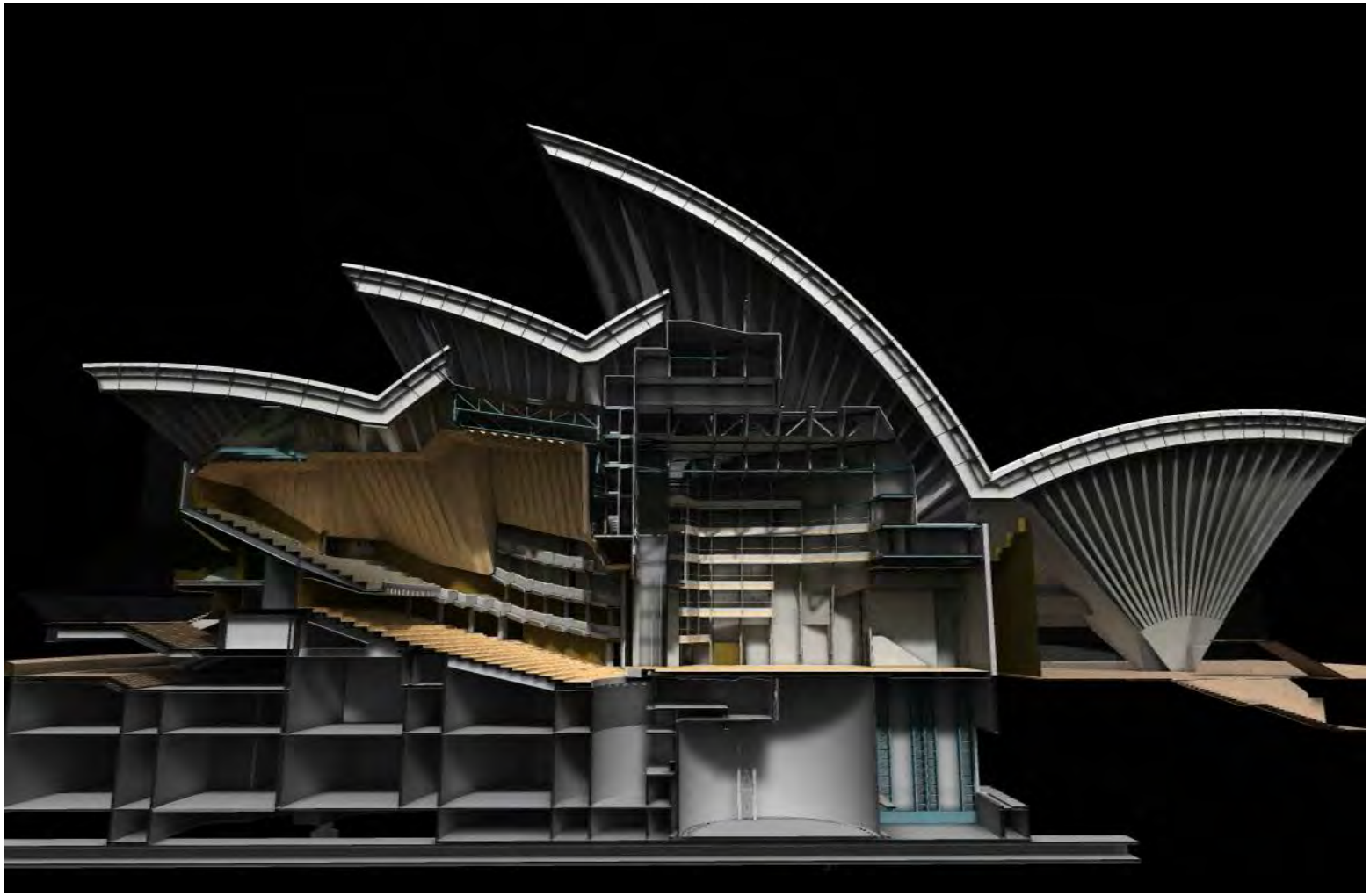
Numerous Awards



Created by Arup / JPW Architects

Stuart Bull - Wayne Dickerson

Animation by Wayne Dickerson Associate JPW

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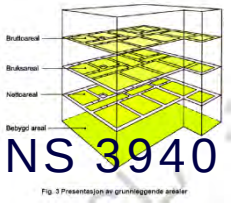
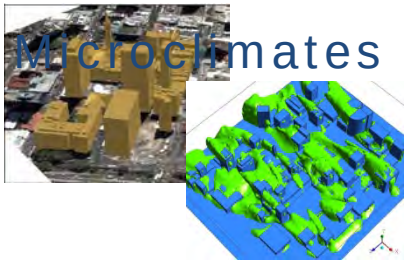
National and international industry awards:
Consult Australia … Project of the Year
American Institute of Architects - Technology in Practic

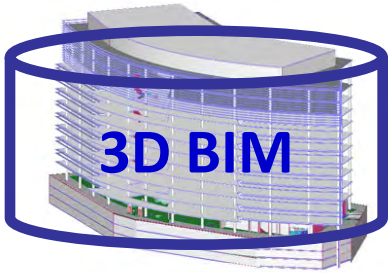
Previous CRC for Construction Innovation Work

LCADesign

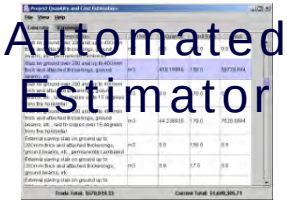


Microclimates



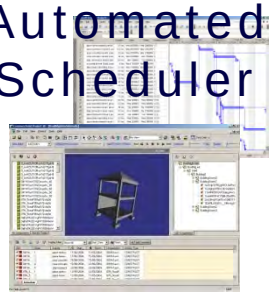


Automated Estimator

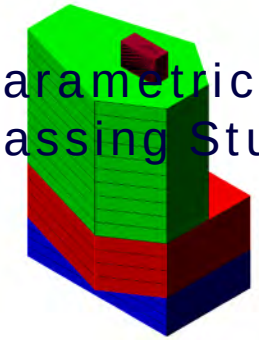


Design Check

Automated Scheduler



Parametrics for Massing Studies



Integrated FM

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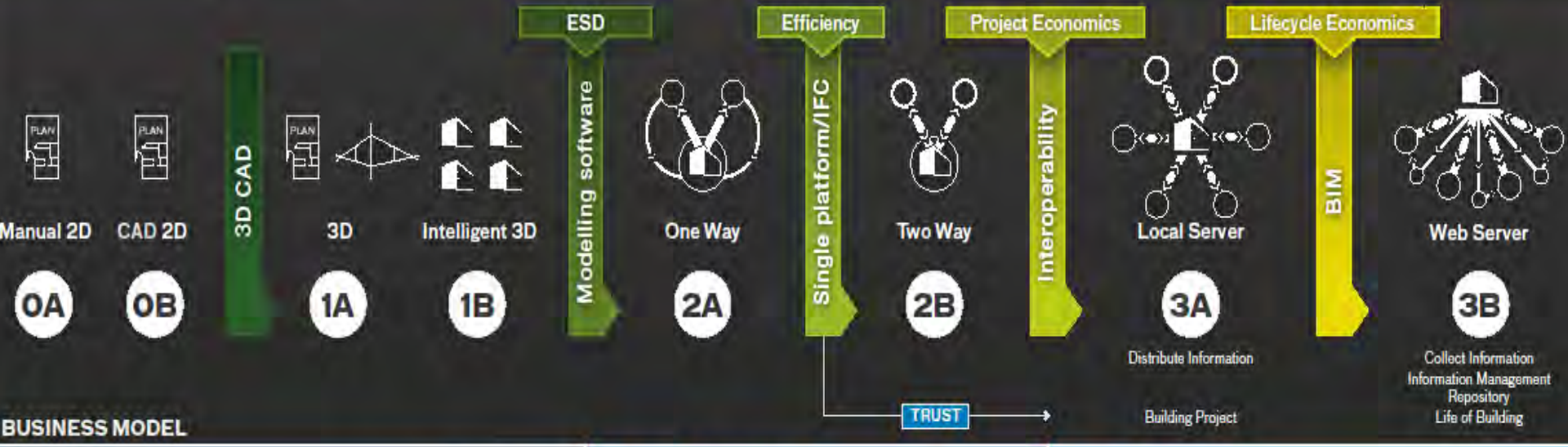
Looking ahead …

TOWARDS INTEGRATION

Taking the Australian construction industry forward

TOWARDS INTEGRATION

WHERE WE WERE	WHERE WE ARE	NEXT STEP	WHERE WE ARE GOING
0 – 2D Manual and CAD based (2D or 3D)	**1 – MODELLING** Single-disciplinary use of object-based 3D modelling software within one discipline	**2 – COLLABORATION** Sharing of object-based models between two or more disciplines	**3 – INTEGRATION** Integration of several multi-disciplinary models using model servers of other network-based technologies
Representation		Prototype	Full Information Capture



ISOLATED	COLLABORATIVE	INTEGRATED

Legend

Communication type

traditional

digital

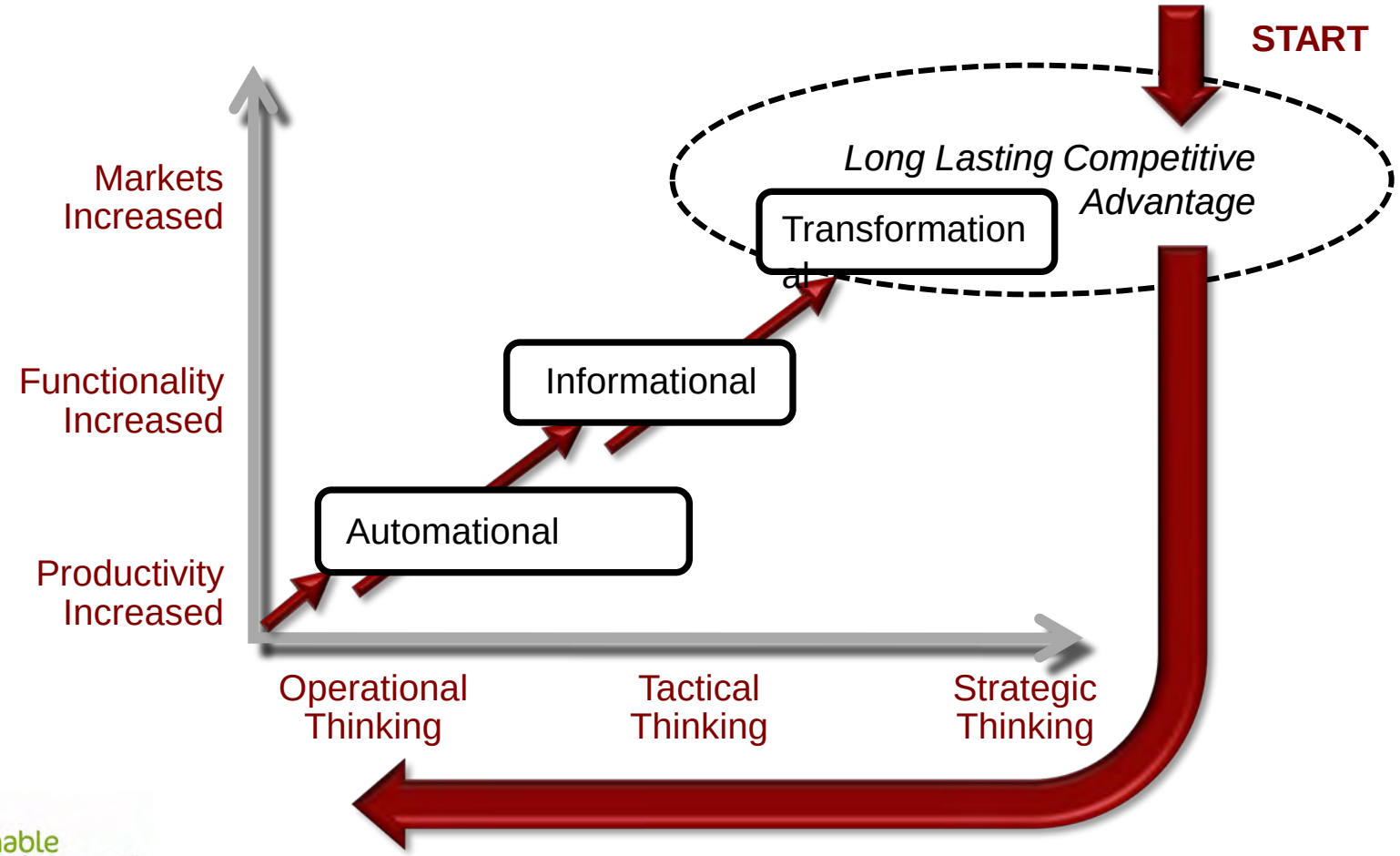
UPTAKE

Australian Institute of Architects

CRC Construction Innovation

Cultural transformation

Business Effects of ICT Innovation



Need enablers to move forward!

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Object Libraries

Open source digital modelling object library

- In Australia approximately 20,000 “design” firms creating their own product libraries
  - Poor efficiency
  - No interoperability
  - No consideration of downstream use
- Product manufacturers need to support multiple tools
  - Want single point of distribution

Provide national consistency across industry
Provide SMEs with a vehicle to adopt and benefit

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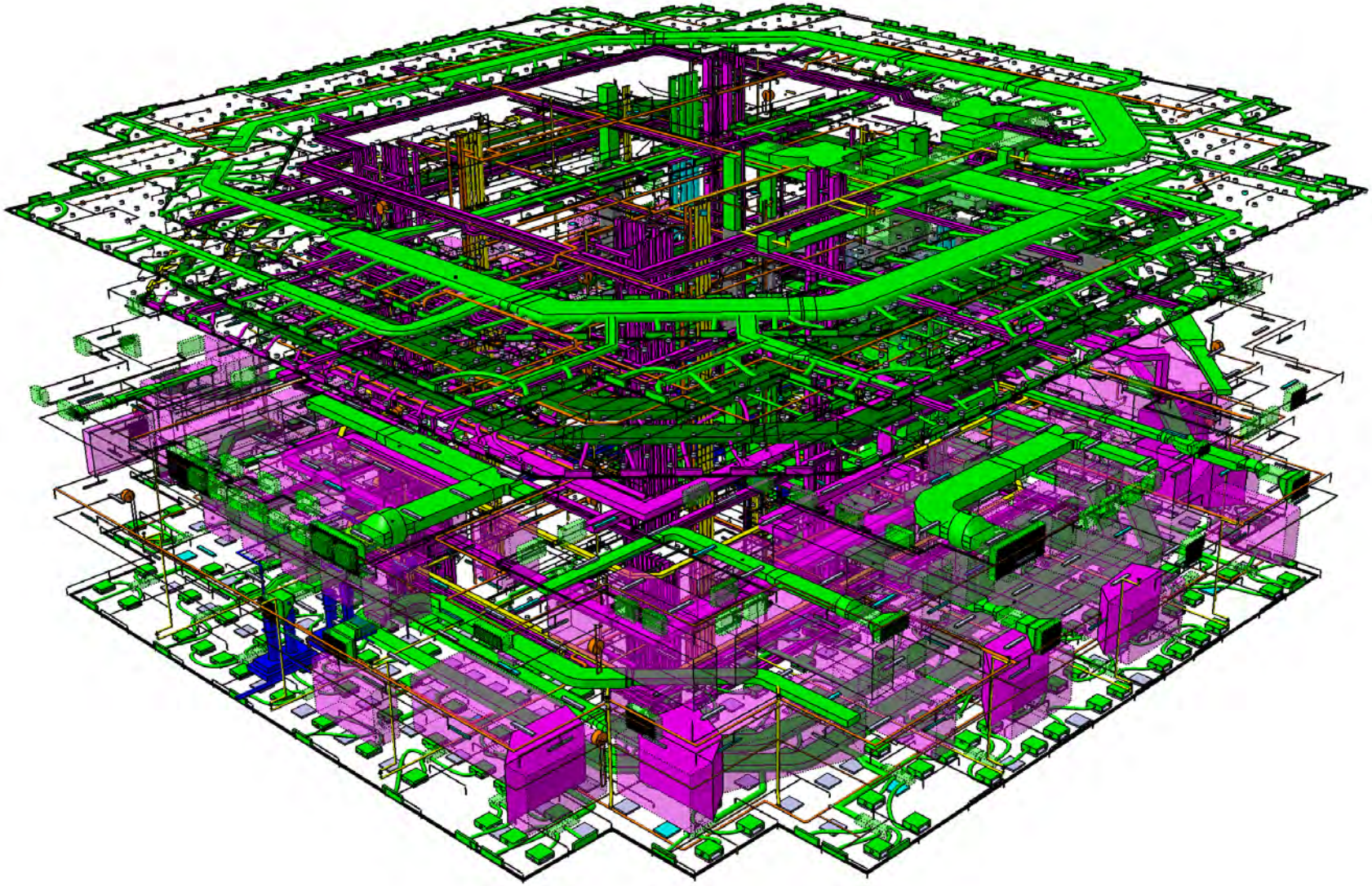
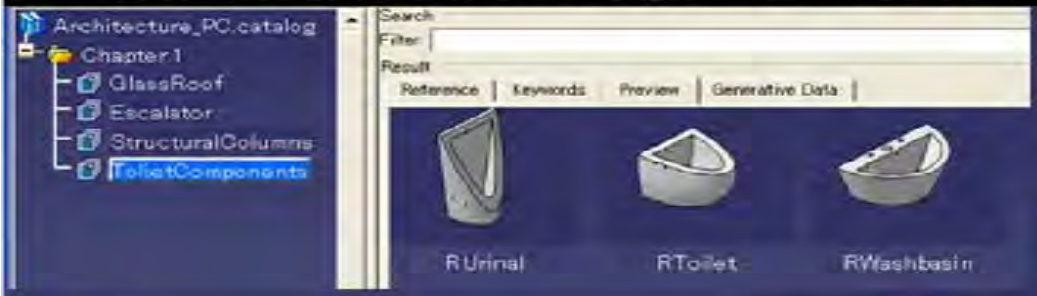
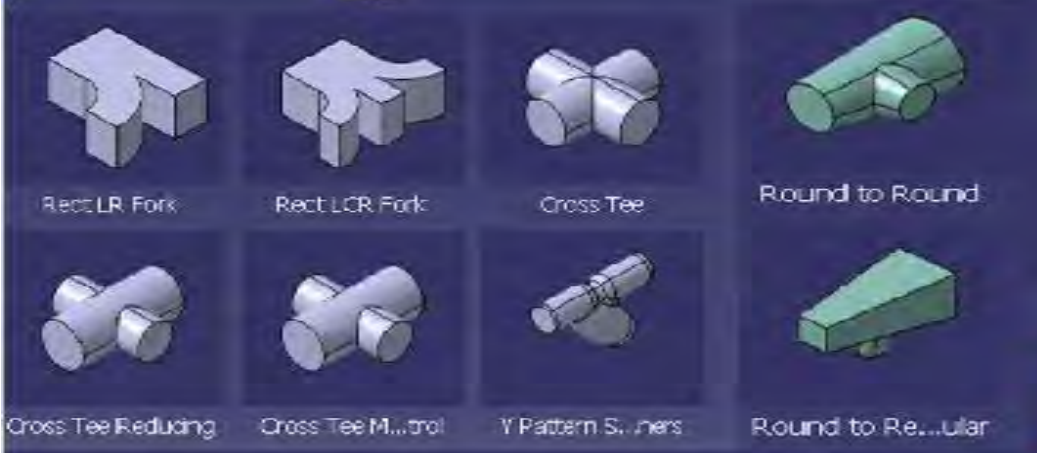
Project Product Library



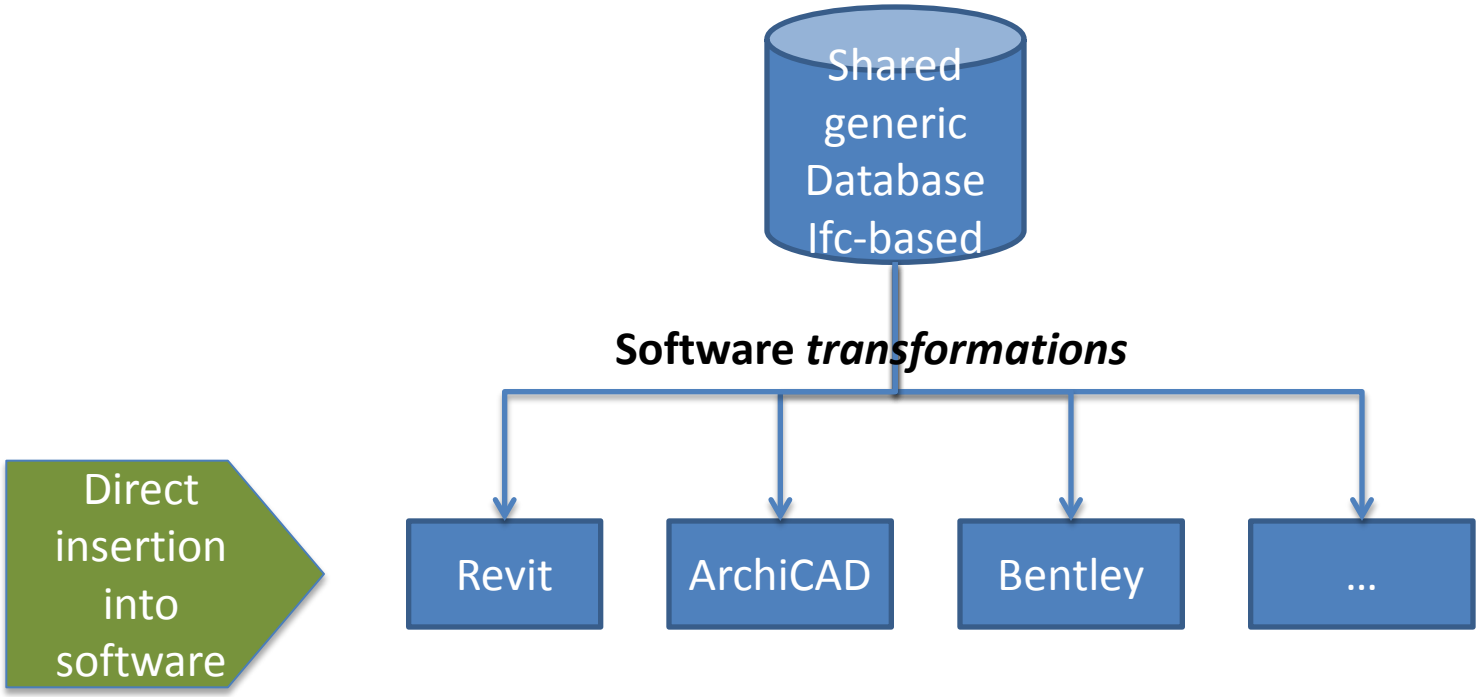
Reusable Kit of Parts of Intelligent Parametric Generative Elements Containing PROJECT KNOW





Object Libraries

- Our approach



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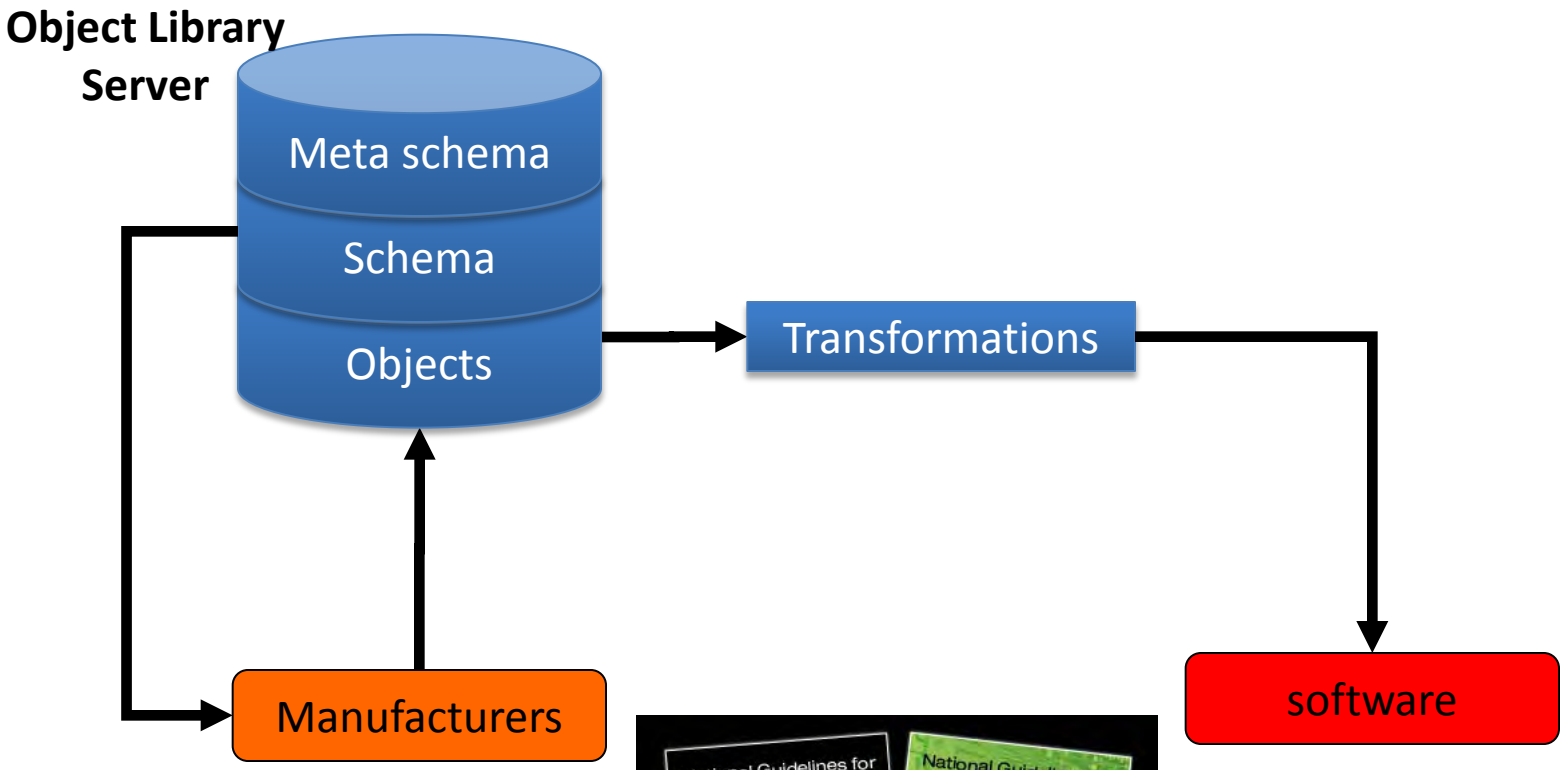
Object Libraries



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Managing a Portfolio of Buildings

- Queensland Government Assets
  - 1,300 schools, 70 TAFE campuses
  - 200 owned office buildings
    - 1 million m^2 office space
  - 65,000 units of social housing
  - 14 Correctional Centres
  - 170 Hospitals & Healthcare centres
  - 340 police stations
  - Major cultural buildings

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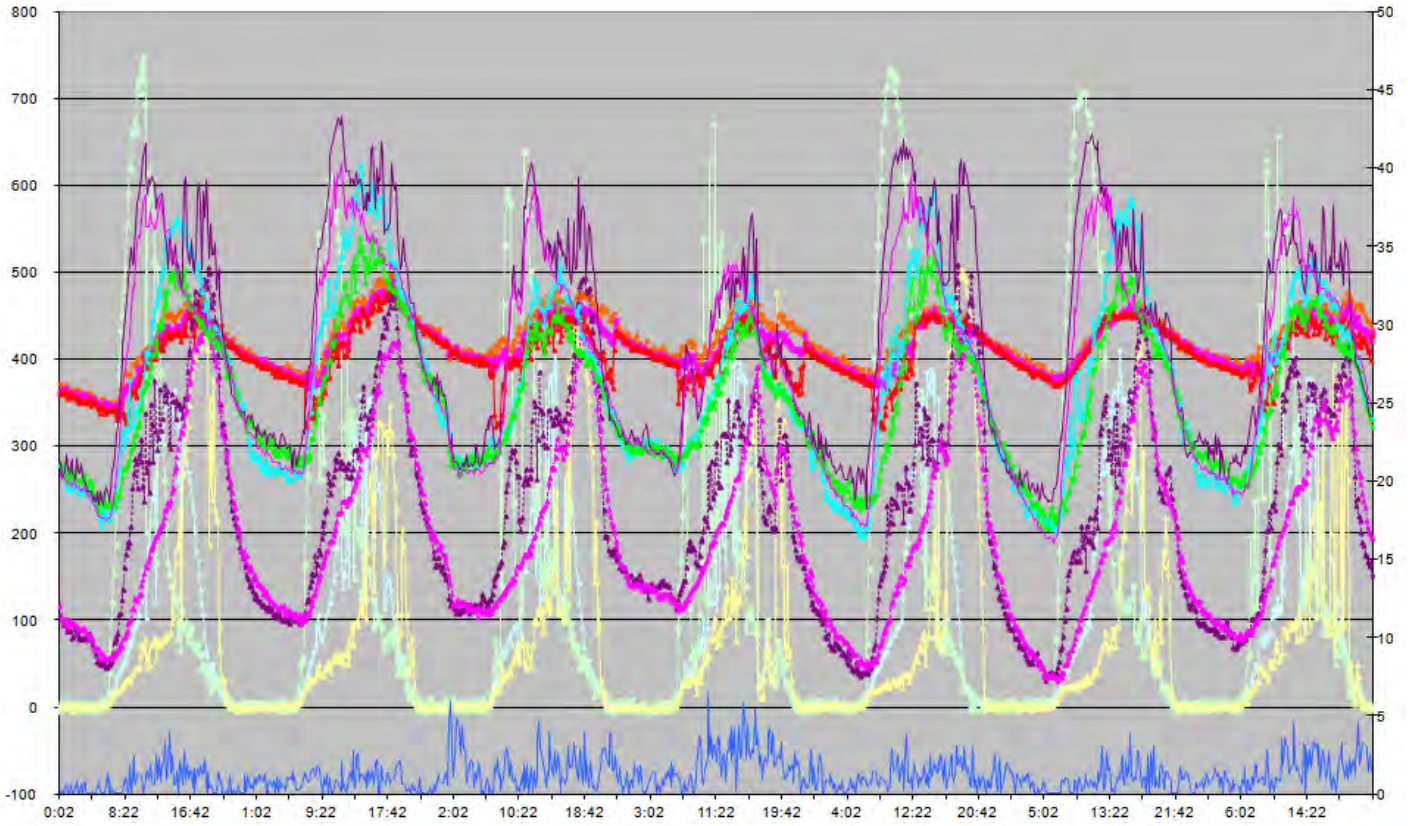
Managing a Portfolio of Buildings

- How do we manage all of these?
- Build an asset register
  - Support strategic planning
  - Characterize by building type
  - Data collection through annual surveys
  - High level modelling of portfolio

Sensors for Infrastructure

- What is the problem?



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Sensors for Infrastructure

- What is the problem?

Image courtesy of Queensland Project Services

Photos courtesy of
The New York Times

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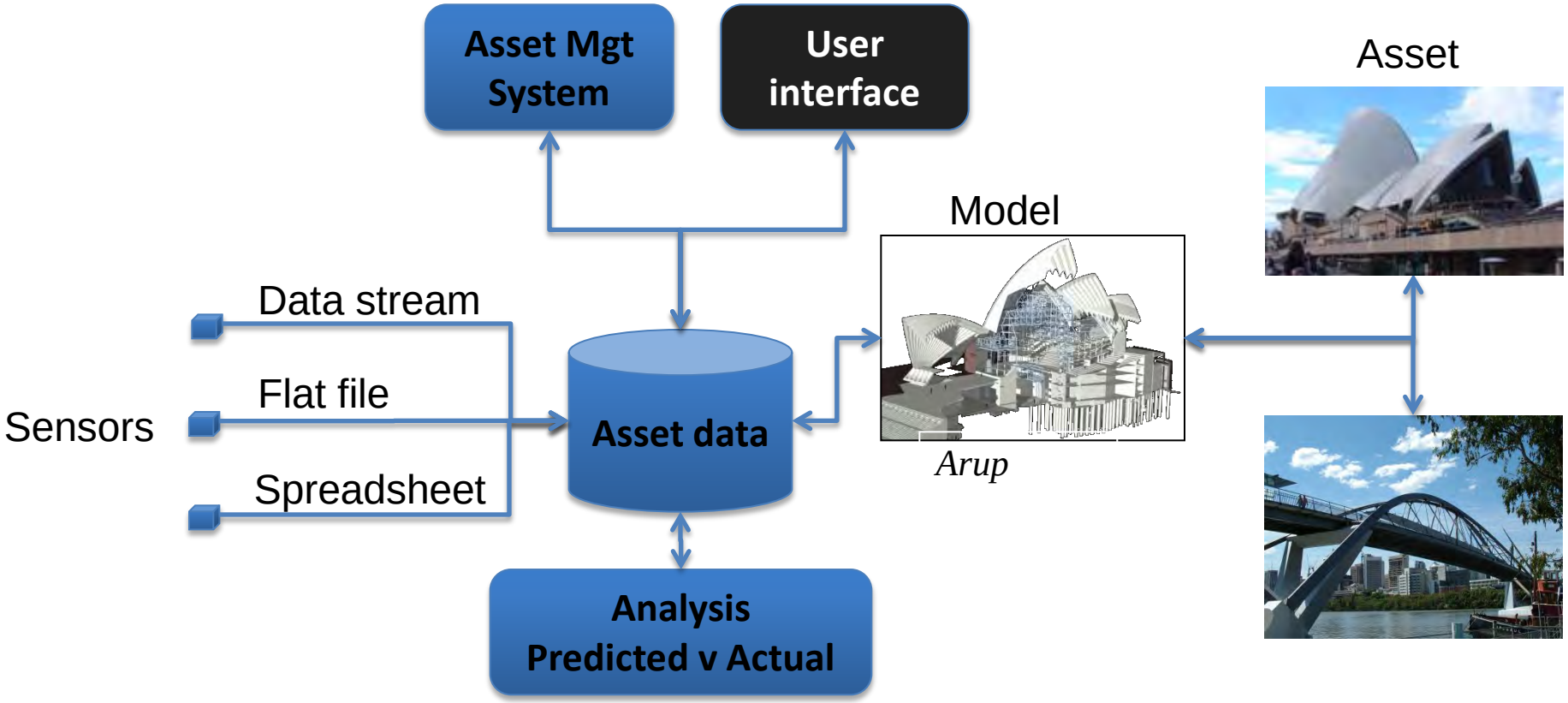
Goodwill Bridge, Brisbane

Sensors for Infrastructure

- What IT structure do we need?



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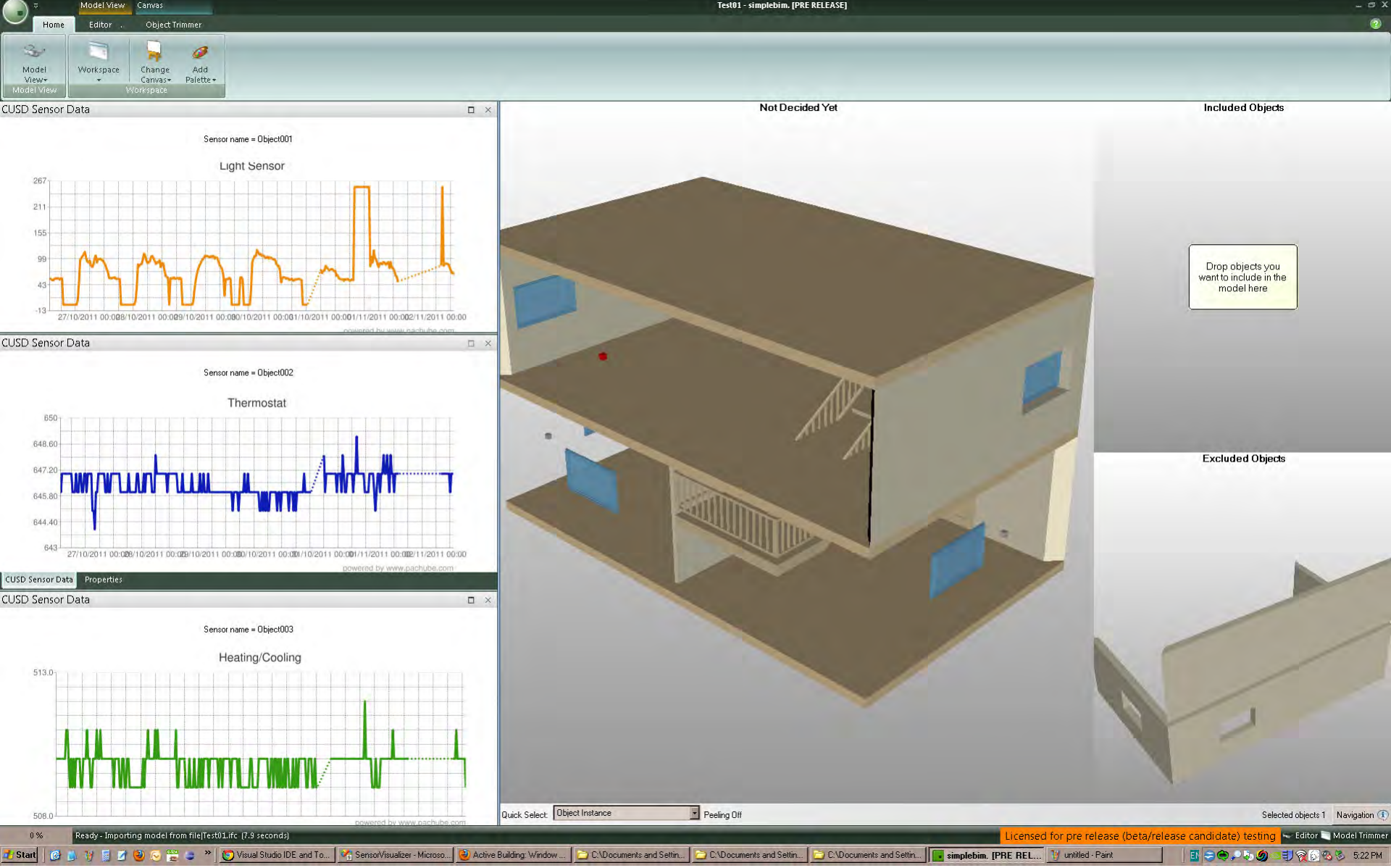

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Construction 2020

1. ***Environmentally sustainable construction***
2. ***Meeting client needs***
3. ***Improved business environment***
4. ***Welfare and improvement of the labour force***
5. ***Advanced information and communication technologies***
6. ***Virtual prototyping for design, manufacture & operation***
7. ***Off-site manufacture***
8. ***Improved construction processes***

IDDS is central to our future

Sustainable Built Environment National Research Centre

the new world

The road is long,
full of adventure, full of knowledge

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5-9 May 2013, Brisbane, Australia

QUT

www.sbenrc.com.au