Smart Cities

Session I: Lecture 3:
Contemporary Computing and the City

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Outline of the Lecture

1. The Convergence of Computers and Telecommunications
2. Networks: Spoke and Hub, LANs, WANs, MANs
3. ARPANET: NSFNet: The Internet. The World Wide Web or simply the Web, WWW
4. Convergence and Decentralisation: More and More Miniaturization, Desktop, Tablet, Hand-Held Devices, Smart Phones but the other way too: Supercomputers, Parallelism e-Science
5. The Client-Server Model, Software, Modules, Apps, Multiple Operating Systems, Web 2.0, The Cloud,
6. Plug and Play Software: Big Data and Current Trends

The Convergence of Computers and Telecommunications

When computers were first invented, the program, data and he hardware were all tied together – in that the first computer programmers were scientists – engineers who knew how the machine worked and fashioned their programs and data to the hardware.

But very soon there was a division of labour and the preparation of the program and the data was separated from the running of the program. Programs were then written at higher level and were then ported on cards or tape to the machine itself where those who operated it ran the program and produced the results. This lasted really for about 20 years or more until physical links were built between programmer and machine

Networks: Spoke and Hub, LANs, WANs, MANs

These physical links were essentially to begin with the machine as the hub and the programmer using some sort of device such as a VDU or teletype linked as spokes into the hub.

This kind of arrangement lasted until the 1980s when gradually the hub spoke arrangement broke down due to the fact that access could be made across telephone lines

In parallel, local area networks were developed so that computers could share resources like printers. The ethernet was invented at Xerox Parc and this marked the beginnings of a degree of interactivity where computers were separated into different functions. These LANs heralded in the idea of the client and the server where one of the key shared resources were machines that could serve local users.

During the 1980s, these networks were scaled up to wide area networks and then to metropolitan area networks and much of this was accomplished using much faster communications technologies such as fiber optics.

To an extent, these networks began to merge with telecommunications networks in general and by the early 1990s – some 20 years ago – most users of computers were unaware of how they connected to resources.

Much of this depended on the internet which had started as a special networks connecting research labs in the United States. We have come across this before in our walk through the smart city where we showed that in 1972 UCL was the first outside of the US to connect up.

ARPANET: NSFNet: The Internet. The World Wide Web or simply the Web

The initial network was called the ARPANET – Advanced Research Projects Agency Network – set up by Department of Defense in the 1960s to share resources and the first email was sent in 1971 by Ray Tomlinson who was working for BBN on ARPANet. It was from one machine to the one next door to it but over the network. It had the message QWERTYUIOP and Tomlinson also invented the @ sign to denote the machine to which the mail was sent.

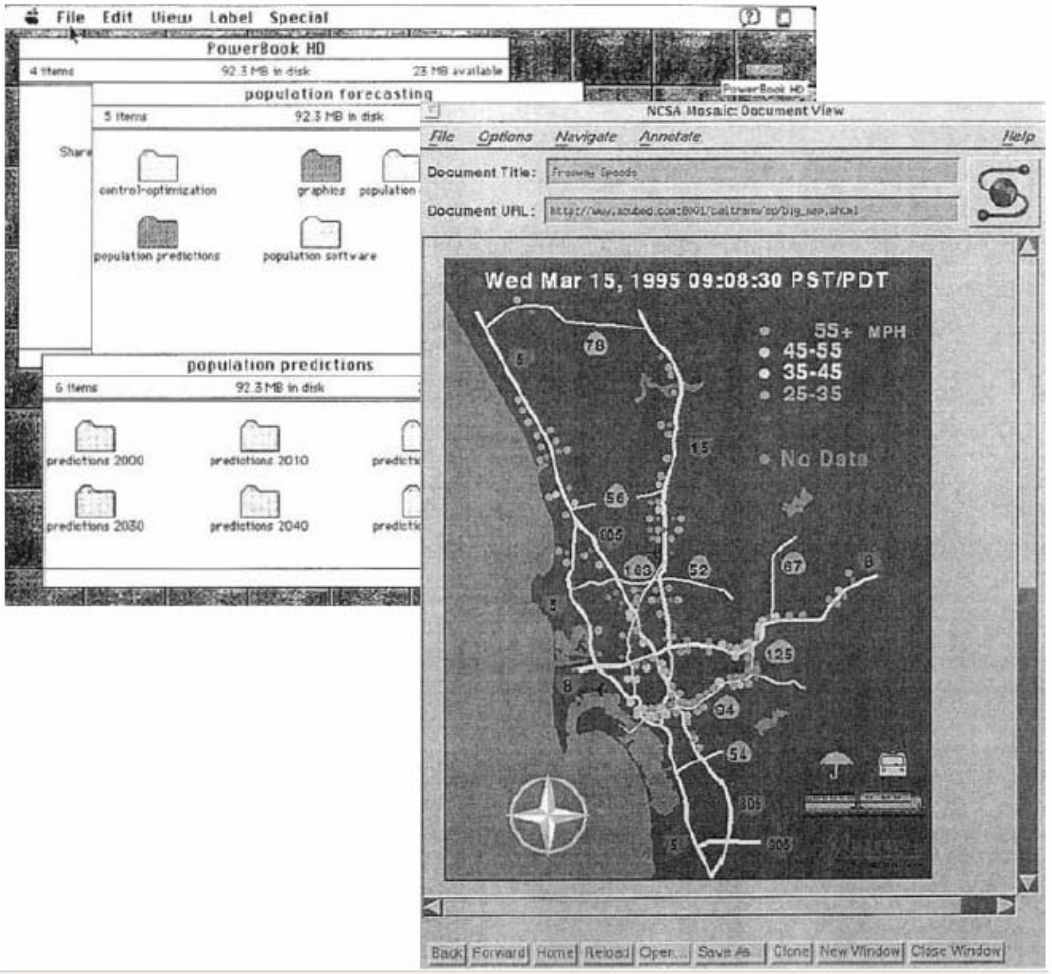
ARPANet grew fast and by late 1980s most university machines world wide were connected using NSFNet which the network had morphed into – and then began the provision of resources across the net, information in specific centres.

FIGURE 1.1

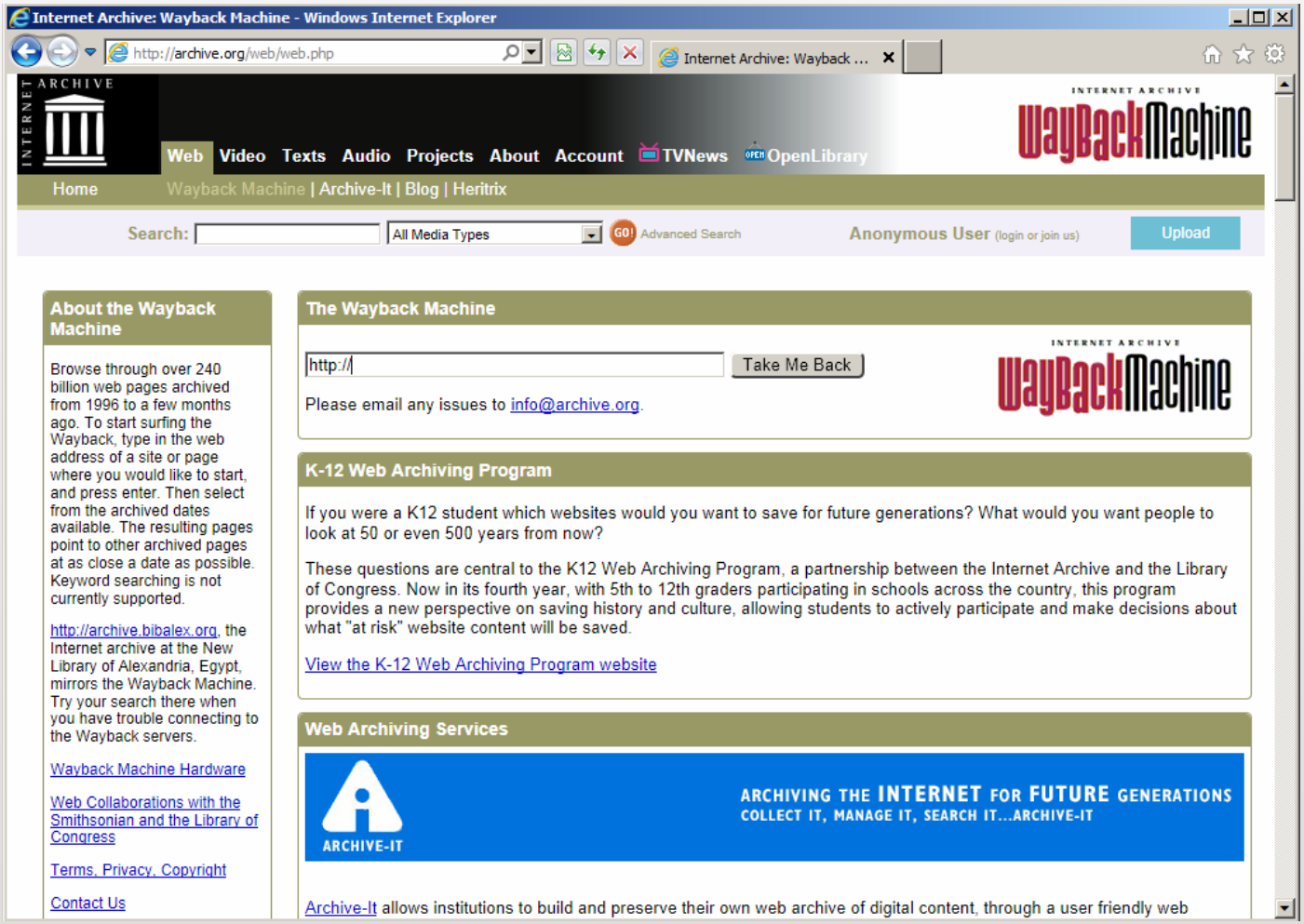
Early Graphics (ca. 1995) for PSS:

A. PSS Loosely Coupled on an Apple Mac Desktop

B. Real Time Traffic Display Through Web Technology, San Diego, CA



If you want a really good look at the past over the last 20 years go to the WayBack machine




CASA Index - Windows Internet Explorer
http://web.archive.org/web/19980207201424/http://www
CASA Index
INTERNET ARCHIVE
WayBackMachine
http://www.casa.ucl.ac.uk/
Go
1,047 captures
7 Feb 98 - 24 May
JAN
FEB
MAY
7
1997
1998
1999
Close
Help
CASA
Welcome
Centre for Advanced Spatial Analysis
UCL
Site developed by CASA members
last updated 27/08/97

Convergence and Decentralisation: More and More Miniaturization, Desktop, Tablet, Hand-Held Devices, Smart Phones, Supercomputers, Parallelism

I don't think I need to say much about this as we are living through the revolutions still and it shows now sign of ending.

But there are a couple of points:

1. Software is built in layers which are relatively independent from one another – this means you don't have to understand the next layer down or the next layer up or at best you only have to know about adjacent layers – this is what makes us able to builds really fancy things because we don't need to rely on knowing and doing something about the other layers

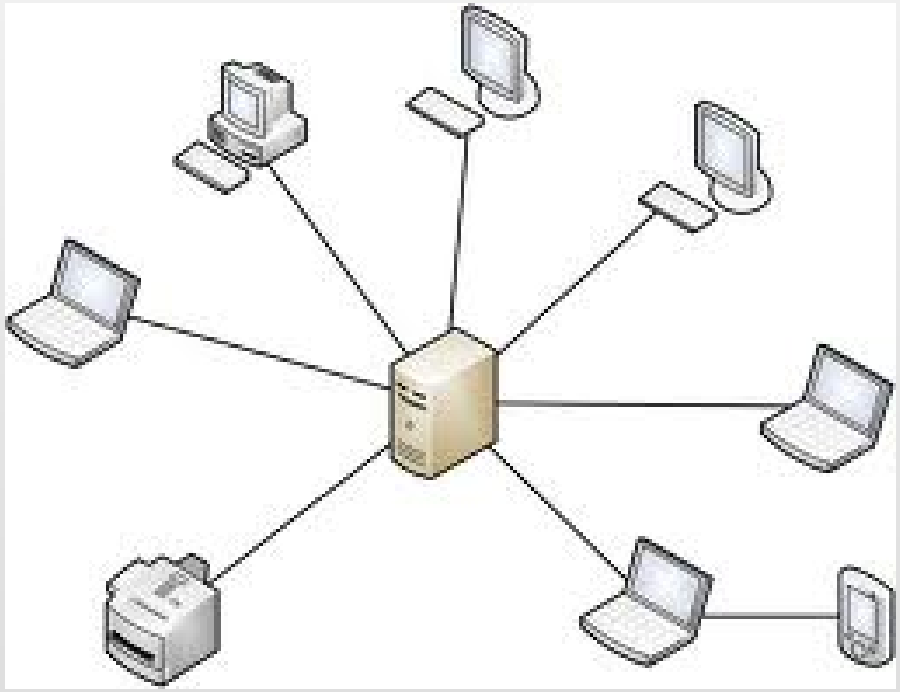
2. Computation is being spread between machines – this is parallelism and initially it was embodied in supercomputers but now is it simply connected through banks/arrays of servers. For example, all the big data centres such as the one Google has in Oregon are configured in this way.

3. The cloud so called because it represents off site storage and computation to an extent fulfils the same role – massive storage and computation but often for individual rather than corporate single users.

4. All this activity is meaning that computation is spreading out everywhere – when computers are everywhere – plugged into ourselves as well as the environment, we will see specialisation – concentration and de-concentration in ways that are similar to physical forms. As yet these are hard to see.

The Client-Server Model, Software, Modules, Apps, Multiple Operating Systems, The Cloud

The easiest to see is the spoke and hub models but some clients can be servers as well and vice versa



There are thin clients and thick or fat clients meaning that in thin clients most of the computation is on the server with the opposite for thick clients. It is a matter of degree and there is even mixing of some functions which are thick and thin within the same client.

A good example of a think client is a graphics terminal – originally all such terminals were thin clients until PCs and other local devices became the way one interacted with remote resources

It is worth noting now that software is breaking up into modules that can be on different servers and clients and with the rise of Apps then dramatic division of labour is occurring in who does what where.

There are many others things that one might ay about contemporary computing and it is worth noting operating systems which are essentially lower level program environments that control the resources on any machine. These are usually tailored to the architecture of the machine much more than higher level programs such as C++ or Java or any of the variety of scripting languages available such as R

It can still be a nightmare to move between OS on different machines – Mac and PC for example. Linux was favoured a decade ago as a general purpose OS but since the rise of handheld devices then there is still no convergence to common standards – not there is android versus iOS for phones and I think Microsoft has its own as well

Plug and Play Software: Big Data and Current Trends

Ok let me finish on Big Data and say a few words about this and send you a short note on Big data and the Smart City that I have just written.

For this we will need an email list of those in the class and I will send you this note tonight

But let me give you some sense of big data, and then finish with something about plug and play and Apps.

<u>Next Time: Next Session</u>

SESSION II: SMART CITIES ARE ABOUT INFORMATION NETWORKS AND FLOWS

4. The Wired City: The Computable City
Graphics, and Convergence of IT and Communications. Automating, Instrumenting, Measuring, and Sensing How We Locate and Move in the City: Where the Hardware Really Resides, The Transformation of Physical Distance

5. Material and Electronic Networks: Transport
Cities as Flow Systems, Coupled Networks, Materials, People, Energy, Information

6. Shapes of Smart Cities
A New Kind of Urban Form, Smart New Towns, The Impact of Networks on Form, Remote Networks, Virtual Forms, Virtual Cities

References so far ……

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George Dyson (2012) **Turing's Cathedral: The Origins of the Digital Universe**, Vintage, New York.

Dava Sobel (1997) **Longitude: The True Story of a Lone Genius Who Solved the Greatest Scientific Problem of His Time**, Walker and Company, reprint, New York

Tom Standage (2007) **The Victorian Internet: The Remarkable Story of the Telegraph and the Nineteenth Century's On-line Pioneers**, Walker and Company, reprint, New York.