

# **30 Years of International Networks**

## **Lessons of the past, visions of the future**

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# The Cross Roads

- **Are at cross-roads of the Internet**
- **Several new Services are starting to use the Internet**
  - **Mobile 3G – as it develops**
  - **WiFi – growing rapidly**
  - **Several huge new countries – like China**
- **Many current services realise new needs**
  - **Security, mobility, multicast, re-configuration**
  - **With backwards compatibility**
- **Internet Governance key issue - Geneva**

# Corollary of the the Choice

- The new services should find present Internet problems resolved
- Can be done by many small fixes to keep present system going
- Better to move over to system that has tried to resolve most of the problems
- **Think next generation IPv6 the way to go**
- What can the past tell us, what does the future hold in the move to IPv6?
- I am using this partly to illustrate how the past can guide us on the future

# *6net* Analogue->Digital Telephone Switch

- **The UK BT tried to go over in mid '60s**
  - Technology buggy
  - Costs too high
  - Abandoned for a decade
- **A decade later technology was right**
  - Transition would be too disruptive on manufacturing
  - Used old arguments to delay change a decade
- **Decade later agreed to move over in 5 years**
  - Moved in 18 months for economics and difficulty of running two systems simultaneously

# Prestel vs Minitel

- Both tried to provide uniform information services
- Both tried to provide the only such services nationally in the 70s
- Prestel failed, Minitel succeeded for over a decade, but then the Web took over
- **Why**

# Minitel vs Prestel/Videotext

~75 - 85

<b>ITEM</b>	<b>Prestel/ Vidotext</b>	<b>Minitel</b>
<b>Terminal Cost &amp; Spec</b>	<b>Medium</b>	<b>Low</b>
<b>Data Provider</b>	<b>Central</b>	<b>Any</b>
<b>Terminal Provision</b>	<b>Full Cost</b>	<b>Subsidised</b>
<b>Provider Network</b>	<b>PSS</b>	<b>Special -&gt; Transpac</b>
<b>Access Network</b>	<b>PSTN</b>	<b>PSTN &amp; Packet</b>
<b>Database Provision</b>	<b>Any</b>	<b>Any</b>

# *6net* The One Slide Comparison

- **Prestel wanted to own the data, Minitel let anyone own it**
- **Minitel provided free universal terminals**
  - On the back of the Directory System
  - Meant cheap terminals
  - Anyone could add data
  - **Thus Minitel successful, Prestel very limited**
- **Minitel provided and required special terminals, net and specific data types**
  - **Thus eventually Web won over Minitel**



# *6net* The Teletex Service ~ 80-84

- Based on Telex plus features
- Attempted to license terminals
- Attempted to restrict directory
- Mandated many features
- Specialised Data Network
- **Failed. Needed special terminals – could have used normal ones, far too regulated, did not allow people to become part of service without central control**



# WAP Repeat of Mistakes

- **Only recently Mobile Providers repeated the early mistakes with WAP**
  - Again they tried to keep all data on their systems
  - Again the data had to be specially formatted for WAP
- **Again the system failed to catch on, the customers wants the services accessed together, the Data Provider wants to offer it once.**

# *6net* Move to IPv6 versus Arpanet

- Clearly we should all go to Next Generation Internet
- In 1971-73, UK Government had zero interest in Arpanet
  - Unless Industry wanted it.
- In 1971/72, British Government was interested only in European dimension
  - Europe Good, US Bad, unless industry wanted it
- ICL said two weeks visit to US was worth more
  - Only British Post office funded it 5000
  - Whole story in [www. england.isoc.org](http://www.england.isoc.org)
- **No other government had interest or were asked**
- Now UK government again waiting for industry call, other Europeans governments more open

# IPv6 Advantages

- **Reviewed IPv4 and made many changes**
  - **Changed address length 32 -> 128 bits**
    - **Removing any future address range need**
    - **Removed need for Network Address Translation**
    - **Allows sophisticated address management**
  - **Made end-end encryption mandatory**
    - **If implemented would improve security greatly**
  - **Provided efficient support for mobility**
    - **Clear WiFi likes it, not so clear on UMTS**
  - **Provided good hooks for automatic config**
  - **Made provision for signalling QoS**

# Concerns at Transition

- **IPv6 not needed, have enough address space, it will not run out soon**
  - Not clear on address space. China growing fast, others also, UMTS would need lots, embedded devices many more
- **The software for transition not available**
  - The stacks are improving fast
  - Most major computer suppliers have stacks
  - Great attention paid to transition aids
- **Applications show little improvement**
  - Most applications can change only the API to the underlying stack – but then do not use new features.
  - Only when done and deployed can you use features

# More Concerns

- **Costs prohibitively high**
  - Detailed costing refutes this – but there are costs, of course
- **There is no proof it would work**
  - There are many medium-scale pilots now – like 6NET
- **It will be years before we need bother**
  - Some countries will make the transition within five years – Japan, Korea, China
  - Many others have transition policy – e.g. France, **US Defence**, UMTS
- **We have heard it all before with OSI in '80s**
  - True, but this is different and much better prepared

# *6net* What about OSI in the 1980s?

- **IP started as a two-man effort**
  - Grew dynamically by peer design, implementation and pragmatic experience
  - Added protocols came from systems needs
- **OSI Protocols designed by international committee without implementation**
  - Change control very bureaucratic
  - Tried to design a complete system
- **OSI adoption attempt by fiat, IP by natural selection**
- **IP provided free on Unix by DARPA support and tested in numerous projects**
  - **OSI not really part of such a wide experimental action**

# Barriers to IPv6 Transition

- Have answered many of the objections, nevertheless there are problems
- The few vital, short-term drivers are
  - Probably Games and Mobile
  - Manageability of NATs and problems of end-end security through time
  - **Reducing Urgency of introduction**
- Investment will be needed ISPs etc
- The consistency of many applications with IPv6 must be verified
- The management of change needed
- The availability of all components needed by a particular organisation must be demonstrated

# NCP-IP Transition

- **TCP time scale**
  - Started 1973,
  - Standardised 1978
  - Pilot Service started 1980
  - Transition 1983 – completed very fast
- **TCP/IP Advantages over NCP**
  - Addresses 256 -> 4,000,000, 000
  - Multiple Networks
  - Transport separated from Network



# *6net* Comparison with NCP ->TCP in 1983

- **Very different situation, 200 Hosts vs 200M**
  - Now impacts all aspects of our live
  - Can no longer take disruptive risks
- **Most manufacturers had no interest**
  - IBM, DEC, UNIVAC supported proprietary nets
  - Now most have IPv6 suites – e.g. Microsoft, IBM, Sun, Cisco, Juniper and can support IPv6
- **Switch was sudden, no gradual transition**
  - Though UCL service transitioned early
  - This time co-existence will last many years
  - Dual-stack working is expected
  - Gateways will be there from the beginning



# Some Similar Results

- **Some older machine will not change**
  - There will be transition services for a while
  - Newer machines will be put in IPv6 only
  - The cost of running two sets of systems at the same time will encourage faster transition
- **Whole systems like UMTS and some large-scale deployment of WiFi may be IPv6 only**
  - But IPv6 features used may be very limited
- **After initial burst of getting applications moved as before, will use new features**

# Disruptive Tendencies

- **Security will remain serious problem**
  - Many Government agencies do not want too much end-end encryption
  - Fought against uniform systems in the past, after September 11 may do so again
  - Some strong industry pressures against IPSec and MIP. Mobile companies want to use SIM-based security under their control
- **Users likely to press for similar facilities irrespective of mode or place of access**

# Some Unresolved Issues

- **Now many large legacy applications**
  - If well designed, little problem in moving
  - Some 6NET cookbooks addressing this problem
  - Sometimes have poor network-code separation; can give problems
- **When to adopt and when adapt**
  - Much can be done by adaptation gateways
  - Eventually adoption is more efficient and requires much less maintenance
- **Which higher-level standards must migrate**
  - A key debate in the IETF, 3GPP and elsewhere

# *6net* Naming, addressing and directories

- Obviously the 128 bit address space of IPv6 will have major impact in Internet
- IP telephony is clearly happening
- What will be the impact on an integration of IPv6 addresses, telephone numbers, web addresses, e-mail address, security certificates and documents
  - Currently DNS is simple, but deals only with 1<sup>st</sup>
  - Enum deals partially with the second
  - An integration of these and document stores would have immense impact



# The Information Network

- **The Internet has metamorphosed from a data network to a vital information and transaction network**
  - **Most other communications-based services are moving onto the Internet**
  - **E.g. Telephone moving onto it, Telex has disappeared**
- **My main thesis on the move from IPv4 to IPv6 impacts only the basic network**
- **Far greater changes can be expected in the mechanisms for information provision – and their control**
  - **Of course these changes will have major impacts also on protocols and components**

# *6net* Needs in Information Dissemination

- **Some countries and organisations wish to limit access to the information**
  - Pornography, SPAM and Viruses acceptable reason for limiting Internet content
  - Some countries' more concerned with limiting access to potential opposition
  - Currently some limit access to sites – but not usually to search engines
- **There is major concern on SPAM, Data Privacy, Caches and use of Cookies**
  - The approach to these have national scope, but the Internet does not
  - There may have to be support in the protocols and regulatory framework

# *6net* Finance, Taxation and Governance

- **Until recently taxation and duties could be decided and applied nationally**
  - It is no longer possible with the present Internet
  - Even if certain transactions look at the source of the transaction, dummy accounts could easily be set up
- **Legal sanctions are normally applied where the offence took place**
  - With Internet Fraud, SPAM, Privacy violation, this may not be adequate
- **Governance – Efficiency versus International**



# Summary

- **One set of changes which must occur is the transition to IPv6**
  - We should all understand its impact.
- **Far more fundamental changes will occur as the Internet is recognised as the Information and Communications network**
  - Here there will be immense technical impact – but also on the legal & regulatory environment
  - Even new sanctions may have to be devised