Generalisation, Web Mapping & Data Delivery over the Internet

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ICA WG, Barcelona, Spain, September 2000

http://www.laser-scan.com/papers/

Abstract

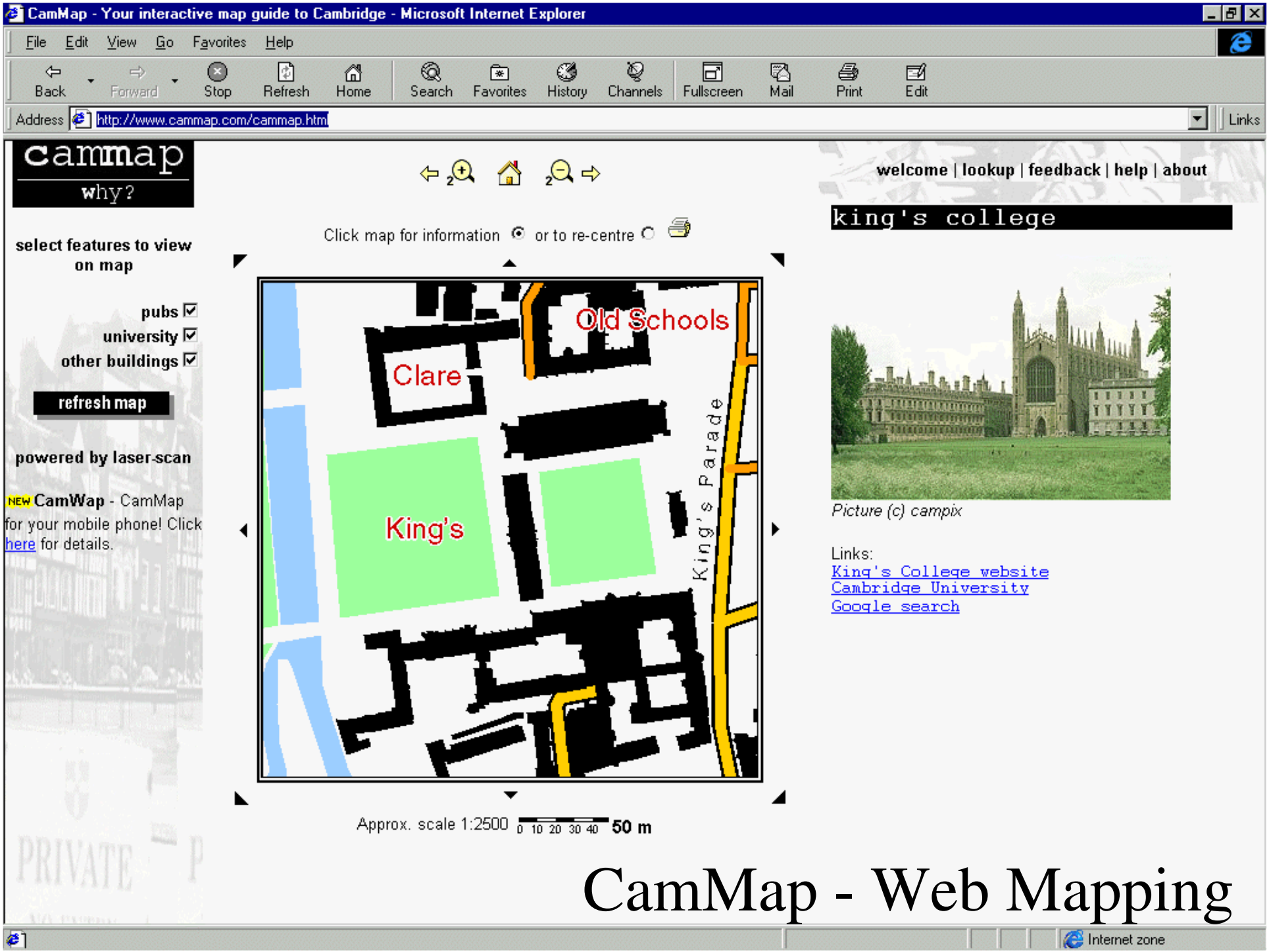
- We are moving at breakneck speed towards the Information Society, where information is available on almost any subject, on-request, wherever you are. As the majority of information has a location component, it is natural to use mapping as a prime medium for provision of information, and such maps have to be generated on-demand to suit the particular request.
- This paper overviews an active object approach to generalisation and presentation of location-related information. It also covers interoperability standards which allow combination of spatial information from disparate Internet sources.

Contents

- Introduction
- Active objects
- Generalisation
- Internet and Web mapping
- Interoperability
- Mobile mapping
- Conclusion

Internet as Information Source

- Dramatic growth fuelled by
  - cheap hardware
  - the World Wide Web as an application
  - Simple protocols (http and html)
- Majority of human information has location component, so web mapping is growing fast
  - see http://www.CamMap.com



CamMap - Web Mapping

Mobile Phone

- Explosive growth worldwide
  - 238M sold last year, predict 400M this year!
- A communication tool
  - Originally for person-to-person
  - Now information enquiry tool
- SMS Text messaging as well as voice
- WAP hype (but promise is there)
- Severe limits currently but will go
  - Display size and resolution, bandwidth, etc

PDAs, Palmtops & GPS

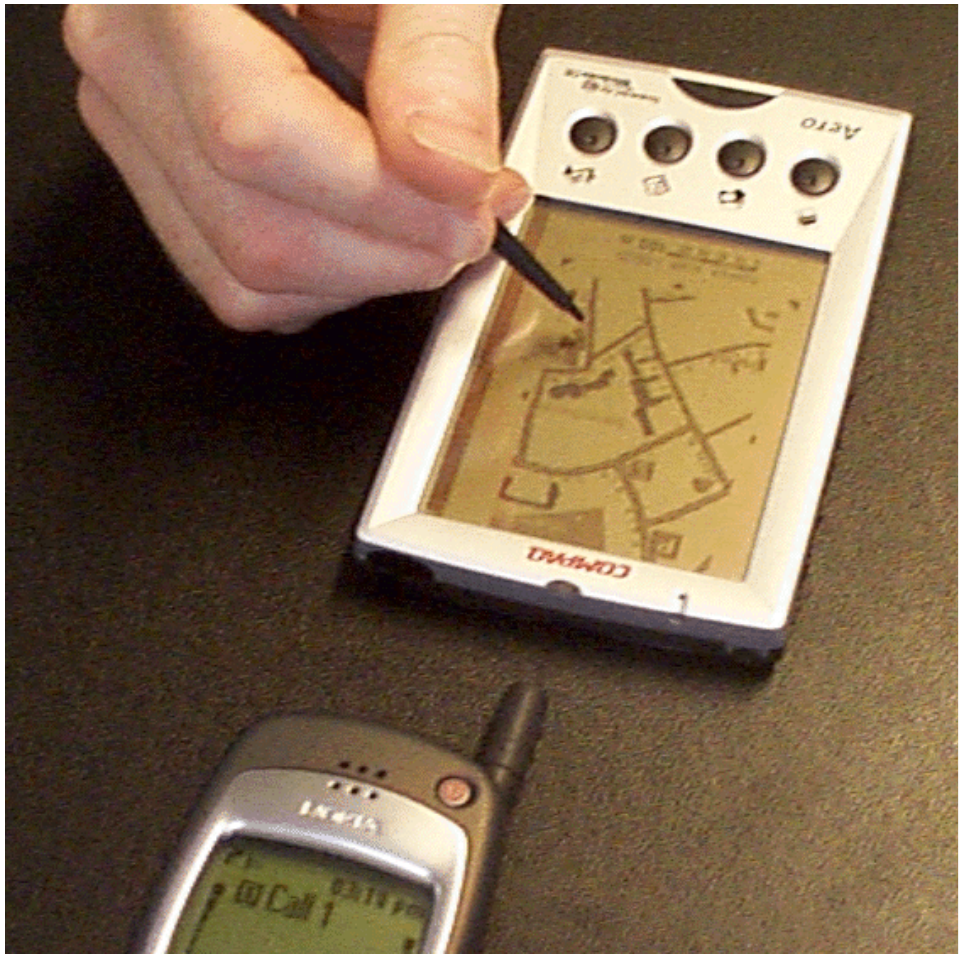
- PDA - Psion, Palm, Aero
  - digital equivalent of Filofax
- Palmtop - HP Jornada
  - scaled-down laptops
- GPS receivers
  - were bulky, now small

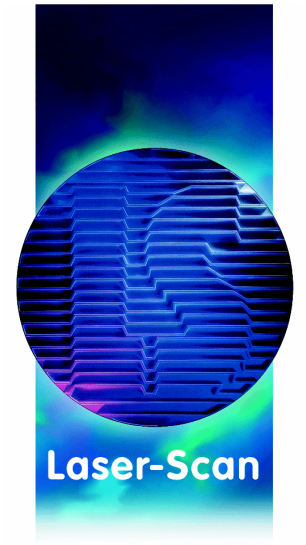
Wireless Handheld Information Appliance (WHIA)

- Meld of mobile, PDA, palmtop, GPS
  - will become as common as wristwatch
- WHIA -"Whia has tha bin sin I saw thee?"
- Much better screen (folding?)
- Will still have limits enforced by conflicts
  - less weight, longer battery life
- Intelligent presentation of information vital.

WHIA simulation

- Combinations of existing appliances
- PDA + Mobile phone
- Works now, albeit slowly





Where am I?

- Mobile phone already knows where it is
  - in order to hand over from cell to cell
  - refinements like Cursor from CPS
    - 25m in open, much better in dense areas (malls)
- Satellite positioning (GPS) is alternative
  - better in open, worse in clutter (city)
  - extra power consumption
- Future WHIAs will use a combination
  - to give reliable position to a few metres

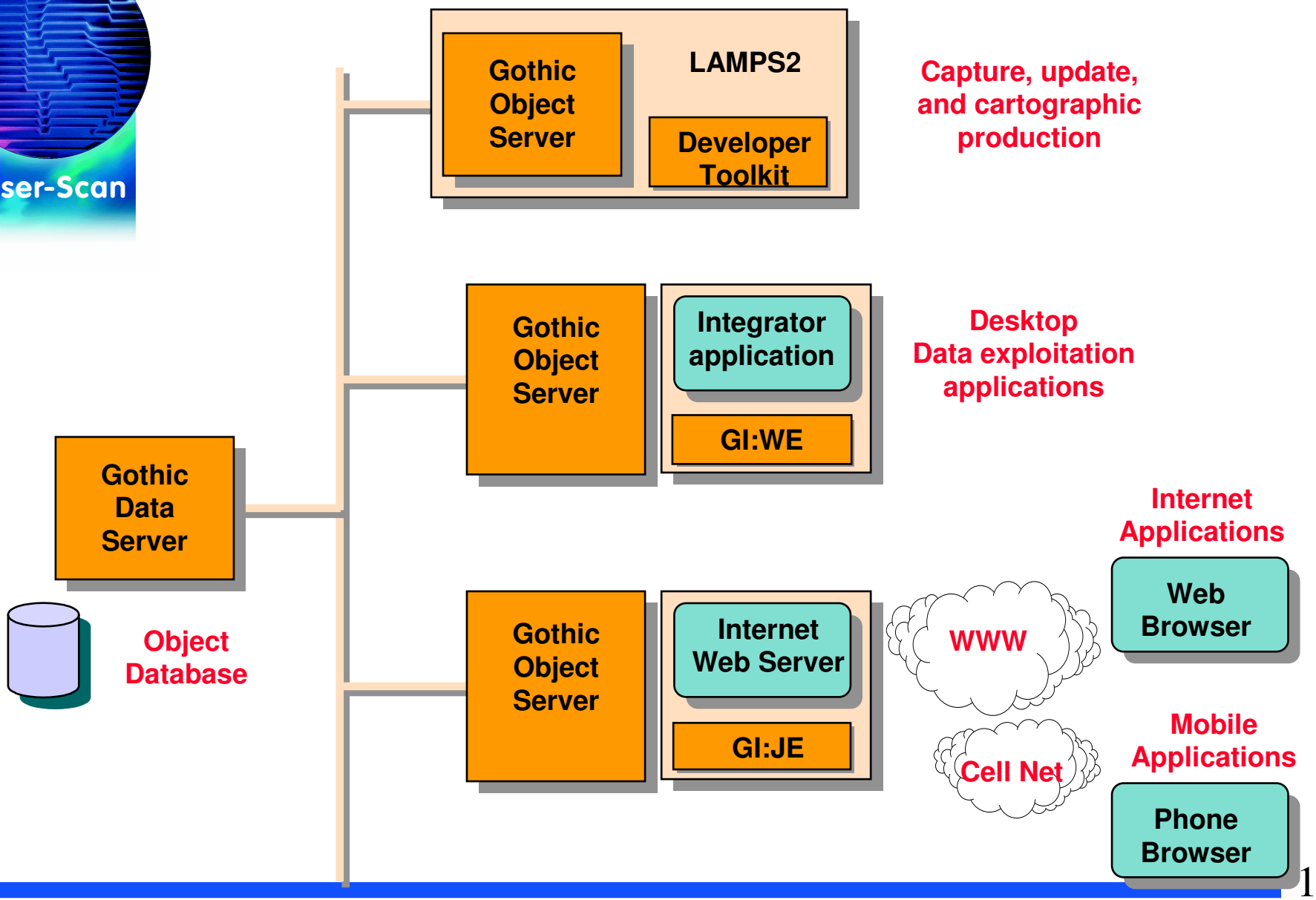
Location Questions

- Location Questions
  - Where am I?
  - Where is the nearest …?
  - How do I get to …?
- Answers by various techniques
  - synthesised voice, or human operator
  - graphical map on screen, or text message
  - A4 paper sent by fax
- Primary source is always geographic information server (active object database)

Active Objects

- Encapsulation
  - Data and behaviour not separated
  - Objects respond to messages
- Referencing
  - direct knowledge of related objects
- Inheritance
  - a church is a kind of building
- Polymorphism
  - click on different class objects and get appropriate description and highlighting

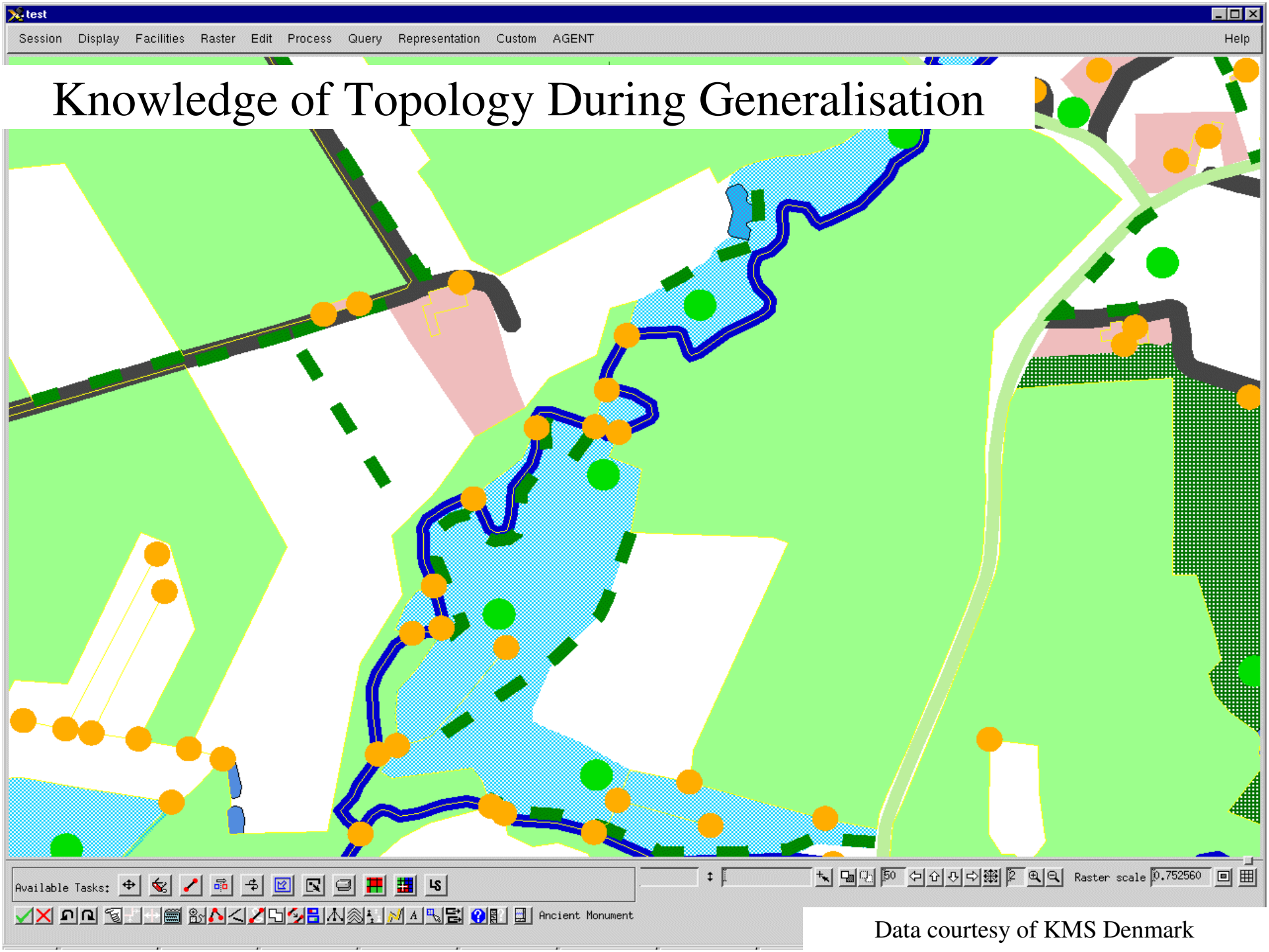
Gothic Family



Object Spatial Database Mapping

- Efficiently store/retrieve spatial objects
- Schema - data model of real world
- Continuous mapping (no sheet edges)
- Topological structure (adjacent, connects)
- Active object views - intelligent subsets
- Active representation - good cartography
- Active generalisation derives appropriate features for current scale and need
- Validation methods ensure data integrity
- Open access - from desktop/web/WHIA

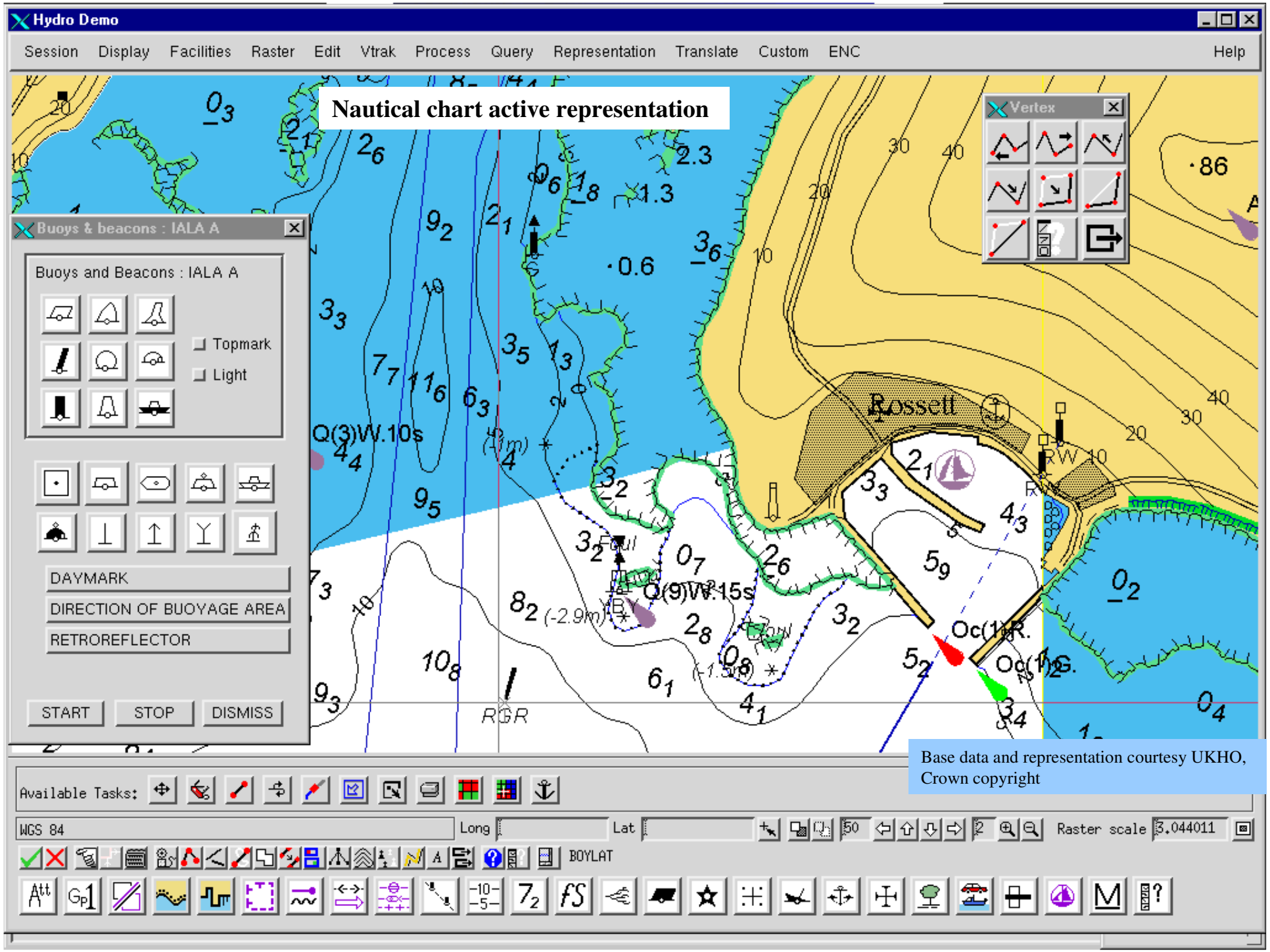
Knowledge of Topology During Generalisation



Data courtesy of KMS Denmark

Active Display

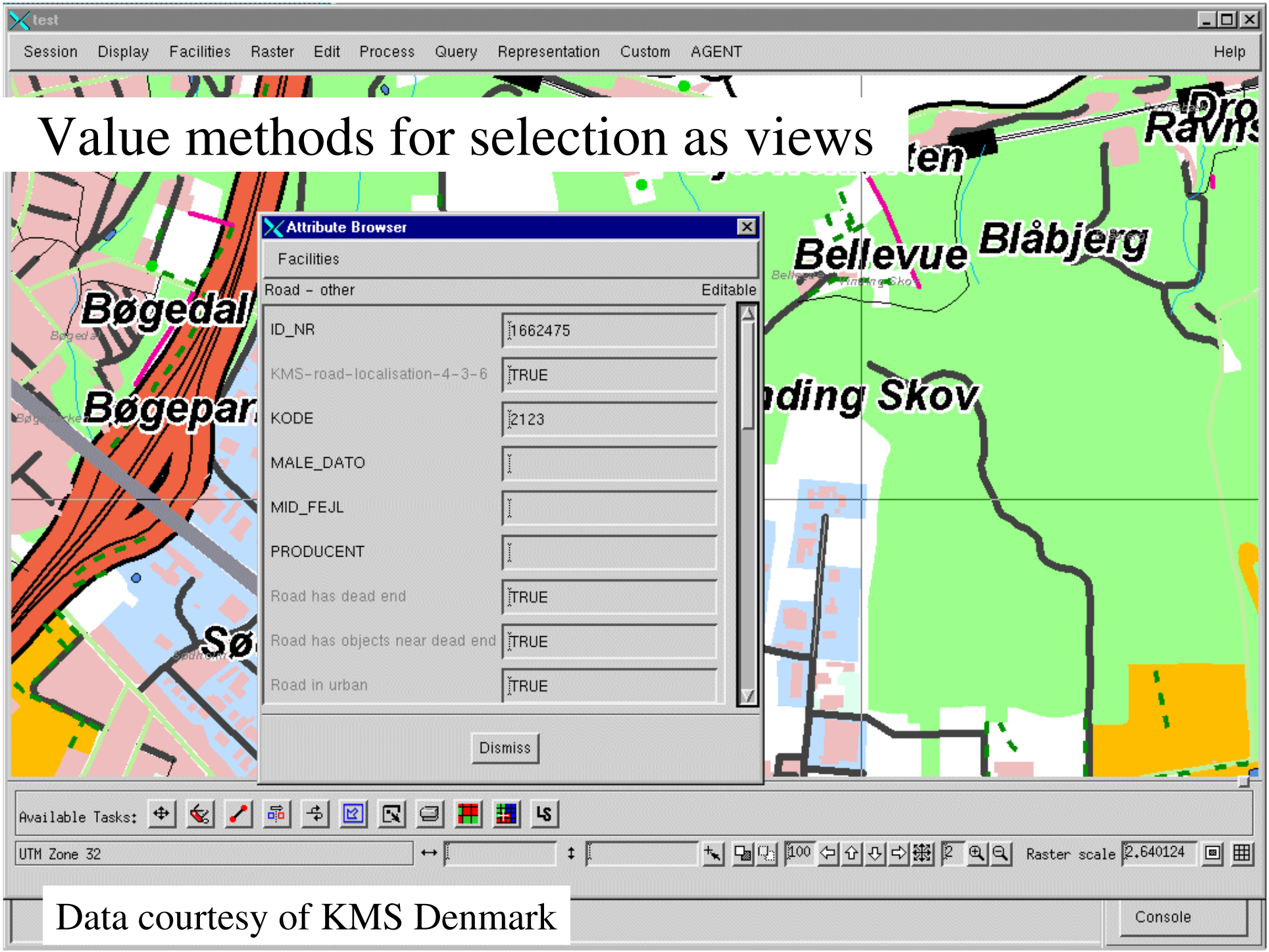
- Message to objects - ‘please draw yourself’
- Object display method can then:
  - decide not to draw, or use rich set of styles
  - change type according to scale (area to point)
  - use different geometry with less detail
  - draw itself differently several times (casings)
  - move into clear space - avoid edge or collisions
  - modify representation according to surrounds
    - shorten text label to match length of road
- All applicable to web or WAP mapping


Hydro Demo
Session Display Facilities Raster Edit Vtrak Process Query Representation Translate Custom ENC Help
Nautical chart active representation
Vertex
Buoys & beacons : IALA A
Buoys and Beacons : IALA A
Topmark
Light
DAYMARK
DIRECTION OF BUOYAGE AREA
RETROREFLECTOR
START
STOP
DISMISS
Rossell
Q(3)W.10s
Q(9)W.15s
Oc(1)R.
Oc(1)G.
RGR
Available Tasks:
WGS 84
Long
Lat
Raster scale
3.044011
BOYLAT
Base data and representation courtesy UKHO, Crown copyright

Generalisation

- Active Object Generalisation
  - single - collapse, refine, exaggerate, simplify
  - multiple - aggregate, typify, displace
  - implemented as behaviours in database
- In future will happen in real time
  - now use to pre-prepare scale bands
  - store as alternative geometries
- Active database views to choose objects
  - ask each object ‘are you in this view?’
  - object can use spatial toolkit, and references

Value methods for selection as views



Data courtesy of KMS Denmark

Agent Generalisation

- Next step is active Agent generalisation
  - Individual map features become aware
  - work co-operatively to achieve goals
- AGENT project
  - EC funded three-year project
  - Ends this December.
  - Brings together industry, govt, academia

The AGENT Project - Partners

***Institut Geographique National* (leader)**

University of Edinburgh

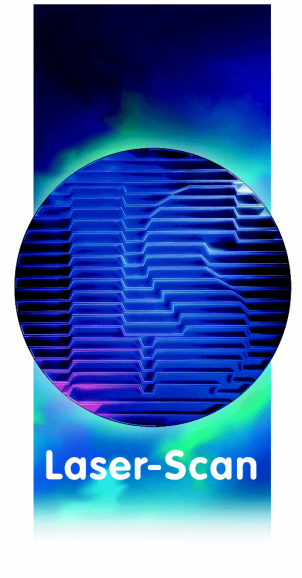
EC funding
ESPRIT 24939

Laser-Scan Ltd.

Institut National Polytechnique de Grenoble

University of Zurich

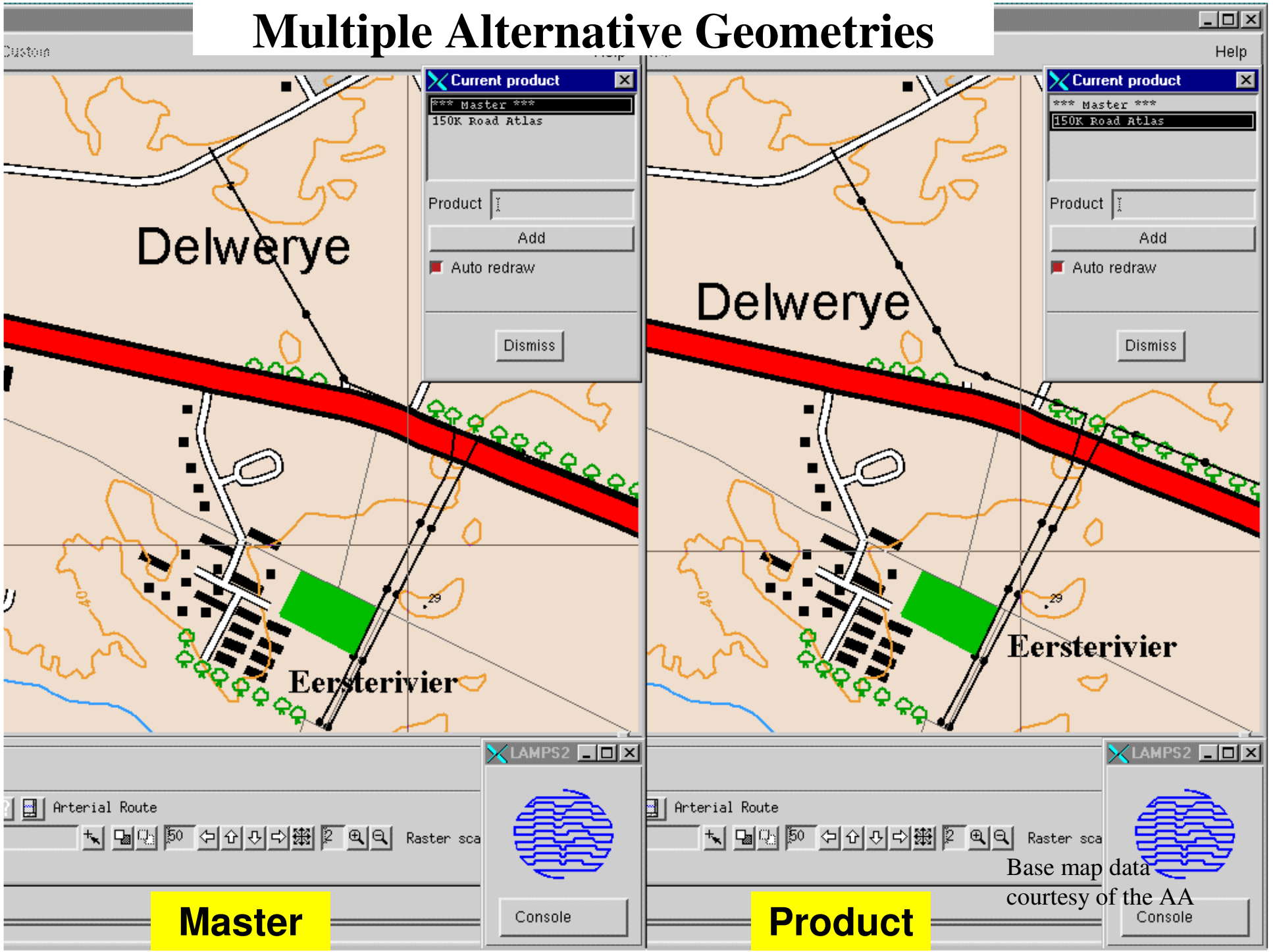
Meso-agents (Districts) and Micro-agents (Buildings)



2 Big Steps Forward

- Micro agents try different algorithms, keeping results if makes better, discarding and trying different if makes worse.
- Meso agents coordinate generalisation across sets of objects, so avoid consequential conflicts, retain gestalt

Multiple Alternative Geometries



Web Mapping Examples

- CamMap (and CamWAP)
  - Live mapping
- Location Mapping
  - quality cartography via PDF
- LINZ
  - National 1:50K topographic maps on-demand
- EDINA Digimap
  - Serve all OS data to UK academic community

Web Mapping with Active Generalisation

CamMap - Your interactive map guide to Cambridge - Microsoft Internet Explorer

File Edit View Go Favorites

Back Forward Stop Refresh Home Search Favorites History Channels Fullscreen Mail Print Edit

Address http://www.cammap.com/cammap.html Links

cammap
how?

welcome | lookup | feedback | help | about

select features to view on map

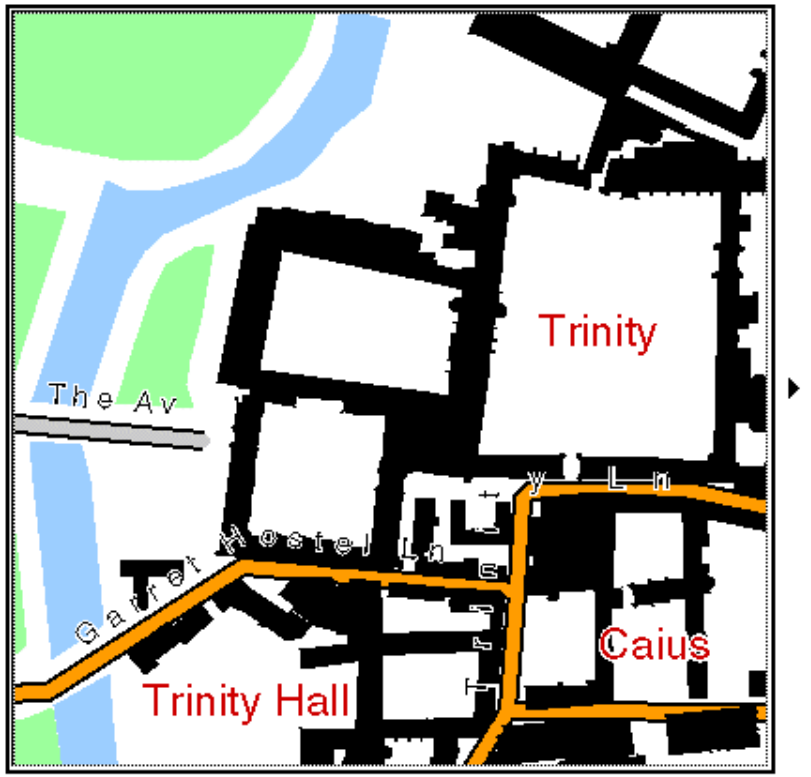
pubs ☑
university ☑
other buildings ☑

refresh map

powered by laser-scan

NEW CamWap - CamMap for your mobile phone! Click here for details.

Click map for information ◉ or to re-centre ○



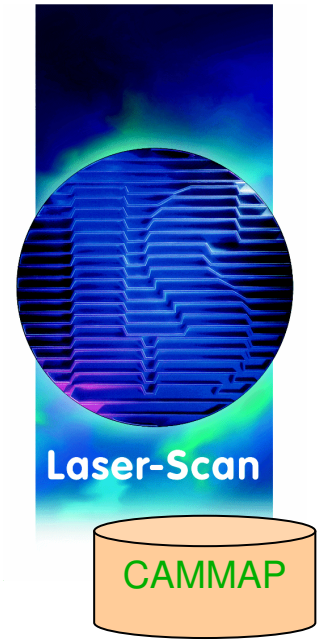
Approx. scale 1:2500 0 10 20 30 40 50 m

trinity college

Picture (c) campix

Links:
Trinity College website
Trinity College Choir (Hyperion records)
Cambridge University
Google search

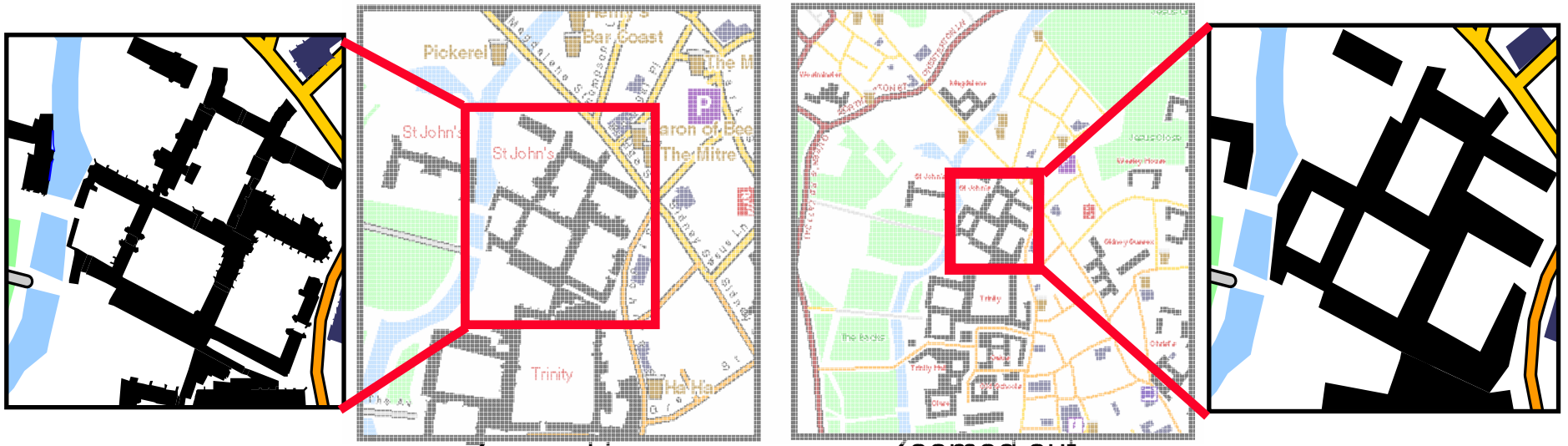
Internet zone



CamMap

www.cammap.com

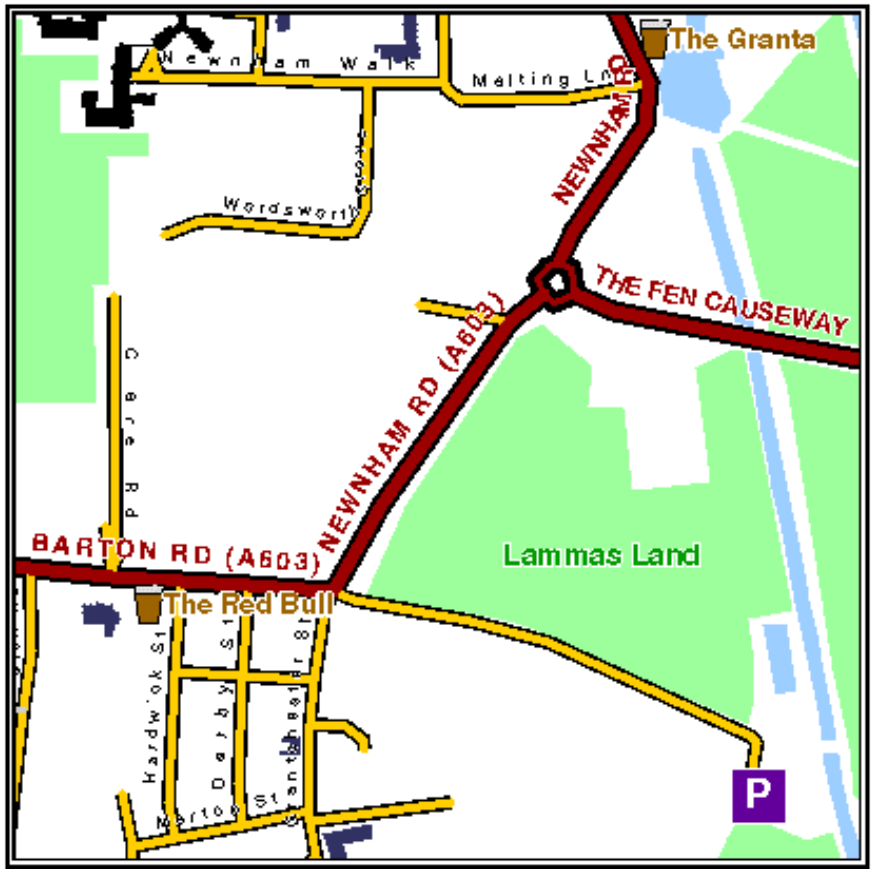
- CamMap Data Model
  - Building generalisation



Zoomed in - Based on OS Landline

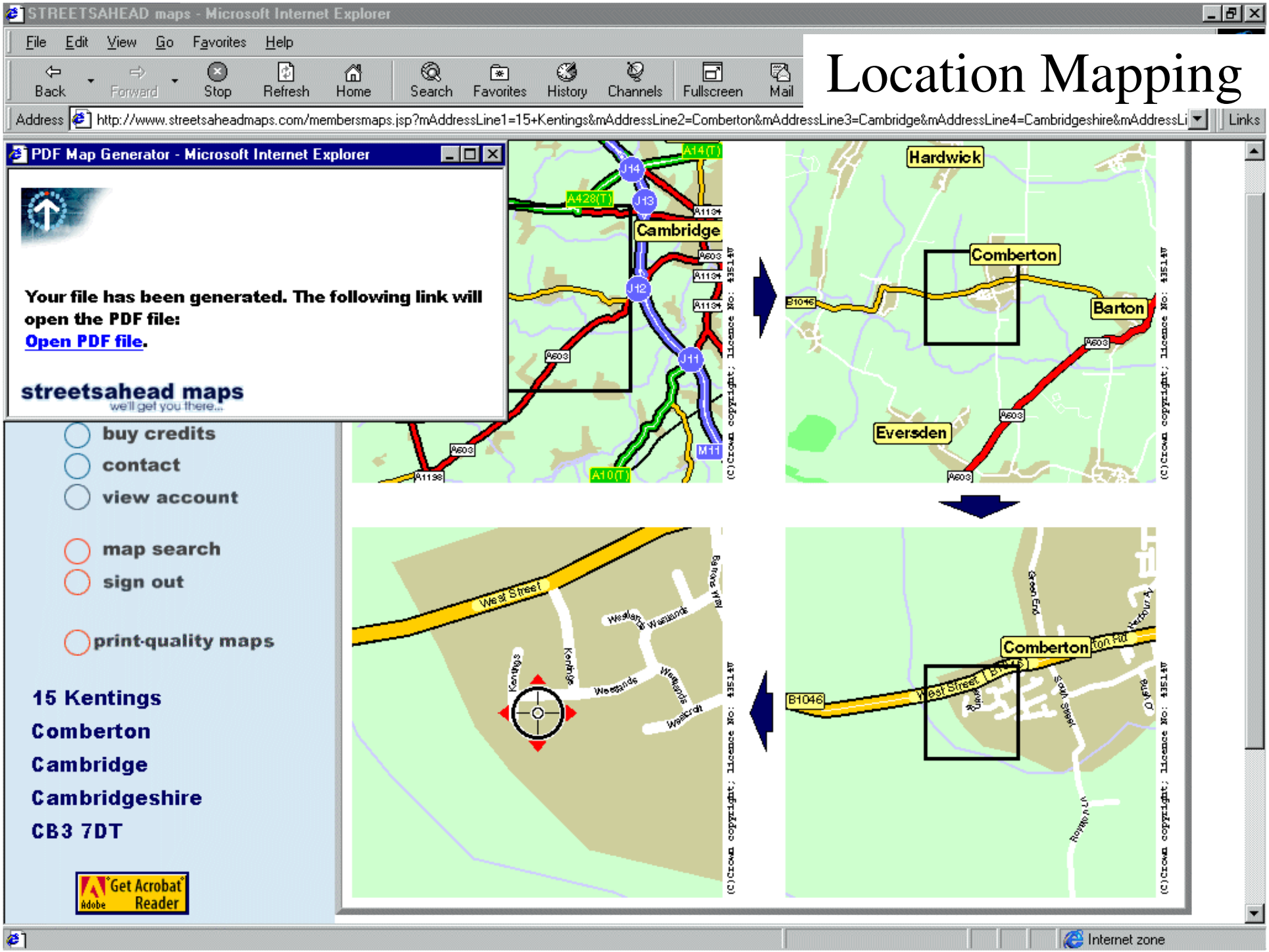
Zoomed out - Based on OS 10k Raster

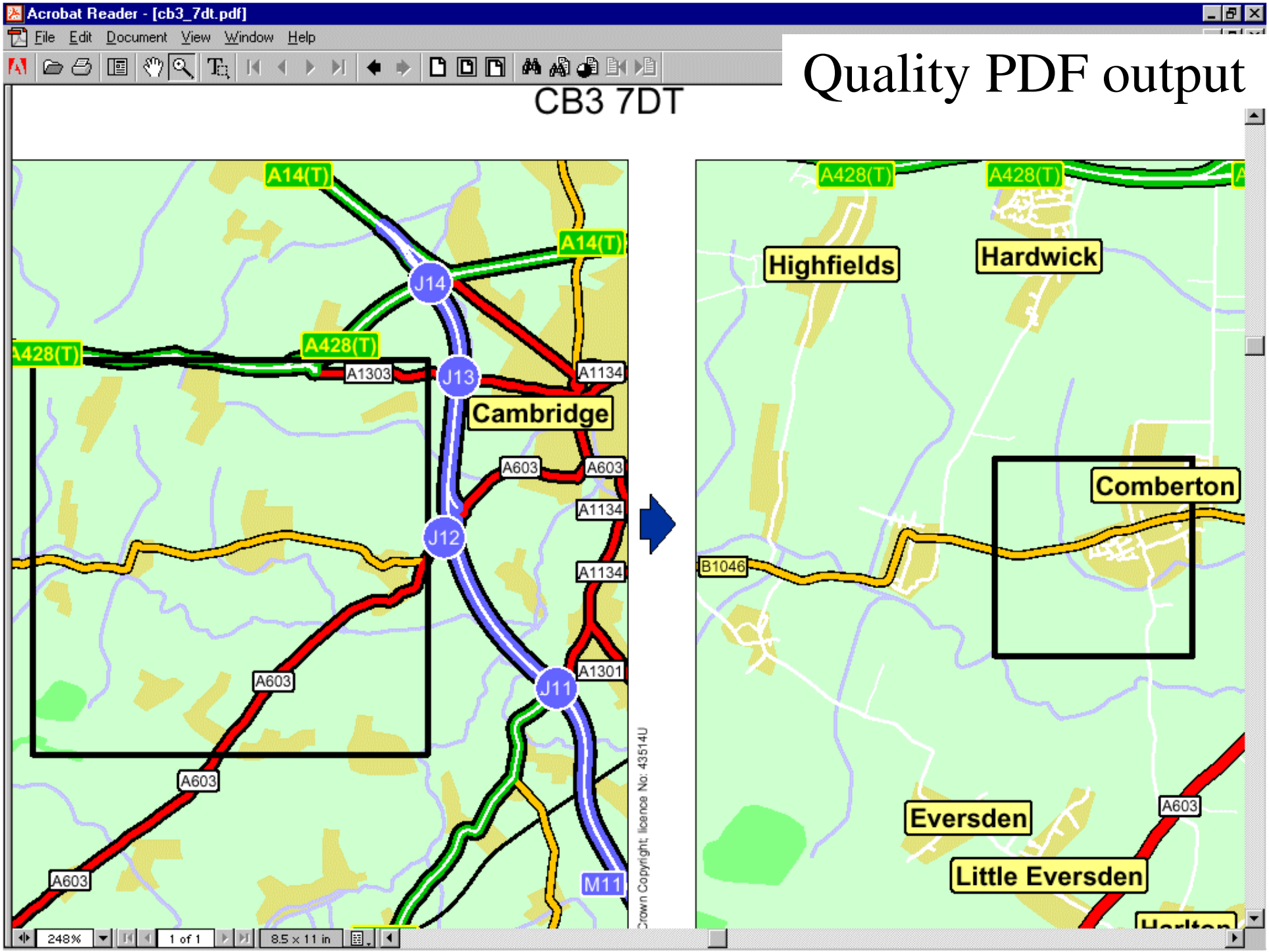
CamMap - Text Labels



- Shorten names
- Drop road numbers
- Intelligent positioning
  - avoid edge
  - avoid conflicts
- Done at draw time
  - Right for this request

Location Mapping




Acrobat Reader - [cb3_7dt.pdf]
File Edit Document View Window Help
CB3 7DT
Quality PDF output
A14(T)
A14(T)
J14
A428(T)
A428(T)
A1303
J13
A1134
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A1301
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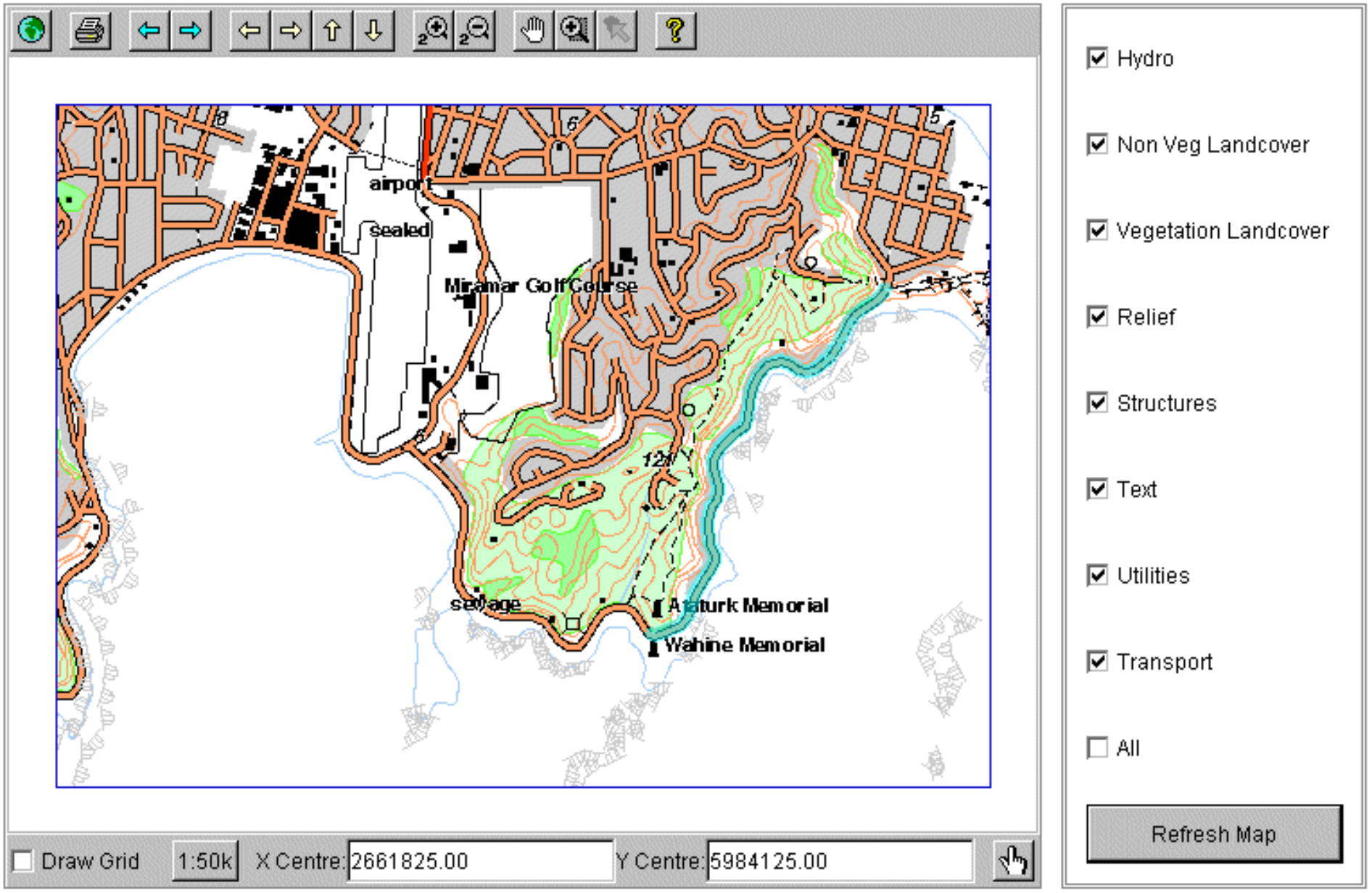
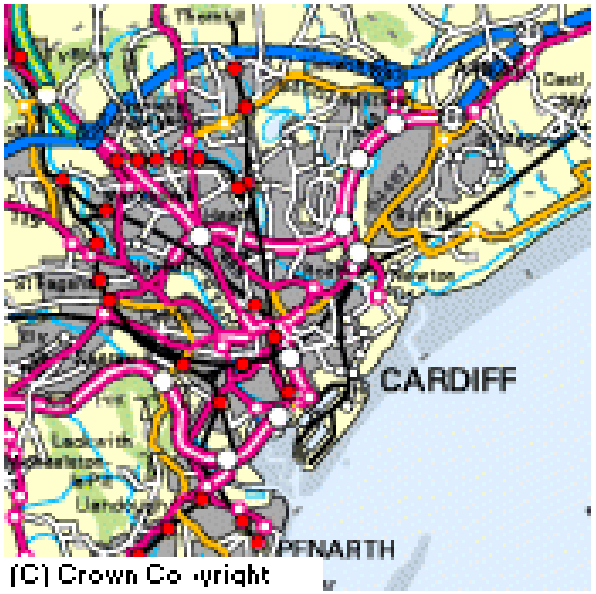
Highfields
Hardwick
Comberton
B1046
Eversden
A603
Little Eversden

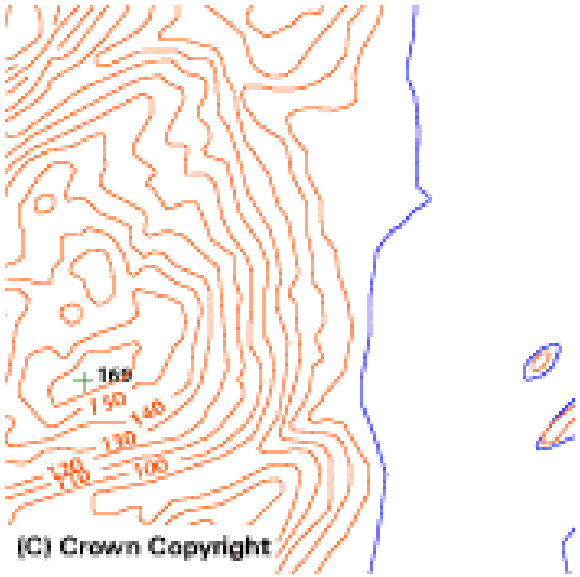
Land Information New Zealand - Web access to Topo



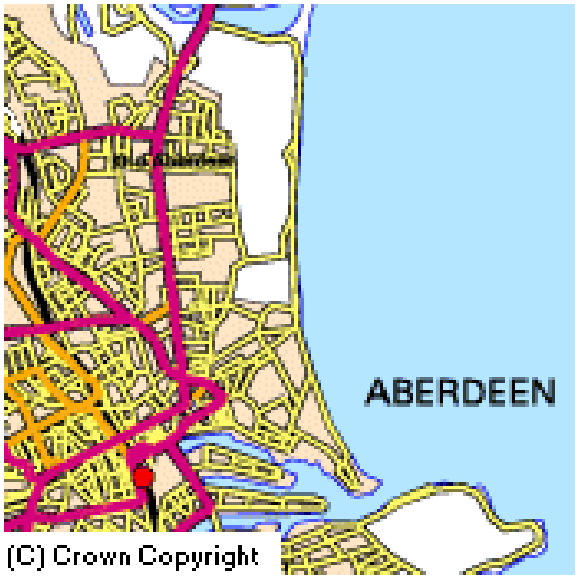
EUDL DigiMap - Data available



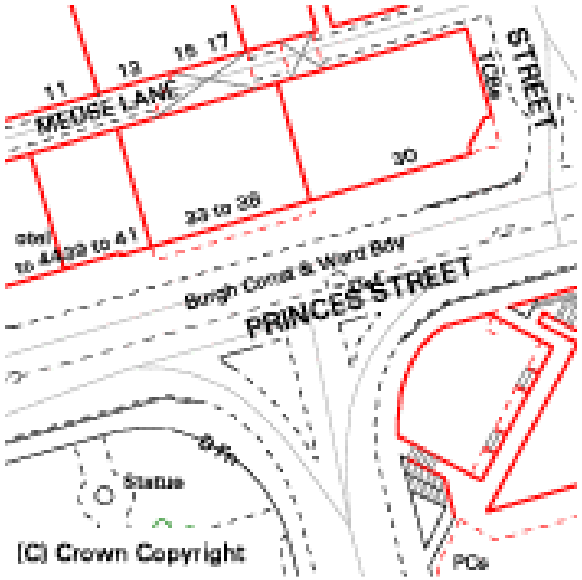
Strategi®
- 1:250 000
- National coverage



OS Land-Form PANORAMA™
- 1:50 000
- National coverage
- Contours and DTM



Meridian™
- 1:50 000
- National coverage



OS Land-Line®
- 1:10 000 - 1:1250
- 30% of national coverage in any one year

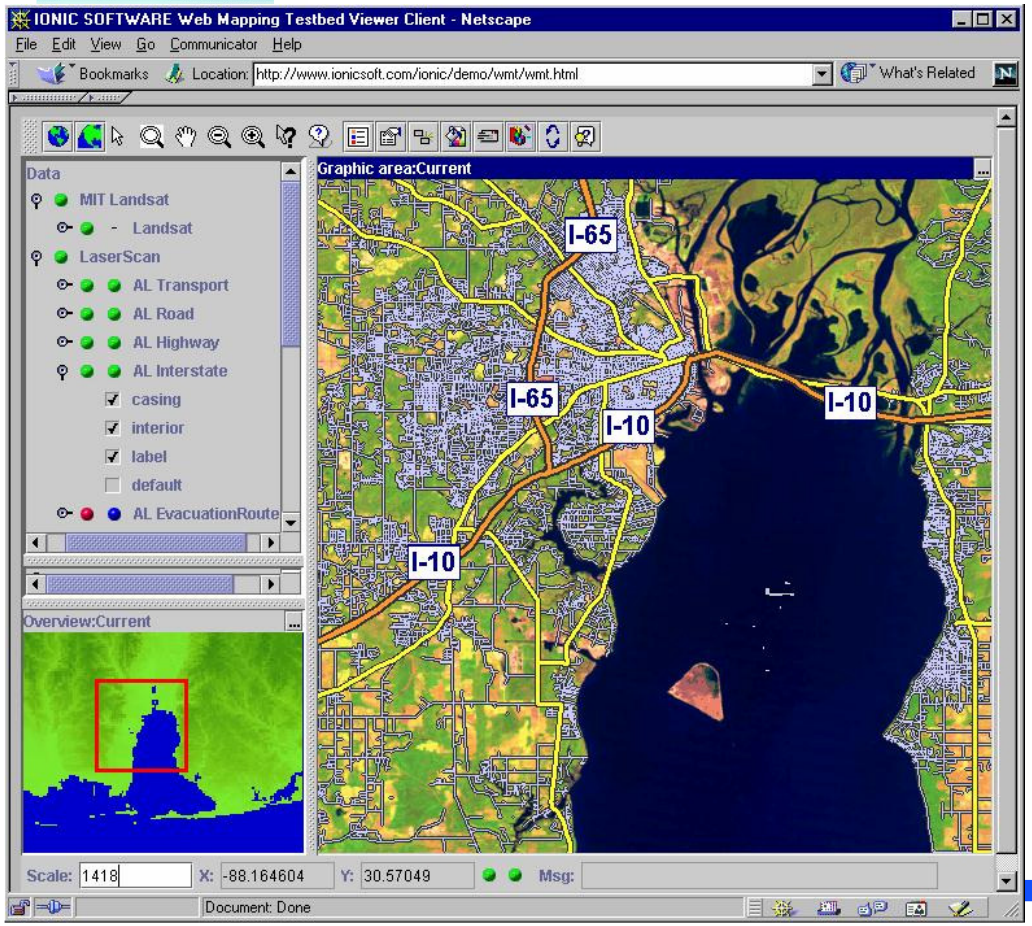
Edina Digimap (EUDL)

- Serve OS mapping to UK academia
- Pilot being re-engineered to use Gothic
- One of biggest continuous map databases in the world (223,000 sheets in Landline)
- Can browse to area, scale and content
- Then ask for quality hardcopy in PS/PDF
- Or data in NTF/Shape/MapInfo/etc for further analysis in GIS

Interoperability

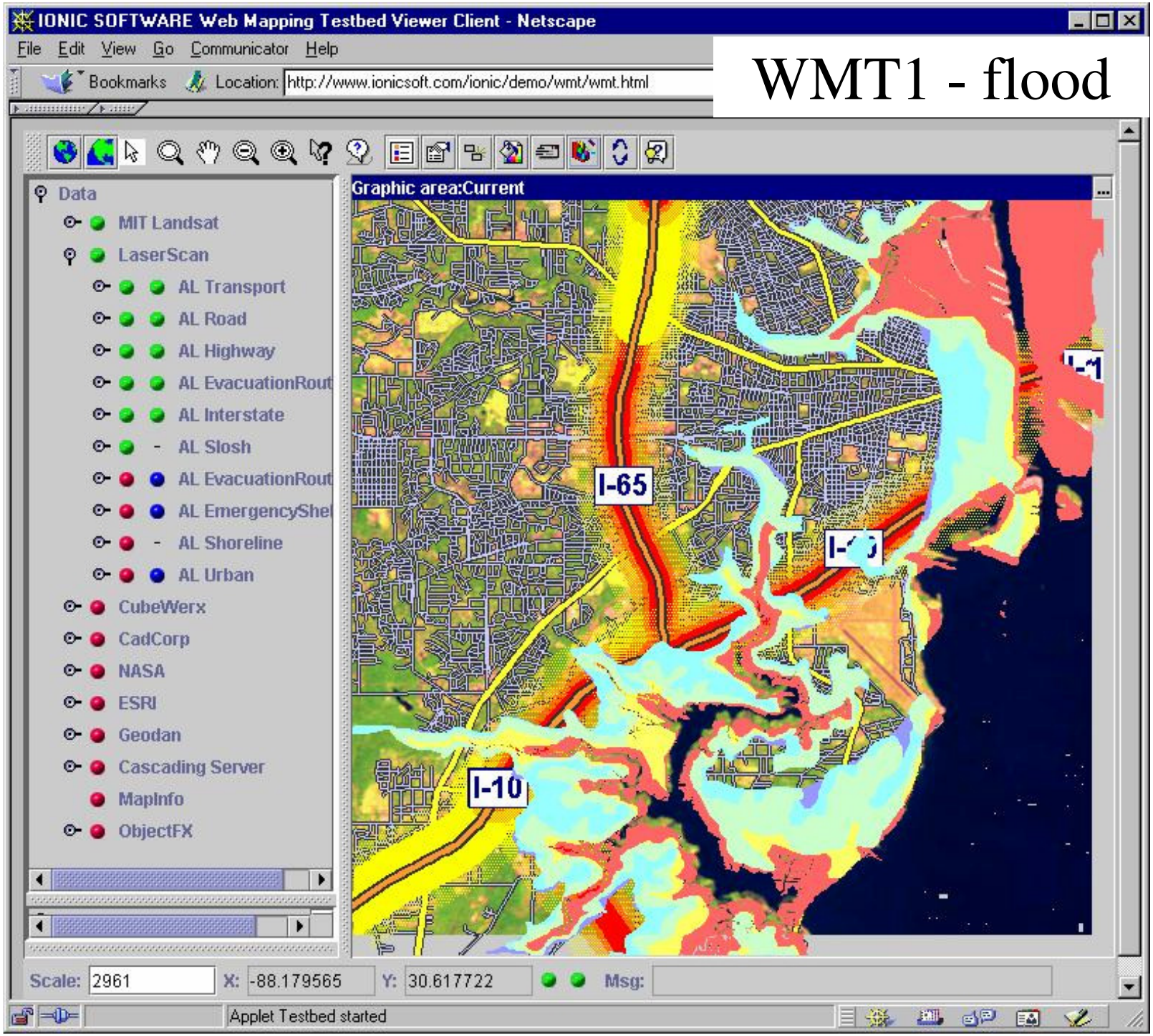
- OpenGIS Consortium - OGC
- Defined APIs
  - GetMap, GetFeatureInfo, GetCapabilities
- Web Mapping Testbed (WMT1)
  - Flood Scenario in Mobile, Alabama
  - Brings together Govt, Industry
- CamMap uses WMT protocols
- WMT2 just started

Web Mapping Testbed 1



- Viewer client from Ionic
- SPOT imagery from MIT
- Roads from Laser-Scan

- Access from remote DBs
- Combined in viewer


IONIC SOFTWARE Web Mapping Testbed Viewer Client - Netscape
File Edit View Go Communicator Help
Bookmarks Location: http://www.ionicsoft.com/ionic/demo/wmt/wmt.html
WMT1 - flood
Data
MIT Landsat
LaserScan
AL Transport
AL Road
AL Highway
AL EvacuationRout
AL Interstate
AL Slosh
AL EvacuationRout
AL EmergencyShel
AL Shoreline
AL Urban
CubeWerx
CadCorp
NASA
ESRI
Geodan
Cascading Server
MapInfo
ObjectFX
Graphic area:Current
I-65
I-10
Scale: 2961
X: -88.179565
Y: 30.617722
Msg:
Applet Testbed started

WMT2 - feature access

OGC Applet - Microsoft Internet Explorer

File Edit View Go Favorites Help

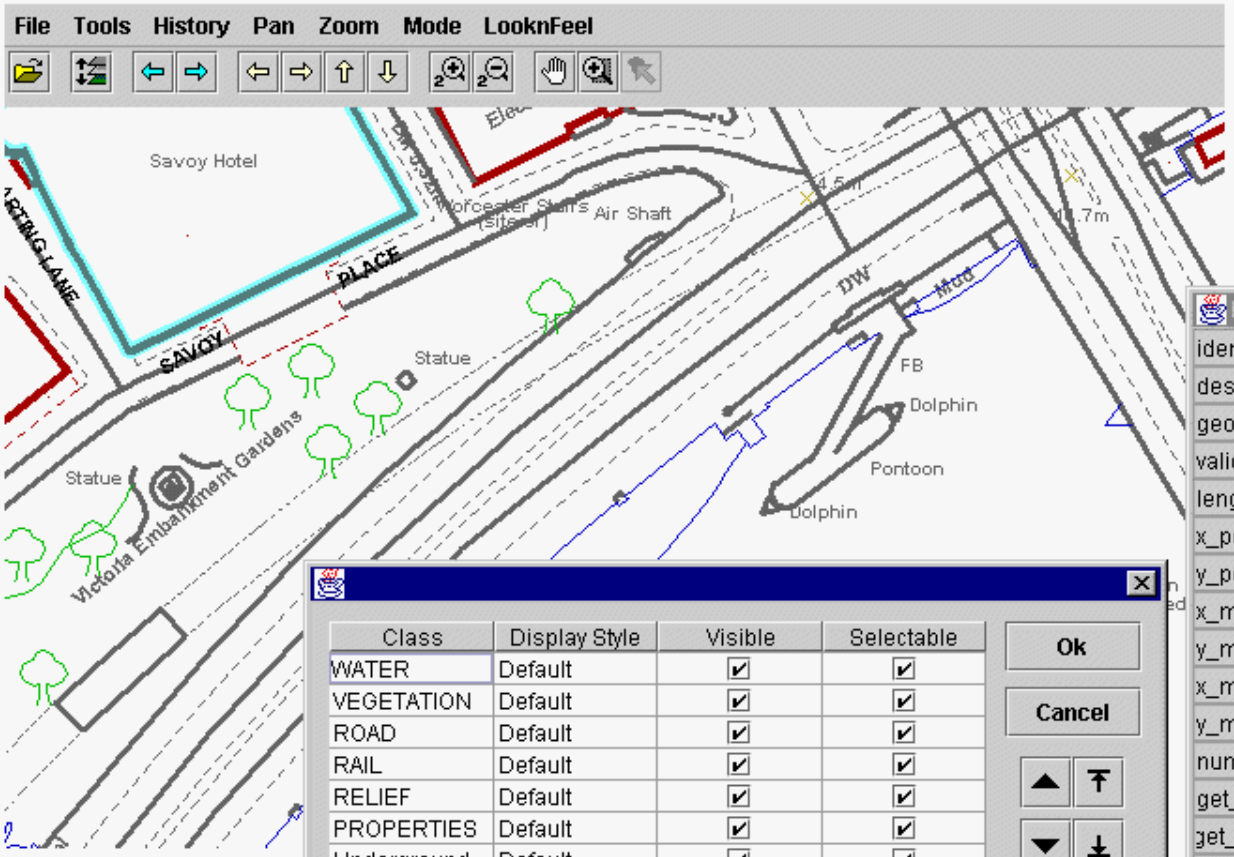
Back Forward Stop Refresh Home Search Favorites History

Address http://wmt.laser-scan.com/html/examples/GIJEDisplayApplet/OGCClient.html

Links

back **Laser-Scan OGC Client Applet**

This applet makes use of Laser-Scan's **Web Map Server** and **Web Feature Server** for use in the WMT-2 TIEs.



Class	Display Style	Visible	Selectable
WATER	Default	☑	☑
VEGETATION	Default	☑	☑
ROAD	Default	☑	☑
RAIL	Default	☑	☑
RELIEF	Default	☑	☑
PROPERTIES	Default	☑	☑
Underground...	Default	☑	☑
Miscellaneou...	Default	☑	☑
Minor Line D...	Default	☑	☑
General Line ...	Default	☑	☑
BUILDING	Default	☑	☑
BOUNDARY	Default	☑	☑

Ok

Cancel

Add...

Delete

Building Outline

identifier	[102,37311277,1152]
description	< 1152>Building Outline
geometry	LineString
validate	OK
length	219.525676
x_point	530517.35
y_point	180681.25
x_min	530511.15
y_min	180631.05
x_max	530587.3
y_max	180698.7
number_of_vertices	45
get_dimension	1
get_topological_dimension	-1
get_potential_dimension	2
goth_priority	0
goth_new_priority	-1
Nearest_Road	7312612,7880] Go...
Nearest_Seed	533678,10983] Go...

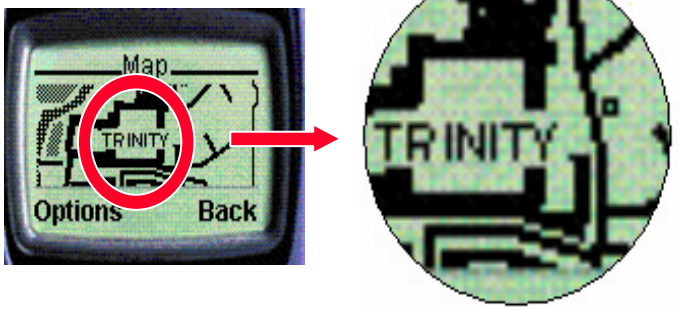
Applet started.

WMT2

- Focus areas:
  - Catalog and metadata
  - Feature retrieval (not just pictorial map)
  - Update of features
  - Portrayal and symbolisation
  - Security and access controls
  - Context and session
  - GML and XML

Mobile Mapping

- Small screen limits useability, but
  - with intelligent selection and active representation, can achieve useful results
- See WAP version of CamMap - CamWap
  - uses same object database
  - different display methods
    - haloing round texts
    - negative casings for roads
    - minimalist labelling



- Restrictions will reduce with WHIAs

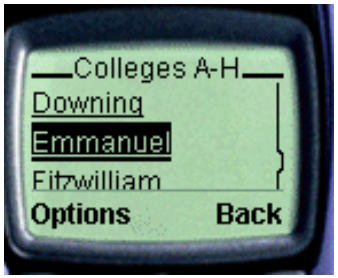
Laser-Scan

CamWap

wap.cammap.com

CamWap

- Features:
  - Interactive pan, zoom
  - Postcode search facility
  - College lookup



Conclusions

- Rise of Internet has changed access to information, including spatial info
  - paper mapping is no longer primary source
- Union of mobile phone with PDA etc
  - Wireless Handheld Information Appliance
  - current limitations (screen etc) are temporary
  - over next few years, WHIA will become central medium for information retrieval

Conclusions 2

- Rise of WHIA will change the nature of cartography business
  - much of knowledge and skill of cartographer will have to be embedded in generalisation and active representation software
  - and in pre-prepared generalised ‘usages’ in db
- Active object technology in the information server is crucial to on-demand retrieval and clear presentation of the requisite data
- Result is an active map on the browser or WHIA, tailored to the user's current need.

Object Oriented Mapping

Is The Way Ahead !

http://www.laser-scan.com/papers/

GOTHIC LAMPS2