tronic networks" (Kelly, 1998, p. 2). A concise summary of the skills needed to function productively in a knowledge economy is given by the Ministry of Economic Development in New Zealand:

"Know-why and know-who matters more than know-what

There are different kinds of knowledge that can usefully be distinguished. *Know-what*, or knowledge about facts, is nowadays diminishing in relevance. Know-why is knowledge about the natural world, society, and the human mind. *Know-who* refers to the world of social relations and is knowledge of who knows what and who can do what. Knowing key people is sometimes more important to innovation than knowing scientific principles. *Know-where* and *know-when* are becoming increasingly important in a flexible and dynamic economy."[2]

Personal knowledge management skills as well as a knowledge management infrastructure for the organization or professional body supporting knowledge workers are critical to the learning needed for a knowledge economy.[3] The National Health Service in the UK for example identifies personal knowledge management skills for those in the healthcare professions as including: skills in asking the right questions; searching skills including in defining and identifying the sources of evidence it is appropriate to search for when faced with a particular decision; storing information for effective reuse; and being able to critically appraise the evidence that is obtained.[4]

All of these relate to new approaches to learning in which technology is a constant tool, and from these to a transformed model of education.

Given this societal context, the need for schools, higher education, professional development, and corporate learning to change is obvious. The World Bank (2003) contrasts traditional learning with learning for a knowledge economy as moving away from the teacher and textbook as sources of knowledge towards the teacher as a guide for finding and interpreting real-world information; away from learning being delivered to learners who receive it toward learning by doing and participating as close to the real world as possible; from assessment being based on responding to questions with pre-determined right and wrong answers

[2] http://www.med.govt.nz/pbt/infotech/knowledge_economy/knowledge_economy-04.html

[3] See for example, the portal of resources at http://www.sveiby.com/library.html

[4] See http://www.nelh.nhs.uk/ebdm/knowledge_individuals.asp

to assessment being based on competence development as documented by a variety of forms of performance including those that require integrating one's work with the work of others. Developments in higher and professional education as well as corporate learning are gradually occurring that reflect these shifts. Information and communication technologies are necessary tools, but only when used in ways appropriate to the ways people will work and learn in a knowledge economy.

Much of what is currently called e-learning, where a computer system selects learning objects for knowledge transfer, is in fact counterproductive to the development of competencies for a knowledge economy. The following examples show interpretations of e-learning that, in contrast, relate to the competencies needed for functioning productively in a knowledge economy.

Examples from Professional and Higher Education

Corporate: In corporate settings, the benefits of informal learning including with knowledge management tools and resources are well known, but corporate training still tends to operate via traditional models reflecting a knowledge transfer orientation. Much of what is called e-learning in the corporate sector involves providing knowledge transfer through the computer so that the employee does not have to "attend" a classroom session itself oriented around knowledge transfer from the expert to the learners. Such an approach to learning, while speeding up and personalizing the knowledge transfer process, will not lead to the sort of transformation that is called for in a knowledge economy. Instead at Shell International Exploration and Production (Shell EP) an approach to e-learning in which participants in courses make use of the skills and tools of knowledge management and learn from each other related to their actual workplace problems and experiences has emerged in over 70 courses since 2002 (Margaryan, Collis, & Cooke, 2004). Because participants in the courses represent many different backgrounds and experiences, these differences are built upon to improve the process of learning from each other. For example, one course brings together experienced well engineers and geologists who must work on multidisciplinary teams in the workplace in order to identify new sources of oil. While each of the participants needs to update himself in his own discipline, he also needs to work productively with his non-discipline colleagues. Thus the course is organized around a model of participants contributing resources and

sharing experiences via company knowledge management systems and a common course Web environment during the first portion of the course while still remaining in their workplaces, and then when coming together for a one-week face to face session still using the Web environment to support their working in multidisciplinary teams. While in the classroom component they deepen their own discipline knowledge by learning from the contributions made by the others in their discipline to the Web environment. But they also take responsibility for helping their non-discipline teammates to be able to adequately understand and explain different perspectives to the workplace problems. Assessment is based on how efficiently and effectively this knowledge sharing, building and coaching takes place.

The sorts of e-learning involved in Shell EP do not emphasize the use of e-modules oriented around knowledge transfer, although these are available to support the knowledge-building processes. Instead Web technology is used to support the knowledge sharing, knowledge building, and coaching activities of the participants, as well as to integrate the organization and assessment of these activities in an efficient and manageable way accessible to everyone in the course from their own workplaces.

Professional development: The ongoing professional development of practitioners outside of a particular corporate setting is predominately a matter of life-long learning where there may or may not be professional accrediting bodies or societies to steer the learning process. Here the role of *communities of practice* for learning becomes essential. Etienne Wenger describes a community of practice as being "formed by people who engage in a process of collective learning in a shared domain of human endeavour…" where "members engage in joint activities and discussions, help each other, and share information. They build relationships that enable them to learn from each other" (http://www.ewenger.com/theory/index.htm). Thus communities of practice are important to ongoing professional development.

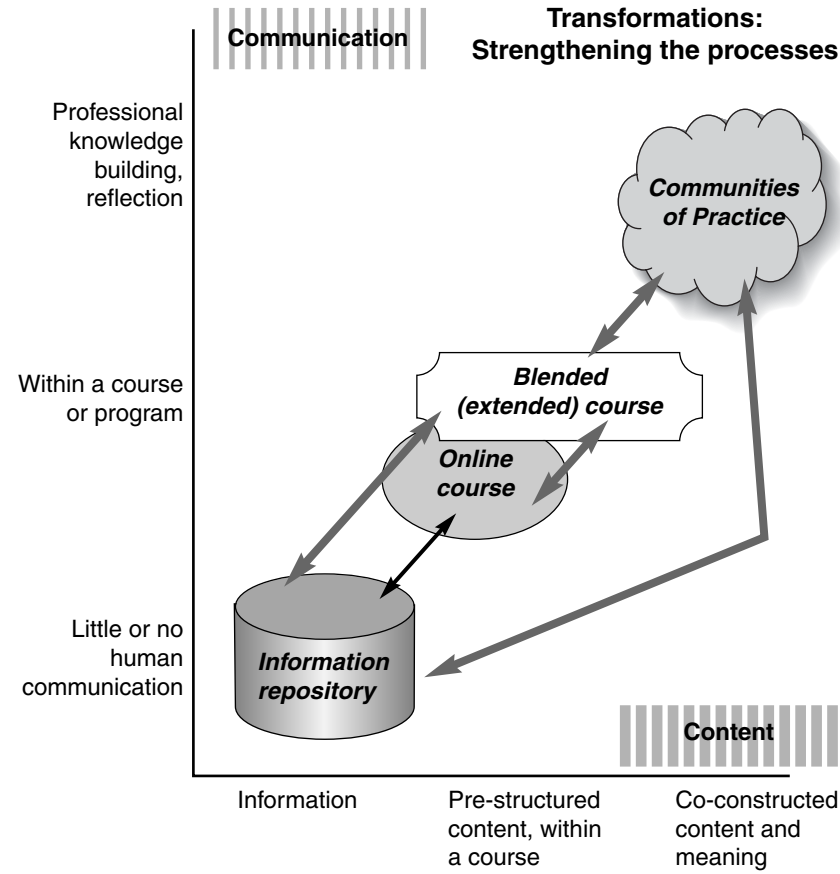
In a review of best practices in 2000 for professional development (Bowskill, Forster, Lally, &McConnell, 2000), the importance of the use of electronic networks for on-going professional development was highlighted. Key strategies include:

- The use of guests or experts from within the communities, for example as guest lecturers interacting with others via the use of online tools. The interactions may be in preparation for a

face-to-face event or may be in response to specific requests for help or support;

- The use of shared archives, such as those from online discussions, from workshops, from knowledge management systems, or from other forms of contributions from the members of the community of practice;
- Mentoring and coaching, supported by online resources and tools.

Figure7.1 E-learning in terms of content and communication with communities of practice representing the intersection of the richest forms of each



Source: Collis & Moonen, 2005.

For all of these, network tools provide access to the community over time, distance, and depth. Such communities can also contribute to the learning of others not (yet) active in the community, for example through making their archives available via the Web or an intranet, or by engaging young professionals still in training into some of the dialogues and dynamics of the community. Figure 1 shows how such interlinkages can involve communities of practitioners with practitioners in training and their instructors.

E-learning is here seen in terms of two dimensions: Content and communication. Communities of practice use communication for knowledge sharing and co-construction as the richest form of e-learning.

Higher education: Electronic portfolios are increasingly being used as reflection and assessment tools in higher education5. There are many definitions for a portfolio from before the time of electronic portfolios, such as "a purposeful collection of student work that exhibits the students' efforts, progress and achievement in one or more areas. The collection must include student participation in selecting contents, the criteria for selection, the criteria for judging merit, and evidence of student self-reflection" (Paulson, Paulson, & Meyer, 1991, p.60). An electronic portfolio uses electronic technologies, allowing the portfolio developer to collect and organise portfolio artifacts in many types (audio, video, graphics, text) in a way that is scalable and accessible over time, distance, and modality. An electronic portfolio provides a comprehensive storage medium for the results of individual assessments, accommodating a potential variety in the instruments themselves as well as providing assessment opportunities at different time frames and for different performance indicators, in particular indicators dealing with less-tangible results. There can be a number of different levels of use of electronic portfolios, such: (a) a collection of artifacts, (b) collection of artifacts with reflective statements, (c) the previous with self-assessment, (d) a course-centered portfolio, (e) a program-centered portfolio, (f) a standards-centered portfolio, and (g) a learner-centered portfolio. At the University of Twente in the Master of Science program for Technology in Education and Training, the use of electronic portfolios goes beyond the benefits for the individual student. Students set up their portfolios not only to provide evidence of their own individual growth relating to the competencies of the program, but also develop a portion of the portfolio as a learning resource

for students who will enter the program in subsequent years, helping them to understand what the competencies mean in practice.

For uses of the electronic portfolio that involve accessing the resources in a scalable and convenient way, network tools are needed, thus electronic portfolio use becomes a form of e-learning.

Affordances and Barriers

These examples illustrate how the social and technical developments of the knowledge economy can be applied to different learning settings, within formal courses and programs and for informal professional development. Network technology, particularly including groupware tools and tools for self-expression, provide key affordances. However, there are many potential barriers. For example, for the use of electronic portfolios to make an impact in education, standards and procedures for integrating these as assessed processes and products within courses and accreditation procedures are needed and must be applied in a consistent way for marking and grading. These processes will be new for both instructors and students alike, and can lead to uncertainty, excessive time demands, and disputes relating to grading decisions. From the institutional perspective issues relating to the cost of the electronic tools, the management and monitoring of the network systems involved, and security are issues that must be handled.

More generally, for the instructor or trainer and the learners, new roles and processes must be accepted and managed and for universities, training centres, and accreditation bodies new flexibilities must be introduced. The skills and insights for participating in a variety of knowledge communities over time and distance need to be stressed and assessed as much as (if not more) than the acquisition of knowledge. Fundamentally this may lead to a clash among cultures in an organization. The organisational cultures of the e-learning contexts can be seen as worlds where different values and attitudes can be applied (Boltanski & Thevénot, 1991). The organisation culture is a key variable in the motivation for why a transformation might take place. Boltanski and Thevénot (1991) describe six different cultures within organisational contexts. Table 1 shows the characteristics of these different worlds in terms of features which are relevant for the transformation of an educational organization from traditional to knowledge economy orientations.

Table 7.1 Relevant characteristics of the worlds (Strijker, 2004, adapted from Boltanski & Thevénot, 1991)

	Verbs	Value Features
The Industrial World	To organise, to control, to formalise, to standardise	Efficiency, performance
The Domestic World	To behave; to respect traditional roles	Responsibility, convention, hierarchy; rules
The Civic World	To debate, to gather, to inform	The group, collective action, collective entities
The World of Opinion	To convince, to persuade	Reputation, credibility
The Merchant World	To buy, to sell, to negotiate, to deal, to rival, to accumulate	Business; competition, rivalry
The World of Inspiration	To create, to discover, to research	Singularity, innovation, originality

An organization that reflects the Domestic World, as is the case with many higher education institutions, will not be transformed with a model of e-learning that also reflects this world. Instead, the examples relating to the knowledge economy that have been mentioned here are closer to the World of Inspiration. A mismatch of cultures can prevent the realization of e-learning initiatives (Strijker, 2004).

The knowledge sharing communities in large organizations, supported by knowledge management tools and processes and effective coaching and mentoring in the workplace, are the closest current match to the requirements for productive participation in the knowledge economy. In such corporate settings, the need to adapt to the changing business environment is a strong motivator for change and for new models of organizational learning. However, such models of learning oriented around knowledge sharing, management, and co-creation are infrequently seen in higher education. For a transformation of education to occur national policy and accreditation processes and institutional assessment and degree requirements will need to better reflect the societal transformation that is already emerging. And network technologies must be used for "know why," "know who," "know when," and "know where" much more than "know what" in the primary processes of education.

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Chapter 8

Reshaping the State and its Relationship with Citizens: the Short, Medium and Long-term Potential of ICT's

Geoff Mulgan

Introduction

Government has always been concerned with information and communication as much as control and coercion: writing was born out of tax collection, bureaucracy was pioneered as a means of managing territories and people with the use of records, commands and intelligence (the very word statistics comes from the German 'Staat'), and all states have paid close attention to rituals and propaganda.

Each wave of technology has changed the options available for the organisation of government, shaping how much can be managed, delegated, commanded or coordinated, and there has been a coevolution of techniques of governance—the new knowledge of professionals, methods of raising taxes, measuring and monitoring—and of communications technology, such as scripts, roads, telegraphs, satellites and more recently the web and the grid.

This evolution has not always been fast. It took over a century from the invention of the telephone to its widespread application to government services—for example placing nurses backed by diagnostic software in call centres. But the last 10-15 years have brought a dramatic acceleration (albeit one that has probably slowed in the last 2-3 years) in the application of new technologies making use of the web in and around government, an acceleration accompanied by a probably unprecedented, real time, running commentary from academics and consultancies.[1]

[1] For example Accenture, *E-government leadership: High performance, maximum value* (London: Accenture, 2004).

In terms of the maturity of applications the front runners remain Canada, the US and Singapore; but there are probably some 8-10 countries at roughly similar stages of development, often making parallel mistakes, but steadily transforming the day to day business of government. E government is a perfect example of the rapid trend towards continuous benchmarking by governments and the acceleration of cross-border learning, albeit much less tempered by hard evidence than fields like macroeconomics and labour market policy (and more vulnerable to hype from vendor companies).

This paper draws both on international and on UK experience and aims to show that the question of e government is inseparable from broader questions of government: how it is evolving, in response to what forces, with what tools, and taking what shapes. I suggest a framework for assessing impacts in terms of public value. And I suggest that some of the most promising developments involve a shift from government providing structures, to government providing infrastructures on which more diverse forms of social organisation can be based.

Public value and e.government

Grandiose claims have been made for e.government, including that it would deliver:

- Major efficiencies
- Increases in overall societal productivity and competitiveness
- Transformations in the relationship between citizen and state

The now familiar distortions of rhetoric that have accompanied ICTs for several decades have been present again during the phase of major investment in e applications. Behind these claims the central issue for any state is whether e applications contribute to legitimation—the trust that is essential to collecting taxes, electoral success and the day to day functioning of government. This legitimation can be understood more precisely as an activity of value creation by the state. Broadly speaking states that create public value will tend to be legitimate, able to act, to recruit, to persuade citizens to share information and so on. The fundamental issue of e.government is how much it creates—or destroys—public value.

This question of public value has been the focus of a good deal of recent work. The core arguments of public value theory[2] are:

- that in democracies states exist to create and add public value—meeting the needs and wants of citizens
- that value is generally provided through a combination of: outcomes, services and trust (or the quality of the relationship between states and citizens).
- that public value has to be constantly discovered through politicians and officials interrogating public demands, discovering relative priorities
- that this value is different in nature from private value, and from the conventional accounts of welfare economics, in part because it is shaped out of dialogue and politics rather than existing as an objective reality
- that a clear understanding of value has to come prior to any meaningful discussion of efficiency or productivity (otherwise reforms which appear to increase efficiency risk destroying value).

E government has evolved as a means of contributing to value in all three areas—outcomes, services and trust—and this provides a useful rubric for understanding its evolution, assessing its current and future performance, and avoiding the pitfalls of technological determinism and hype. It also provides a helpful counterweight to overdetermined accounts of ICTs in government which postulate very general new principles linked to the broader evolution of a knowledge society or economy: instead, as I will show, some of the directions of change are contradictory.

[2] Summarised in Creating Public Value by Mulgan, Kelly and Muers (Strategy Unit, Cabinet Office, 2003); other relevant literature includes Mark Moore's book 'Creating Public Value' published in 1995, and a special issue of the Australian Journal of Public Administration

Outcomes

First, outcomes. The following are some of the varied ways in which the broad family of e.government applications can assist governments in the achievement of outcomes for which they are held accountable (such as lower crime, unemployment, better health &c):

- The simplest applications are models of information provision that help to deliver superior outcomes—for example online systems that provide comprehensive jobs databases have helped employment services to improve their outcomes in Sweden, the US and other countries. Often these have required new kinds of public private partnership.

- Somewhat more sophisticated are online curricula that assist home based working. These are beginning to have an impact, building on the various public and private on-line learning services now available (ranging from the UK's National Grid for Learning and Open University to the University of Phoenix and the plethora of private distance providers). They can provide a base of common knowledge, along with diagnostic tools as well as learning.

- Within public services a growing impact is being achieved by much more transparent performance data: a well known example is the use made of crime statistics for regular peer review sessions and performance management in the New York COMSTAT system. In the UK there is now web access to near real time performance data on schools, police forces, hospitals and welfare providers. This sort of transparency is still resisted by many professions.

- A panoply of policy measures have been tried out to enhance knowledge intensive economic activity. Despite many false starts (for example in the promotion of clusters and technopolises) these have become increasingly sophisticated: the ICS Polynet project led by Sir Peter Hall and conducted for the European Commission will show the rapidly evolving synergies between different advanced business services and the interplay of communications bandwidth, regulatory environments, transport (air and high speed rail), key institutions (big firms, markets and universities) and labour markets.

- Within fields of public policy we are beginning to see the use of more sophisticated knowledge management systems to spread best practice, research findings and organise communities to share tacit knowledge: the Cochrane collaboration provides one end of this, the UK NHS health collaboratives are another example. Private sector experience with knowledge management has been decidedly mixed; these public examples too involve major issues around culture, incentives and day to day practice. The networks of mutual learning established in the UK around programmes like Surestart (for under 5s) and the New Deal for Communities (regenerating poor areas) are good models for the future.

- Some governments are using more sophisticated tracking of data to improve outcomes. In the UK the move to tracking of all children at risk is an important—and controversial—example. One of its potential virtues is that it enables much more holistic organisation of government across organisational boundaries.

- Looking further ahead there are major potential gains to be achieved from the application of grid computing to efficient outcomes—mapping patterns in real-time using data collected from medical trials or public services in order to accelerate learning.

- Finally, a longer term implication of some current applications is to make knowledge more widely available not just to professional practitioners but also to the public in order to improve outcomes. In the UK NHS strategy is based in part on an assumption that the public will over time take greater responsibility for their own health, supported by online diagnosis and information systems; easily organised forums to bring together people with similar conditions; and wider understanding of the links between personal behaviour and health outcomes.

In all of these areas egovernment is bound up with the broader trends towards making government more consciously knowledge based, shaped by evidence, and also providing much greater quantities and quality of knowledge for society and the economy to organise themselves.

Services

The second area of public value, services, has been the main focus of rhetoric about e.government in recent years. Much of this has primarily drawn on consumer models of service delivery, themselves often drawn from manufacturing.

Uses of e applications in services have tended to follow a fairly common pattern of evolution running from:

- Information—provision of websites containing existing information, some of which is banal but where in some cases even quite modest measures like making all health inspections of restaurants available online can have a big impact in terms of public value

- Communication—for example NHS Direct providing online diagnosis, or the moves to brigade different services together in more interactive ways; providing frontline staff (eg police officers, housing repair teams) with PDAs and other mobile devices to speed up response to public issues.

- Transactions—for example putting all financial transactions online as in Singapore (where most transactions can be performed online, including payment of fines and taxes); Australian visa services which are fully electronic from end to end; or the UK's Courts OnLine service which allows citizens to launch minor cases in a purely electronic way.

- Open access—moving beyond functional transactions to enrich service delivery cultures through allowing many more comments and informal knowledge to be combined on the web.

- In the longer term offering users the means to pull together a mix of elements to customise services to their own needs. The UK's Direct Payments model for the disabled is one variant of this: providing a choice over mixes of money, service provision all backed up by both face to face and online information and help. These models come closer to the service approaches favoured in premium areas of the market—highly personal, responsive—and move further way from the mass models still predominant in most private sector service.

Canada has probably gone furthest in the deliberate targeting of user satisfaction with services, addressing the 5 main drivers of satisfaction (timeliness, knowledge, extra mile/smile, fairness, and outcomes) and showing a steady improvement between 1998 and 2002 at every level.

These evolutions of service delivery models raise some difficult issues. One is that each further state of evolution requires some shared data systems across organisational boundaries, and some common protocols. Some countries have felt able to adopt unique identifiers as in Finland; but in many others there is insufficient trust in the state to allow this. Another is that integration of services across boundaries may be easier for non-state organisations given the nature of bureaucratic and professional interests: those states most willing to allow porousness across boundaries may reap gains fastest. A third is that these all enable more networked organisational structures with greater decentralisation of operational decision making in ways that are likely to threaten the power of middle tiers.

All are in part about altering the mix of channels to maximise public value—which implies automating some services and intensifying the personal nature of others.

Trust

The most difficult area of public value has always been the third—trust. Here, the development of e government is bound up with the broader opening up of the state to scrutiny, and the changing nature of the conversation held between states and the public. The picture is complex. Most citizens relationships with states are abrupt, unsatisfying and disjointed—voting in an election, serving on a jury, receiving schooling, being paid pensions and so on.[3]

There have been some common moves to reframe the environment for trust, including:

- Greater use of pre-legislative scrutiny, with legislation online prior to its agreement

[3] See Touching the State, Design Council, London, 2004

- The move towards permanent consultation and conversation[4], bound up with the spread of Freedom of Information legislation. Governments are to some extent being turned inside out as previously secret performance information becomes public.

- Methods of policy making with wider communities involved—for example the relatively open methods used by bodies like the UK Strategy Unit, including publication of project plans and working papers; likewise at local level the normalisation of online committee timetables, minutes, webcasts &c

- Changing practices in politics and parliaments, as politicians open themselves up to email, dialogue (and learn to cope with new ways of orchestrating campaigns). The British Labour Party's Big Conversation designed to help frame its forthcoming manifesto is an interesting example of a new approach both to face to face meetings and to use of the web

- New vehicles for citizen involvement—such as the BBC's very successful iCan project; mysociety.org which is producing social software such as theyworkforyou.org which provides easy access to all elected representatives; and upmystreet.com's geographically tagged message boards

- Social programmes addressing digital divides (cheap or free computers; access to institutions; training programmes);[5] the UK now has near universal access to free internet (via some 6000 government supported sites in the UK)

- Wired neighbourhoods—encouraging greater mutual support and social capital (building on findings such as Keith Hampton's study of Toronto in the late 1990s which showed that residents who were connected online had far more day to day interaction with other residents than those who were not connected).

[4] For example the UK's rule of 12 weeks consultation on policy proposals

[5] Engaging the community in e-government: a briefing paper from the Strategic Support Unit (Improvement and Development Agency, 2005)

All of these are in part about changing the nature of the conversation between state and citizen—making it more reciprocal, open and nuanced. However, these trends are complex.

i) Greater transparency combined with aggressive news media can reduce trust (as some countries have learned with FOI).

ii) there are complex dynamics in public engagement—sometimes as in Porto Allegre public expectations can rise so fast that even successful programmes of involvement can lead to disappointment

iii) Analysis of trust in public institutions shows that the key determinants are how institutions behave—competence, integrity, speed of admitting mistakes—rather than any more structural trends.

Tensions around outcomes, services and trust

Outcomes, services and trust can be closely linked. In several countries the major barriers are now perceived to be public take-up rather than government provision. This of course raises the question of whether they are right to be sceptical of the offers being made. A related issue is whether the key barriers are questions of trust, in particular confidence in government's commitment to confidentiality. In some countries this may require stronger principles to underpin use of personal data—for example that identifiable personal data should remain under the control of the individual; guarantees of maximal anonymity to organisations providing data to governments; and strong sanctions for misuse of data.

This is just one of many complex ways in which trust, outcomes and services interrelate. In some countries the paramount issue is security against threats; where government is seen to respond inadequately one result may be greater mutual public distrust. Legitimacy therefore depends on often quite coercive enhancements to surveillance, with crime, DNA and other databases, linked together in ways that often conflict with privacy and civil liberties concerns.

Some of the key improvements in services and outcomes depend on there being sufficient legitimacy to impose strict common standards. There is a long history in communications of new categories liberating everyday relationships and strengthening community: the Penny

Post invented by Rowland Hill in 1840 required consistent addressing systems for every building in Britain; half a century later the telephone required consistent numbers for every building too, yet amidst this radical standardisation new scope was given for an infinite diversity of conversation, care and love. Similarly imposition of some common protocols in IT, and maximising interoperability, is coming to be the most important priority for innovation in technology. This implies a partial swing to greater centralisation.

Another link is that legitimacy and trust depends on value for money in delivering outcomes and services, yet IT programmes have been notorious for overrunning on costs. The UK NHS modernisation programme for example, the largest single IT project globally, has recently been estimated to cost £30bn, twice the earlier estimate. Part of the problem in securing reliable estimates is that many of the potential benefits flow from radical, and unproven, changes to organisational structures—allowing much greater decentralisation within tighter frameworks for accountability, performance and financial control. Different models for organising purchasing also appear to have achieved very different levels of value for money. [6]

The many measures to address inequality and exclusion also bring their own contradictions. Many past ICT programmes subsidised or provided hardware without any evidence of demand and this error has been often repeated under the rubric of tackling the digital divide. Few if any of the programmes offering technological solutions to what are essentially social problems have worked: informal social connections continue to be much more important than physical access in terms of opportunities; and many expensively provided networks have remained underused or used for very different purposes from those intended.[7]

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[6] Dunleavy P., Margetts H., Bastow S. and Tinkler J., 'Government IT performance and the power of the IT industry: A cross-national analysis' (Paper to APSA 2004 Conference).

[7] I have written many pieces on this topic, including 'Communication and Control: networks and the new economies of communication (Polity, 1991). A good recent overview is William Davies, 'Don't assume that improving IT alone will breach the digital divide' (*The Times*, 25 January 2005, available at www.ippr.org.uk)

Radical, systemic and incremental innovation in egovernment

This leads to the fundamental issue of the nature of innovation. Much of the daily reality of e.government has been distinctly incremental and cautious, despite ambitious rhetoric, and the impact on underlying state structures have been extremely limited.

This has also been true in the past of uses of communications technology in and around the state. A good example is the use of television in tertiary education: proposed by Michael Young in the UK in the late 1950s, introduced a decade later in the form of the Open University, and subsequently used by very large numbers of students. However, the practices of existing universities continue to be almost untouched, and not a single UK university uses OU course material (other European universities have been equally conservative in their methods).

In the same way most of the new models for using ICT in public services have been introduced alongside older models rather than displacing them—in the UK for example, Learndirect sits alongside traditional further education colleges. The reasons have to do with funding structures (which do not fund outcomes); power; and professional cultures.

For many years observers have commented on the scope for radically different organisational models of service delivery, combining transparency, accountability, decentralisation, and shared platforms. These promise a future of much greater citizen control over processes and services, supported by a mix of online, telephone based and face to face support, as well as greater front-line autonomy.

However it remains the case that there is not a single example of an entire public services that has been radically reengineered to make the full use of new technology. There are some good reasons for caution—risk, uncertainty and the likelihood that significant customer groups would not be able to use new technologies. But vested interests are also a large part of the explanation, as a result of which the new is added as a layer on top of the old, thus making it impossible to realise efficiency gains. This is part of a general feature of governments—that they find it easier to start programmes than to stop them—and a general feature of reform that it has to involve some contestability, and some creation of new structures of power to challenge the old.

Future issues

Looking to the future three areas of possibility stand out, all of which raise important questions about the radicalism of innovation and the potential of European governments to take advantage of future opportunities:

- One is the likely growth in the role of third parties acting as validators of information; as holders and managers of personal data; and as designers and managers of public data and online services. A good example of the latter is the role of upmystreet,com in providing superior local public information to anything provided by the UK public sector. The growing power of third parties may be extremely challenging to some governments and even further erodes government's monopoly even over its own information.

- A second is the potential for open source methods. The term 'open source' has been much misused, and much of the potential of open methods in the public sector is rather different from the specific characteristics of open source in fields like software, encyclopedias and news. However, there is great potential for governments to open themselves out; to make previously internal management information external; to extend the open principles of coordination that have been used in the EU to every aspect of public organisation; and in some cases to extend open methods to fields like legal services. Again the implications may be threatening to existing interests.[8]

- A third is the further evolution of government towards matrix models of organisation, with as much structured horizontally as vertically to meet the needs of population groups or to solve problems. This has long been the promise of ubiquitous communications. The UK has made extensive use of horizontal budgets, ministerial roles, task forces and targets (under the label 'joined up government) on the premise that unless the main drivers of governmental behaviour—budgets, political

[8] The forthcoming paper 'Wide Open' by Geoff Mulgan and Tom Steinberg (Demos 2005) explores the potential for open source methods and proposes a new terminology for differentiating its various meanings.

rewards, targets—are aligned to horizontally change is unlikely to happen. Finland has attempted to integrate horizontal goals much more deeply into government strategy. The US attempts to integrate intelligence and security operations are another current effort.[9] Stronger internal IT and knowledge management systems make it possible for government to become much more flexible, more task and project oriented, breaking away from classic administrative structures. However, most European governments remain traditionally organised into functional silos and change requires strong political will.

Conclusions: public value and the state as infrastructure

The broad future technological trends around e.government are reasonably predictable—more abundant bandwidth, capacity and speed; further digitisation; further miniaturisation; blurring of boundaries between hardware and bodies and biology; personalisation; more intensive conflicts over property rights and privacy; widening use of grid technologies. The precise forms that will be taken by technologies and their uses are far harder to predict—as recent experience over texting, blogs and mobile devices has shown.

But the bigger idea that lies behind many of the trends in e.government is not so much a technological idea. It is rather that states are reshaping themselves to be less structures that directly provide services or achieve outcomes; instead they are becoming more like infrastructures, orchestrating complex systems with greater capacities for self-organisation, and engaged in co-creation of outcomes with citizens and civil society. This requires strong provision of common protocols; easily useable public systems; and legible underlying rules. Some of the effects will be to make government less visible—with more complex underlying processes but simpler interfaces. Some of the effects will be to make government more modular (for example in the design of funding, support systems and care), as part of the broader personalisation of the welfare state—maintaining principles of equity and universality but allowing much more variation and personalisation within the system.

[9] Partly prefigured in Fountain Jane E. *Building the Virtual State: Information Technology and Institutional Change* (Washington DC: Brookings Institutions, 2001

This is the radical potential of e.government. It promises both greater differentiation and greater integration: differentiation of services and public relationships, alongside greater integration in achievement of outcomes, service design and social inclusion. To the extent that it does this it contributes to public value, and more broadly to the productive contribution of the public sector to the wider economy.

Part IV:
Media, Communication, Wireless and Policies in the Network Society

Chapter 9
The IP TV Revolution

Jonathan Taplin

Introduction

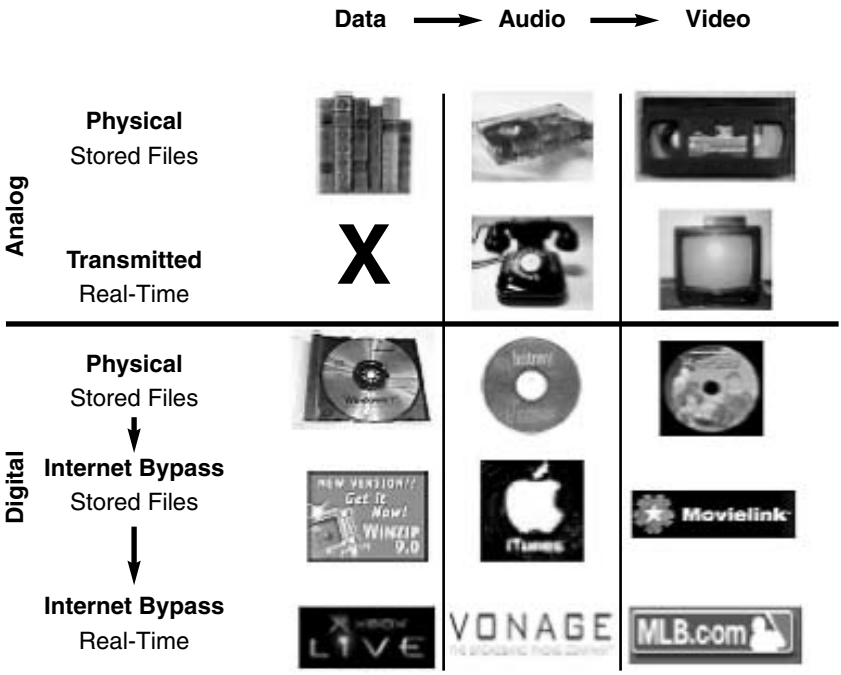
This chapter outlines the critical transition from a media world of analog scarcity (a limited number of broadcast channels) to the coming world of digital abundance where any maker of content (films, music, video games) could have access to the world's audience through a server based on demand media environment. Today, all of the technical innovations needed to rollout this IPTV (Internet Protocol TV) system are in place. What is missing is the information policy initiatives which are being held up by entrenched powers frightened of change. This paper seeks to clarify what the new environment would look like and how the transition to IPTV could aid all of the existing media stakeholders. We believe that the new environment would also enable an explosion of creativity as the distribution bottleneck that has existed for one hundred years of media history could be unlocked.

The Analog to Digital Transition

The realization of a transition from the world of bandwidth scarcity to a new world of media abundance could not have happened without the seminal transition from analog to digital. The import of this can be seen in the chart below.

As we move from the analog age of videotape and broadcast TV, the ability of content owners and independent filmmakers and musicians to reach their audiences without needing the distribution power of multi-national media companies has important meaning for the future of an independent media system. To understand the transition to a Media On Demand age enabled by Internet Protocol, it is first necessary to understand the role of the traditional media powers.

Figure 9.1 Analog to Digital Transition



Source Sanford Bernstein & Co.

Background

Since the invention of radio at the beginning of the 20th century, our mass media has functioned in one way. Programmers looked to advertisers to pay for the cost of the media in return for access to the audience for their marketing campaigns. The rise of great multinational consumer product companies (Procter & Gamble, Unilever, Coca Cola, Ford, Daimler Chrysler, Nestle, Phillip Morris) coincided with the rise of radio and then television. This relationship was based on the law of scarcity. In order for Proctor and Gamble to grow it had to turn out an increasing number of basic commodity products (soap powder, toothpaste) whose only differentiation was in their marketing. And they quickly found that the only way to differentiate Tide from any other *identical product* was through TV or Radio advertising. In a world of a few commercial broadcast networks that existed on both Radio and TV

in every major country, the *scarcity* of prime time advertising slots led to what William Paley (Founder of CBS) characterized as "a license to print money." For the audience the bargain was simple. You didn't have to pay for programming as long as you were willing to put up with the commercials. The other part of the bargain was that you paid $3.00 for a box of Tide, the ingredients of which cost about twenty-three cents, the remainder being marketing, packaging and profit.

This somewhat Faustian bargain worked well for all parties until about ten years ago. It was at this point that the growth of cable and satellite networks and the intrusion of new privatized broadcast networks began to make it very hard for a single television program to aggregate the mass audience needed for a basic commodity consumer product. Whereas in 1980 an average hit show on France's TF1 could draw 1/3 of the TV audience, today the highest rated program might draw 1/8 of the TV audience. So as the audience got disaggregated, so did the advertising business. A classic example would be MTV. By putting on very cheap programming (they got the videos for free from the record companies), MTV was able to undersell advertising to companies interested in reaching teenagers. This in turn allowed them to create outsized cash flows based on an average audience of about 500,000 viewers for any one program. The risk reward ratio was so great that between 1990 and 2000 over 220 new niche cable & satellite networks were created.

In the late 1990s a second disruptive factor to the classic TV advertising model entered the picture. This was the construction of the worldwide optical fiber backbone. The enthusiasm of the capital markets to supply funding to any entity willing to secure right of way led to a classic oversupply condition the pain of which was shared by both firms and governments. As any shareholder of Cisco, Nortel or Lucent will tell you, there was more than enough pain to be shared. Strategic planners at those three companies as well as many of their competitors and suppliers made one major miscalculation. They looked at the amount of fiber optic cable being delivered in 1999 and 2000 and projected the number of routers, switches, lasers and other gear that would be needed to enable that fiber. They then geared up their production capacity to be able to provide this. And then a curious thing happened. The orders never came. Partially because wave division multiplexing allowed carriers to get as much as 100 x throughput for each strand of

fiber and partially because local Broadband connectivity did not continue to grow exponentially, the backbone providers simply left the "dark fiber" in the ground. So the telecom crash hit both the suppliers (Cisco, Nortel, Lucent) and the carriers (Global Crossing, AT&T, British Telecom, France Telecom, etc).

But what was a problem in 2001 becomes an opportunity today. The conversion to an IP-TV platform is possible because although we have already constructed a completely new way for Media to function in the society, we have chosen not to enable it. It is as if we had constructed the Autobahn in the 50's but neglected to build out the on and off ramps. In the last 6 years we have built an Internet Protocol (IP) based broadband network of such immense capacity that it is safe to say that we will not have to lay another mile of backbone fiber for the next ten years. Qwest, one of the companies that built out the backbone, ran an ad last year where a tired salesman pulls into a motel and asks the clerk if they have movies in the rooms, to which the clerk replies "every movie ever made." This is not an idle boast. Qwest's 34 strands of fiber could technically serve up every movie ever made on demand to every hotel room in the U.S. The only problem is that they have only "lit" four strands.[1] In order to realize such a dream we have only to imagine for a second, the notion of Universal Broadband. Today most western countries have what is called Universal Telephone service, meaning that every household has the availability of a minimum level of subsidized service. The notion would be to extend this provision to data and video. Although the existing build out of Broadband to the home has been progressing well, with Merrill Lynch estimating 110 million worldwide home broadband subscribers by 2007[2], a transition to a new system of IP-TV could only be enhanced by more Universal Broadband service.

Assume that by 2008 every home had Universal Broadband with an Ethernet jack in the wall to which you could plug any browser based IP media terminal (Figure 9.2) connected to a TV monitor with 2 MBPS connectivity capable of receiving streaming DVD quality video on demand.

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[1] Author Interview with Joe Nacchio, CEO of Qwest, November 2000

[2] Merrill Lynch, *Broadband Report Card*, Oct. 19, 2004

Figure 9.2 Nevius Media Center Server

This system would use the one international set of standards (IP, HTML, MPEG) and would not in anyway be "choosing a winner" from the existing competitive technology and media companies. In addition the ability to use the tradition remote control and a Browser ensure a classic TV 'Lean-back" experience (Figure 9.3).

In this world anyone who wanted to "Publish" media would have no more trouble than putting up a web site today. They could sell their programming by subscription, "Pay per view" or give it away for free with targeted advertising. They would not have any "gatekeeper" determining who could reach their audience. Many of the worries about Media Concentration would be seen as the old paradigm of "Scarcity" as opposed to the IP world of total abundance. As the web has shown, no classic media company from the 70's and early 80's is a dominant force on the Internet. Yahoo, Google, AOL and Tiscali are all from a new era and make a lie to the notion that the old-line players always win in an open playing field. While it is clear that the marketing power of major media conglomerates like AOL Time Warner or Viacom/CBS would have huge power in the marketplace, it would be the power to persuade, not the power to control. Needless to say such an open system would depend on maintaining a regulatory stance of Network Neutrality as defined by U.S. FCC Chairman Powell's "Four Freedoms of Broadband"[3]. The EU telecom regulatory bodies have begun to weigh in on this matter and it is perhaps the most critical regulatory issue of our time.

[3] Freedom to Access Content. Freedom to Use Applications. Freedom to Attach Personal Devices. Freedom to Obtain Service Plan Information

Figure 9.3 Media Center Control System

But beyond the entertainment uses of such a network lies the world of education. Both the current Real Networks and Microsoft IP Video Codecs make it possible to publish video at VHS quality at 500 KBPS and DVD quality at 1.5 MBPS. These tools could enable the most important Distance Learning initiative in history. When MIT announced that it was going to allow people to audit it's courses on the internet, it was but one more sign that the extraordinary institutions of learning in our country are ready to embrace IP based distance learning. Not only can kids catch up on their courses on line, but also the whole world of continuing education for adults would be transformed. The fact that the technology companies of every EU country are always trying to raise the number of foreign technology workers they can employ is symbolic of the inability to retrain our workers for the high paying jobs of today. Universal broadband to the home would enable a platform for Universities and private Training Companies to sell their services to the country as a whole.

Now the obvious question that arises is: Why would the current Media Powers whose enormous market capitalizations have been built on a world of scarcity ever allow such a world of abundance to come into being? The answer quite simply is that they would make more

money. To understand this we must look at the five constituents that control the current media universe: Producers, Advertisers, Distributors, Telecom Suppliers and Talent.

Producers

Producers develop, create, and finance programming. Though many Producers are also distributors (AOL-Time Warner, Viacom, Disney, Bertelsmann) it is important to separate the two roles in order to understand the IP-TV Challenge. As an example, let's take Discovery Networks. Originally begun as the Discovery Channel, their task was to buy existing nature programming from around the world as cheaply as possible and package it for distribution under the Discovery Channel brand. This proved to be quite lucrative as the demographic of educated affluent customers attracted to this programming was being sought by higher end advertisers (Mercedes, Merrill Lynch, etc) who were just beginning to move their ads from high end print publications (Wall Street Journal, New Yorker, Vanity Fair, etc) into television. Needless to say for Mercedes to advertise on a Network sit-com was a total waste of money and so the cheap pricing of Discovery Channel was a relatively efficient buy. However, two things happened from the point of view of Discovery as a Producer that has changed the economics. First they began to run out of programming they could acquire cheaply and therefore had to begin producing their own shows at a much higher cost per hour. Second, as the number of cable distribution channels began to grow (and then explode with satellite and digital cable) Discovery believed it had to defend it's brand against imitators and so grew niche networks (Animal Planet, Discovery Health), each of which had to be programmed 24 hours a day, seven days a week, 365 days per year.

Today the programming budget for the twelve Discovery Networks is probably in excess of $1.5 billion per year[4]. Now the audience for this type of programming has not grown by a factor of 24x, so they are basically cannibalizing their own and their advertisers audience. If you extrapolate this out to the universe of almost 300 "Programming Services" on cable or satellite, you can see that the economics of a 500-channel universe will become increasingly tenuous. Discovery

[4] Legg Mason Estimate, July 2004

alone is responsible for programming 105,000 hours of television per year. Even assuming that half the hours are re-runs, the programming will have to get cheaper each year in order for them to reach break-even on the new networks as there is no way the advertiser will continue to pay higher rates for an increasingly fractured audience (the average Discovery digital channel is reaching less than 80,000 viewers per program).

Contrasting this with our Universal Broadband Network, one could easily see how Discovery could cut by half its programming budget and produce twenty great hours of new "on demand" programming a week with extraordinary production values. The most fanatic viewer of Discovery type programming probably does not have more than ten hours per week to spend watching this type of programming. But if they did, Discovery could cheaply archive every single episode of programming it owns and make those accessible on a pay per view or subscription basis. For the viewer, the programming could be watched when they wanted to watch it, with full VCR-like controls and Discovery could offer a "My Discovery" option that would push pet shows to the pet lover and alligator wrestling to the fans of that genre. Since the object of Discovery's business is to sell advertising, it could offer the pet food advertiser very targeted opportunities to not only advertise to the specific audience they wanted, but to also sell their product through interactive ads with e-commerce capability. All of the technology to enable this vision currently is in place. More importantly, the costs of streaming the programming are going through a dramatic downswing (Table 9.1).

Advertisers

The movement of Euros away from the broadcast networks to cable and Satellite networks continues, but this year even cable networks have had to lower their rates. The famous maxim by U.S. department store mogul John Wanamaker that "50% of my advertising expenditures are wasted. I just don't know which 50%" is truer than ever. This problem has been exacerbated by the introduction of the Personal Video Recorder (PVR), originally under the brand name TiVo and now introduced as an add-on to the standard cable set top box. The potential effect of widespread diffusion of PVR's is quite dramatic (Table 9.1) and could lead to a quicker adoption of the IP-TV paradigm.

Table 9.1 Downward Internet Streaming Costs

	Today	End-1 Yr	End-2 Yr	End-5 Yr
Stream: Megabits/Second	0.300	0.300	0.300	0.300
Cost per Gigabyte	$1.150	$0.690	$0.414	$0.069
Annual Improvement		(40)%	(40)%	(40)%
Usage Megabits per Hour	1,080	1,080	1,080	1,080
Gigabytes per Hour	0.14	0.14	0.14	0.14
Cost per Hour	$0.1553	$0.0932	$0.0559	$0.0121
Cost per Streamed Units ($)/Min.	0.0026	0.0016	0.0009	0.0002
Hours of Usage per Day	8	8	8	8
Hours of Usage per Year	2,920	2,920	2,920	2,920
Streaming Cost per Year @ 8-Hr Day	$453.33	$272.00	$163.20	$35.25
Streaming Cost per Month	37.78	22.67	13.60	2.94
Sub. Fees for 40 Basic Cable Nets	7.98	8.38	8.80	10.18
Annual Increase in Subscriber Fees		5%	5%	5%
Total Content and Web Transport Costs	$45.76	$31.05	$22.40	$13.12
Add Cable Op. EBITDA Margin	35%	35%	35%	35%
Total Charged Consumer	$61.77	$41.91	$30.24	$17.72

Source: Sanford Bernstein & Co.

The ability of the Internet to target an audience was seen as a way out of the misplaced advertising trap, but it quickly became clear that the ubiquitous banner ad lacked the basic power of the ad industry: emotion. As banners proliferated, the web surfer simply didn't even see them, much less click through (click-throughs were lower than 1%). A video quality broadband network affords advertisers the Holy Grail; the ability to target like the web combined with the ability to run full screen 30-second commercials that allow interested users to click-through to the e-commerce page of the advertiser. If you are moved by the Gap ad, you can immediately buy the clothes. Furthermore, the ad buyer can specify a demographic target (females, 14-18, in specific zip codes) and only pay for that target. In recent tests with this broadband technology, click through rates on interactive video ads were more than 30%.

Table 9.2 PVR Penetration and Commercial Skipping Estimates

	PVR Negative Impacts	2004E	2005E	2006E	2007E	2008E	2009E	2014E	2016E
	PVR Assumptions								
22	PVR Penetration	6%	11%	16%	20%	22%	25%	25%	35%
23	PVRS @ Year-End	7	12	18	22	25	28	42	46
24	Growth of PVRs	103%	85%	50%	22%	14%	12%	6%	4%
	PVR Impact Calculations								
25	Pct of Recorded Commercials Skipped	70%	70%	70%	70%	70%	70%	70%	70%
26	Pct of Total Commercials Skipped in PVR Households	14.81%	15.96%	17.16%	18.40%	19.69%	21.02%	27.43%	29.99%
27	Effective Average Homes Reduced by PVRs	(0.96)	(1.92)	(3.09)	(4.05)	(4.92)	(5.88)	(11.46)	(13.68)
28	Advertising "At Risk" in All PVR HHLDs ($mil)	$(560)	$(1,172)	$(2,015)	$(2,782)	$(3,587)	$(4,522)	$(10,834)	$(13,980)
29	Pct of TV Advertising "At Risk"	(1)%	(2)%	(3)%	(4)%	(4)%	(5)%	(10)%	(11)%
30	Adding Demographic Premium	125%	125%	125%	125%	125%	125%	110%	110%
31	Adjusted "At Risk" in All PVR HHLDs ($ mil)	$(700)	$(1,465)	$(2,519)	$(3,478)	$(4,484)	$(5,653)	$(11,917)	$(15,378)
32	Adjusted Pct of TV Advertising "At Risk"	(1)%	(2)%	(4)%	(5)%	(5)%	(6)%	(11)%	(12)%

Source: Sanford Bernstein & CO

Distributors

In a new world media order, the role of distributor would change. Today, the six basic conduits for video media are theaters, broadcast TV, cable TV, satellite TV, video rental stores, and broadband IP networks. The classic producer/distributor like AOL Time Warner seeks to market its product through every one of these channels. And in each of these channels there is a third party who can demand a share of the revenue from the transaction.

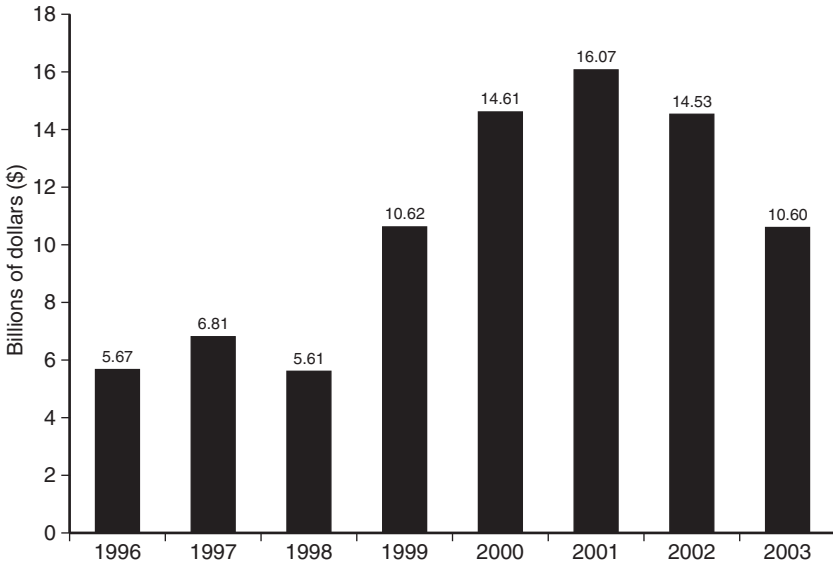
To begin to understand this new world of IP-TV it will be important to differentiate between Broadband Carriers and Broadcasters. Broadband carriers would be comprised of all DSL providers (FT, BT, Telecom Italia, Deutsche Telekom, etc) all cable providers with upgraded Hybrid Fiber/Coax plants, all ISP's offering Broadband service (AOL, Tiscali, MSN) and all fixed wireless providers. Broadcasters would consist of all over the air TV networks and all Satellite networks. In an IP-TV world the Broadband Carriers would make their money by providing metered service much like your cellular or utility service. Heavy users of streaming media would pay more than light users. Distributors of content could then sell to the Carrier's customer base on an Open Access basis and use the three basic models for payment: monthly subscription, pay per view or ad supported content. Clearly the Broadcasting model would not be able to compete because of lack of a two-way network. However, this transition to IP-TV would be gradual and still the "Event" type of programming like sports or award shows which demands a specific mass audience to be present at a specific time would be a staple of the broadcasting universe for a long time.

Telecom Suppliers

The last few years has seen a steep downturn in the Telecom economy. The obvious reason was that without reasonably priced broadband connectivity in the last mile, no one needed to enable the immense backbone networks that had been built. Companies like Cisco, Nortel, and Lucent saw their market caps fall by 50%. Because much of the last mile Broadband connectivity is controlled by the national telecoms, there was a clear bottleneck in the system. Recent

attempts at regulatory relief have proved only partially successful. It is here that the European market must make aggressive moves to keep up in the Broadband economy. Although the necessary fiber backbone for a Trans-European IP TV system is in place, the local build out of robust broadband capacity to the home is lagging both Asian and the U.S. In the U.S. the huge capital investment by cable companies in hybrid fiber coax has led to their ability to offer 6 MBPS downstream to the home. (Figure 9.4)

Figure 9.4 U.S. Cable Capital Expenditures



Source: Kagan World Media, *Broadband Cable Financial Databook*

The recent announcements by both by U.S. carriers SBC and Verizon to build out their fiber to the home networks also presage a real boost to the IP-TV vision. By unlocking the bottleneck, thereby creating a need to enable the immense dark fiber backbone, the European Telecom Economy could be put back on solid footing and a potentially fatal blow to the regions economic health could be avoided.

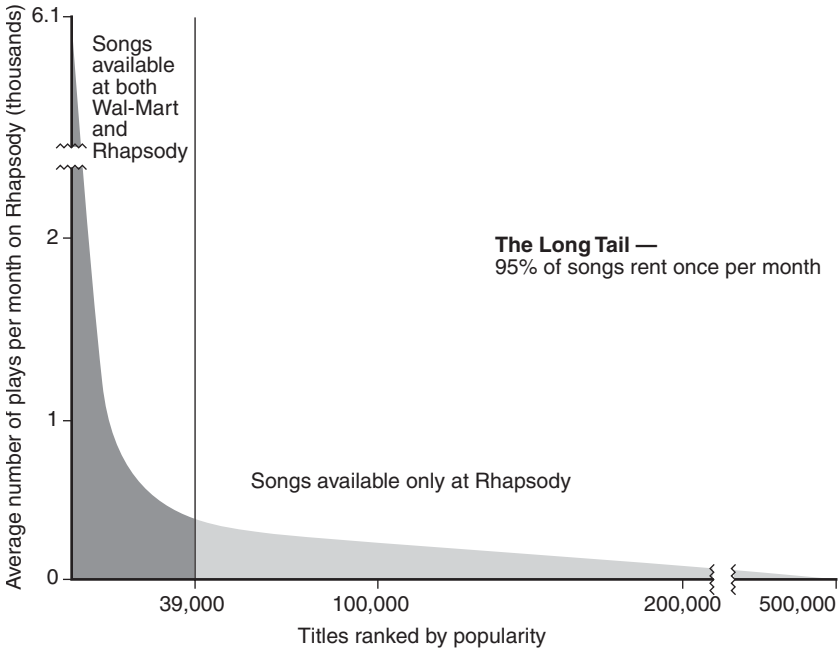
Talent

It is one of the great ironies of the age of media consolidation that giants like Fox, Time Warner and Canal + promote themselves as "Brands." In the world of entertainment, the artist is the brand. The navigation metaphor of Apple's I-Tunes, a digital music service that has sold 54 million downloads in one year acknowledged this reality. All you needed to do was type in the name of the artist. It is actually impossible to search by record company "brand." Further empowering the notion of the artist's primacy is the arrival of powerful new inexpensive digital tools for both music and video production. This production doesn't have to be as expensive as it is and the true artist will work for much less if he or she has a real stake in the gross earning power of their work.

So how would the arrival of Universal Broadband help foster a new artistic renaissance in the culture? If the world of distribution scarcity has built a wasteful media economy, it would stand to reason that a world of abundant, cheap digital technology and distribution might help the true artist escape the current media "Hit" economics. If the only things being financed are aimed at the mass audience that appeal to the raunchiest lowest common denominator, then the artist with a different perspective has a hard time getting financed. This realization is leading some in the entertainment business to realize that the tyranny of the 80-20 rule could be broken. Chris Anderson of Wired Magazine has described a new selling model called "The Long Tail," in which on-line retailers are finding that even the most obscure content sells at an acceptable level on line. Although the average large record store might have a total of 40,000 individual songs in it's racks, the digital music service Rhapsody currently has over 500,000 (Figure 9.5) and song number 499,999 sells well enough to pay for itself.

Is IP-TV a pipe dream? Some Mobius-shaped fantasy? By year-end 2005 there will be 40 million homes in the EU with Broadband. An additional 5 million college students have access to broadband at their University. Moving the signal from the PC to the TV will evolve over the next 12 months as new set top boxes, game consoles and wireless home networks proliferate. What is needed is the combination of political will and the vision to realize that the educational and cultural needs of the country will be enhanced by the widespread deployment of IP-TV.

Figure 9.5 Monthly Download Performance of Rhapsody-Source-Wired Magazine



Source: Wired magazine

We are in the Media Interregnum. In the past lies the failed orthodoxy of the domination of all media by a few major corporations, subjecting artists, citizens, politicians, marketers and the technology economy to their will. In the future lies a Renaissance of media, entertainment and learning fueling a new technology growth economy that will lift our minds and our spirits and keep our economic growth on track in the process. This radical change in the media landscape will not arrive without some serious turf battles between owners of content and owners of "pipe." Cable and Telephone companies will naturally migrate towards a "walled garden" approach to Broadband, hoping to preserve their "gatekeeper" status between content owners and their customers. Already in the U.S. the cable companies have gotten the FCC to reclassify broadband to an Information service from its previous classification as a Telecommunications service. This is not a trivial difference. Telecommunications services have a "common carrier" component, preventing the owner of the network from discriminating

in any way. As the Center for Digital Democracy states, "The principle of nondiscriminatory communication has long governed our telephone system and the Internet itself, allowing any party to transmit any message to any other party without interference by the network operator. This principle of free expression should be maintained for broadband as well. High-speed Internet users should be allowed unimpeded communications with any network device, use of any lawful service, and transmission of any data." In order to move into a new world of IP-TV that will be the preferred platform for all of the constituencies of the digital age, the EU can take the lead to preserve the open nature of Broadband Internet and usher in a new age of IP TV.

Chapter 10

Television and Internet in the Construction of identity

Imma Tubella

Introduction

The world of communications has changed radically due to the development of digital technologies. The multiplicity of Television channels and Internet and the access to information in all its formats from around the world has had a strong impact on traditional media and, at the same time, as Thompson (1997) points out, digital technologies have transformed the spatial and temporal organization of social life, creating new forms of action and interaction, new kinds of social relationship and new ways of relating to others and to oneself.

The new forms of social interaction allowed by Internet oblige us to reconsider the meaning of concepts as community or identity. The big impact of Internet on the expression and perception of social identities is relatively clear: it spans cultural spheres and geographical boundaries and allows communication from many to many. The real difference between the Internet and all preceding media forms is the role it gives to people: millions connected in many to many relationships and interactions. In Internet, common space is a direct result of synergy and connectivity.

One of the most important factors for the development of collective identity is and has been communication. If we understand the concept identity not as a given reality but as a work in progress, we will appreciate the important role of communication as the cement of its building process.

There are two types of identity building which are relevant here: individual identity understood as the sense of oneself as an individual endowed with certain characteristics and potentialities, and collective identity, understood as a sense of oneself as a member of a social group. It is a sense of belonging, a sense of being part of a collectivity.

Both the sense of oneself and the sense of belonging are shaped by the values beliefs and forms of behaving transmitted from the past, but also highly influenced by symbolic materials transmitted by media. In this sense, some authors refer to media as substitutes of tradition.

Giddens (1991) tries to understand the persistence of national identities and propose to be considered by analyzing how citizenship is created and recreated in local situations in the context of the everyday uses and production of culture. During many years, Television has taken the place of vernacular literatures in the construction of a common imaginary and complicity.

My principal concern in this chapter is that while traditional media, in special television, play an enormous role in the construction of collective identity, Internet influences the construction of individual identity, as individuals increasingly rely on their own resources to construct a coherent identity for themselves in an open process of self formation as a symbolic project through the utilization of symbolic materials available to them. This is an open process that will change overtime as people adapt new symbolic materials. This is a relatively easy process for individuals but much more difficult for collectivities who have tendencies to remain fixed in their traditional values.

The difference resides in the fact that the use of television in the construction identity is vertical, from one to many and opposite, the use of Internet in this process of self formation depends of the will of each individual. It is a horizontal use, from many to many.

The narrative of self identity, individual or collective, is continually modified in the process of retelling. The main issue here is to know who the teller is, especially in the case of collectivities. If we think that media in part are the teller, we will understand the importance they have in the process of self formation.

Individuals have gradually more access to what Thompson (1997) describes as non-local knowledge. It is interesting to point out the process of appropriation, because non-local knowledge is always appropriated by individuals in specific locations. The case of *Dallas* is a very interesting one. In Catalonia, *Dallas* has been a powerful tool for the normalization of Catalan language. I will return to this issue when analyzing the Catalan situation in terms of the role of media in the construction of Catalan identity. Now, children in Catalonia play

in Catalan because they watch *Chin Chan* in Catalan. In my childhood, I used to play in Spanish when I was acting as a teacher, as a shopper or as a seller. I only used to speak in Catalan when I acted as a mother. Then, Catalan was forbidden, even for Hollywood actors.

My point of view is that the process of self formation as individuals and as collectivities becomes increasingly dependent on access to mediated forms of communication. How do Information Technologies, and specifically Internet, affect individuals and communities? What constitutes a community in the world of electronic mediation? What are the essential ingredients? Who are the new mediating forces?

As professor Cole writes in the introduction of his last version of the World Internet Project[1], a lot of academic studies have examined the impact of television on viewers' lives, but researchers now realize that we missed a golden opportunity by not looking at individuals and their behavior prior to their acquisition of television sets and going back to the same people year after year to see how exposure to the medium changed them and at the same time, I would add, society. In Catalonia we don't have a panel, we just have an important research program about the transformation of individuals and society due to the impact of Internet[2], but we have some empirical data that can help our attempt to answer these questions.

In our research in Catalonia we assume that network society is not just the result of the impact of information technologies on social structures, but a new social form using communication as one of the central factors defining it, and becoming the emblematic figure of our current society. It is because of this that the study of the use of the communications media is essential to understand the transformation of social life and the creation of new forms of exercising power disassociated from the fact of sharing a common space. However, study of the practices that include Internet use and how this use has modified them, if it has, gives us elements of empirical analysis that help us to situate the levels of interaction and connectivity of Catalan society. On the other hand, questions such as communication practices in relation to the use of language, or to construction of meaning and, therefore, of identity, are also important parts of our analysis.

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[1] http:// www.digitalfuture.org

[2] Projecte Internet Catalunya: http://www.uoc.edu/in3/pic/eng/pic1.html

The Catalan case

In Catalonia, collective identity is central to the political debate. On the other hand, radio and television have been key institutions through which listeners and viewers have come to imagine themselves as members of the national community. It is not strange that the very first law approved by the Parliament of Catalonia in 1982 just as democracy was being recovered was the Law for the Creation of the Catalan Broadcasting Corporation with the purpose of linguistic, cultural and national normalization.

Catalan Television (TVC) began broadcasting on September 11, 1983, some months before Basque Television did as well, breaking the monopoly of television in Spain and, therefore, the centralist Spanish discourse. By 1990, eleven autonomous broadcasting organizations had been approved, seven of which had already begun broadcasting on a daily basis, in an outlaw situation due to problems with the Spanish State.

What did cultural normalization mean at this moment and in this context? In 1975, data from the official census say that only 60% of people living in Catalonia could speak Catalan. In 1986, two years after the creation of Catalan Television, the census says that 64,2% could speak it; and in 1995, this percentage was 79,8%. In our research we observe that Catalan knowledge is currently almost universal, reaching a 97,7%. If we look at Catalan Television audiences in programs like *Dallas* or football in 1984 and 1985 we observe that a big amount of people watching these programs in Catalan were Spanish speakers who couldn't speak Catalan language. The growth in this knowledge is impressive in relation with the delay to reach it. In this way some linguists[3] speak of it as a cultural revolution.

Catalonia is a nation that has always cultivated a strong desire to express and strengthen its identity on both cultural and national levels. From a Catalan point of view, cultural identity is not just a different language but a set of habits, traditions, values, beliefs, and ways of living, thinking and behaving, in other words, a certain style of life. In this sense, media play a very important role as an operational instrument.

[3] Francesc Vallverdú, El català estàndard als mitjans audiovisuals, CCRTV, April 1996

In the field of communication practices in Catalan society, our Project Internet Catalunya of 2002 ratifies a well-known fact: the most frequent daily practice is watching television (90.8%). What is perhaps not so commonly known, and which we have considered to be a communication practice, is that the second most common use of daily time is speaking with people at home, playing with children or similar activities (80.8%). Listening to the radio occupies the third place (64.3%), followed by listening to music (57.6%). Press and magazines occupy the sixth place (45.7%). In 2002, Internet was used in Catalonia by 34,6% of the population. Currently, this percentage has grown to 39,7%.[4]

The communication practice most affected by Internet use in 2002 and certainly now is television. A 16.6% of people watched less television since they were connected to the Internet. Of this 16.6%, 61.7% were under 30 years old.

In a research done a year later in Portugal by the Centro de Investigaçao e Estudos de Sociologia in which our questionnaire[5] was partly used, we can see that the situation was quite different. There was almost no difference between users and non users in their daily use of TV (98,9% and 99,4%, respectively)[6]. At this time, we were thinking about the possibility of networking Portugal and Catalonia to evaluate, in a comparative level, transformation in media use. Unfortunately, we didn't have the opportunity to pursue this in depth. Maybe some day we will be able to do it.

In the United States, the same year, users began to report spending less time with TV, newspapers and magazines (about 45 to 60' a week less than nonusers. Some users reported spending more time with online newspapers[7]. In 2005, the biggest gap in media use between users and non-users continues to be the amount of time they watch television. In 2004, internet users watched about 4,6 hours of television less per week than non-users.[8] The majority of those who watch television

[4] IDESCAT 2004

[5] da Costa, A.F.; Cardoso, G.; Gomes, MdoC; Conceiçao, CP (2003), A Sociedade em Rede em Portugal, Lisboa, ISCTE

[6] Although in terms of time spent on each activity we find considerable differences of up to more than 40 minutes less television viewing among internet users in Portugal.

[7] The digital future report, www.digitalcenter.org

[8] op. cit

every day are Internet non-users while, in contrast, the majority of those who watch it weekly are users and 40% of those who never watch it are also users.

Nevertheless in Catalonia, television is still the reference media for information (74.6%). This percentage in Portugal is 97,8%. For local events the second most frequent method is personal communication. In Portugal, we observe the same situation but, even if personal communication occupies the second place, the distance between Television (99,3%) and "speaking with family, friends and other people" (84,0%) is higher than in Catalonia.

In contrast, in 2002, Internet was used as an information source by just 1% of the Catalan population and only to find out about international events. General population mainly trusted radio, while Internet users trusted printed media.

As far as language related to communication practices is concerned, Spanish dominates the printed media, far ahead of Catalan. On television, in contrast, both languages are almost even, with 47,6% of the population watching television in Catalan.

In Internet the dominant language is Spanish. On one hand, this is due to a question of the amount of contents in this language, yet on the other hand, to a question of choice.

In general, among Internet users, 89% do not habitually use English, 53,7% do not habitually use Catalan and 20,5% do not habitually use Spanish.

The next practice that has very slightly diminished is watching videos or DVDs, followed by reading books and listening to the radio. It is always the youngest group that has the highest tendency to migrate towards the Internet. In contrast, the communication practice that has increased most is listening to music (5%), possibly due to the Napster phenomenon, followed by playing computer or console games.

In short, Catalan population had and still has two main communication practices: watching television and talking to people in their immediate environment, specifically within the family environment, corresponding, as we shall see, with the dominant, overall major feeling of identification, the family.

In the 20th century, "home" has been a breathing space from work and public life, a place where one can pull back from the world, enjoy one's personal privacy, build familial relations and individual objectives. Increasingly, however, people are able to work, learn, shop, participate in civic events and campaigns and even vote from home. The separation of work and leisure evaporates and the meaning of privacy, home and community is changing significantly.

Therefore, television is still the reference communication medium, yet in contrast, people trust radio more. From the point of view of consumer confidence, radio occupies the first place as 29.6% trust it more, compared to 25.8% who have more confidence in the printed press and 20.8% who trust television. If we analyze consumer confidence levels in the Internet, we see that those who trust it a lot are mainly users (89.3%), although 67% of those who say they trust it very little are also users.

Identity and communication are language, but so are emotion, sentiment and individual and collective representation. In this sense, Catalonia, in spite of the great leap forward that Catalan Television represents, has a serious control deficit in its own representation. In the process of construction of meaning, or of a certain creation of collective consensus, we should ask what the role of communications media should be and, specifically, that of Internet as a tool for social and collective cohesion, because identity is a source of meaning and sensibility, but it is also shared sensibility, and the communications media are the creators of sensibility.

As important as History itself is the history that the community is able to explain to its fellow members, the history of myths and beliefs created as an element of cohesion. If this statement is correct, we should agree with the importance and the influence of the communications media in the construction of a common discourse and collective representation.

Finally, a key question for our research is, what role does Internet use or non-use play in building Catalan identity? Because if identity is a network of interactions where the true importance lays not in simple existence but in transformation, in representation and construction of meaning, in difference and not in negation, and if collective identity is furthermore the capacity to communicate, what role does Internet

play in the transformation of this identity? Is it simply a transmission tool in which the only significant factor is the level of use, or does it in some way conform to a differential model? What relationship is there, if any, between population profiles, identity practices and Internet uses? What shared values are there between elements of dominant identification, identity characteristics and the values of the new social structure based around the web, such as individual freedom or open communication?

Building Catalan identity in the network society

In our research in 2002 we arrived to an initial conclusion: the perspective of identification, the traditional referents for identity construction such as language, culture or one's country change and we find new dominant identification referents such as the family or the individual, which are also basic elements of collective identity construction and key aspects for cohesion in a network society.

A key differential factor in Catalonia as a network society could be the search for a collective, complex strategy of adaptation to the change produced by the characteristic phenomena of economic, cultural, social, demographic, political and, in general, structural globalization. If this has a social visibility, it could constitute a powerful construction element for meaning and representation of collective will. That is, to go from a differentiated project of unity, natural to a resistance identity needing the element of dominion to construct a meaning and aspects such as language, territory or history on which to support itself, a network node with its own personality and will to exist, a new definition is needed. Our data show us that the period of resistance identity was overcome because there are certain basic aspects of what we could call "being Catalan," the most significant of which is language, which has been normalized. In this scenario, it is normal for resistance to tend to dissipate.

In contrast, elements that generally are not considered in traditional identity constructions like projects for personal autonomy have, in Catalonia, a positive association to construction of identity.

If, as we have seen, one of the clearest differential factors in Catalonia, today, is language, and a second differential factor is level of personal autonomy, the possibility opens before us for construction

of a project identity going beyond the traditional elements of identity construction and one that integrates others that are much more in agreement with the economic, social and political structure of the information society.

In summary, then, one of the basic ideas emerging from our research, clearly demonstrable in empirical terms, is that once we have analyzed the different dimensions of the projects for personal autonomy, we have verified that on one hand, the more autonomous people are, the more Catalan identity they have and, on the other hand, the more autonomous people are, the more they use the Internet and with more intensity.

If we demonstrate that the Internet is a clear agent for construction of personal autonomy and that for cultural reasons, the younger the population, the more they use it, we could conclude that, although in Catalan identity practice, age works *in contra*, when a project for personal autonomy exists alongside Internet use, identity practice is strengthened in general, but specifically among the young.

This also confirms our hypotheses about the importance of personal will in identity construction that has materialized in a project, the reflection of a collective strategy we discussed above, and which we have also called project identity. Project identity can be built not on the basis of difference, but on a basis of shared beliefs and values, or on personalized patterns of behavior.

Television is a territorial medium, broadcasting in the same space at the same time. Internet is not. The territory of Internet is the language you know, the language you are able to understand. Let's remind here that in Catalonia 89% of Internet users never use English in the net, 53,7% never use Catalan and 20,5% never use Spanish. That gives us a first picture of the Internet territory for Catalan users. Perhaps the main contribution of Internet in the construction and reconstruction of identity and community is the break down of the old idea of a territorial based community and belonging. Today territory is still relevant but there are other important factors to be considered, for instance, connectiveness and cooperation.

Television, a mass medium, has been a space of influence but by definition, vertical and passive: one to many. Internet, a many to many

medium is horizontal, a space of participation, a space of connection. Increasingly we must think in terms of spaces of transmission.

Could we affirm that we are in a transition time from collective identity to cooperative identity, from passive identity depending on third parties to active identity building processes depending just on a one self project? What it seems clear is that identities are constituted within a system of social relations and require the reciprocal recognition of others. If this is true we can say that Internet facilitates the recognition because facilitates a bidirectional communication. Today, identity is not only influenced by what you see but by how you look.

The creation of new social and politico-economical geographies requires new strategies of community self conceptualization and identity. In modern societies, much of this sense of shared identity is communicated through media technologies. These technologies help to transmit shared symbolic forms, a sense of group culture and, at the end, to foster what de Tocqueville called "Fellow feeling, Renan commandership and Anderson deep horizontal commandership. Some authors claim that modern societies are defined by the degree to which the transmission of fellow feeling to symbolic forms is no longer restricted to contexts to face to face interaction. Other authors, such as Robert Putman, think in terms of social capital as features of social life—networks, norms and trust—that enable participants to act together more effectively to pursue shared objectives that permit cooperation among them.

We observe important differences between project identities, with clearly defined shared objectives involved in the horizontally membership building and the legitimating identities using vertical authority. The study of the maintenance of identity in diasporas and the cultivation of a virtual home, using Internet and being connected with the motherland and with fellows on the world, is a good example of horizontal community building.

How does the cultural use of Information Technologies differ from the cultural use of Television? I don't have still empirical evidence of it I hope that my research in progress about the time management of the population concerning the use of media and information technologies in general is going to illuminate my way.

Currently, I can affirm that the use of Information Technologies in Catalonia is transforming the construction of identity from a concept of given destiny where television has played an important role as a tool of cohesion and representation, to a much more dynamic concept involving collective and cooperative action, where the role of Internet, mobile phones, and Information Technologies in general is central.

We are just at the starting point of a two years research program about transformations of media in Catalonia because of the impact of Information Technologies. At the same time, we will analyze the transformation of identity building because of this new influence. We will be able to compare the central role of Television on this construction during the last twenty years and observe what happens now with young people migrating to Internet. We hope to go deep in our data from our first research and to proof the use of Internet as an empowerment tool connected with the birth of a new kind of identity construction based in the individual will and in the capacity to formulate projects, not just to resist but to cooperate.

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Chapter 11

Geeks, Bureaucrats and Cowboys: Deploying Internet Infrastructure, the Wireless Way

François Bar and Hernan Galperin

Introduction

The deployment of communication infrastructure has traditionally been associated with big investment programs undertaken by large entities such as telecommunications operators and government agencies. The reason is quite simple: only these entities were able to amass the sizeable capital and attain the necessary economies of scale involved in deploying wired networks. However, three parallel trends are converging to permit departure from that tradition: the emergence of more flexible spectrum policies, which has removed regulatory barriers to entry; the advent of new wireless technologies, which has fundamentally changed the cost equation in favour of wireless solutions; and the entrance of many small business and non-profit actors eager to play new roles in the creation and management of wireless communication networks.

While advances in wireless technologies have significantly reduced the deployment costs for communications infrastructure, their transformative impact on the architecture and control of communication networks is often overlooked. Because wireless technologies are not subject to the same economies of scale as traditional wireline technologies, they allow end-users—often acting collectively through cooperatives and other local institutions—to deploy and manage systems themselves in ways not previously possible.

This in turn pushes the boundary that divides control between users and providers much deeper into the network, opening the possibility of a radically decentralized approach to system expansion, based on the integration of local wireless networks built and managed by

users. While most of today's networks continue to be built by large organizations, the evidence increasingly points to a potentially disruptive shift in the way wireless communication networks are being deployed and operated (Best, 2003; Bar and Galperin,2004).

The tension between these two alternative logics of network deployment is well illustrated in the case of wireless Internet access services. One the one hand, mobile telephony operators have made considerable investments to deploy third-generation (3G) networks that allow mobile customers to access a variety of IP-based services. On the other, wireless enthusiasts, small entrepreneurs, and local governments are increasingly taking advantage of a new breed of wireless networking technologies to build wireless local area networks (WLANs), particularly in areas neglected by large operators. 3G networks follow the traditional model of large investments in infrastructure equipment for centrally-planned and controlled networks; WLANs on the other hand consist of small investments in terminal equipment by independent actors at the local level without coordination or a pre-conceived plan. While both are evolving in parallel (and some argue, are complementary), the tension is evident in recent policy debates about how to allocate limited resources (notably the radio spectrum) and the role played by local governments and cooperative organizations in the deployment of advanced wireless networks.

The paper is organized as follows: in the first part we review the evolution of the new breed of WLAN technologies, in particular Wi-Fi, and discuss its implications for the architecture and control of emerging wireless broadband networks. We draw on the social constructivist history of large technical systems and the work of economic historians concerned with the evolution of technology to understand the largely unexpected success of Wi-Fi. Next we review the evidence on the bottom-up deployment of wireless networks by local actors, focusing on three types of initiatives driven by different deployment dynamics: end-user cooperatives (affectionately referred to as "geeks" in our title), wireless ISPs ("cowboys"), and municipal government ("bureaucrats"). The conclusion discusses the policy and institutional issues most likely to affect the balance between centralized and decentralized deployment of wireless broadband networks in the near future.

From the cordless Ethernet to the wireless mesh: The unexpected evolution of Wi-Fi

WLAN technologies refer to a broad family of non-cellular wireless communication solutions which in practice includes most of the technologies currently under the purview of the IEEE 802.xx standardization activities. While this encompasses a range of technologies with different attributes and at various stages of development, the focus of this paper will be on the suite of IEEE 802.11 standards also known as Wi-Fi. The reason is simple: this family of WLAN standards has gained broad acceptance, leading to significant cost reductions due to volume production, and the level of penetration in a variety of consumer devices (from PCs to PDAs to mobile phones) is fast reaching infrastructure scale. Wi-Fi has evolved in a somewhat accidental manner, through an evolutionary path not envisioned by its original creators and early backers. This is a rather consistent pattern in the evolution of technological systems (e.g., Nye, 1990; Fischer, 1992). In the case of Wi-Fi, it was initially conceived as a wireless alternative for short-range connections between computers within homes and offices (i.e., a cordless Ethernet). However, it soon became clear that Wi-Fi could also be used to extend the reach of computer networks into public spaces. Moreover, both equipment vendors and wireless enthusiasts also realized that, with the appropriate hardware and clever tinkering, point-to-point connections could be made over several kilometers. The important role played by early adopters in the innovation process and testing of the technology under different conditions is again consistent with previous patterns of technological evolution (the best known case being that of amateur radio operators in the early 20th century).[1]

Wi-Fi has experienced extraordinary growth since 1997, when the IEEE finalized the original 802.11 specifications.[2] It is worth noting that the technology emerged amidst competition from alternative standards for WLANs, notably HomeRF and HiperLAN.

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[1] See Douglas (1987).

[2] Today, Wi-Fi comes in three basic flavors: 802.11b, which operates in the 2.4GHz frequency range and offers speeds up to 11Mb/s; 802.11a, which operates in the 5GHz frequency range and offers speeds up to 54Mb/s; and the most recent 802.11g, which is backwards compatible with 802.11b but offers speeds up to 54Mb/s. Work continues on new variations that will improve the range, security and functionality of Wi-Fi, such as 802.11e (Quality of Service), 802.11r (roaming), and 802.11s (meshing).

Interestingly, because these standards emerged from within the computer rather than the telecom industry, the standardization process has been largely led by the private sector, organized around industry consortia such as the HomeRF Working Group and semi-public organizations such as the IEEE. Compared to the contentious case of 3G standards (see Cowhey, Aronson, and Richards, 2003), the role of governments and multilateral organizations such as the ITU has been rather minor.[3]

It is estimated that there are currently about 60 million Wi-Fi-enabled devices worldwide.[4] Among the many factors that explain the success of Wi-Fi, three are particularly noteworthy. First, Wi-Fi can deliver high-bandwidth without the wiring costs, which makes it an effective replacement both for last-mile delivery as well as for backhaul traffic where the installation and maintenance cost of wired infrastructure is prohibitive (it is estimated that wiring expenses can comprise up to three-quarters of the upfront costs of building traditional telecom networks). Second, there is widespread industry support for the standard, coordinated through the Wi-Fi Alliance, an industry organization including over 200 equipment makers worldwide.[5] As a result, equipment prices have dropped rapidly, and users can expect compatibility between Wi-Fi client devices and access points (APs) made by different vendors. A third key to the technology's success lies in the lack of regulatory overhead: Wi-Fi networks have blossomed on unlicensed bands, namely, thin slices of radio spectrum reserved for lowpower applications in which radio devices can operate on a license-exempt basis—though this is not always the case in the developing world (see Galperin, forthcoming). This has allowed for a wide variety of actors to build WLANs without any of the delays and expenses traditionally associated with obtaining a radio license from telecommunications authorities.

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[3] Today the development of HomeRF has been largely abandoned, and while the new generation of the HiperLAN standard (HiperLAN2) gained some momentum in the EU as a result of ETSI (European Telecommunications Standards Institute) rules related to the use of unlicensed spectrum in the 5GHz band that delayed the launch of 802.11a products in the European market, analysts agree that this Wi-Fi competitor will, at best, fill a small niche in the corporate market.

[4] Presentation by Devabhaktuni Srikrishna, CTO, Tropos Networks (December 2004). Available at www.arnic.info.

[5] The Wi-Fi Alliance was formed in 1999 to certify interoperability of various WLAN products based on the IEEE 802.11 specifications. Since the beginning of its certification program in 2000, the group has certified over 1,000 products.

The major drawback of Wi-Fi is the short signal range. Even though point-to-point connections have been made over several kilometers, Wi-Fi networks typically extend for a few hundred meters at most. This makes the technology generally unsuitable for long-haul transmissions. Nonetheless, related technologies are emerging to address this problem, notably 802.16x (also known as WiMax). This new standard is expected to offer point-to-point connectivity at 70mb/s for up to 50 kilometers, making it an ideal alternative for traffic backhaul. Nonetheless, establishing baseline protocols for WiMAx that would allow interoperability between equipment from multiple vendors has proved more complex than in the case of Wi-Fi. Interestingly, the unexpected success of Wi-Fi, coupled with the potential challenge that new WLAN technologies represent to 3G networks being deployed by mobile telephony operators (Lehr and McKnight, 2003), has significantly raised the stakes in the standardization process, bringing many more players to the bargaining table and making agreements more difficult to reach.

The new generation of WLAN technologies challenges many assumptions associated with the deployment of traditional telecom networks at the local level. Laying conventional fiber and copper wires, or even installing expensive cellular telephony base stations, is not unlike paving roads. It requires large upfront investments, economies of scale are pervasive, and the architecture of the network has to be carefully planned in advance because resources are not easily redeployed. As a result, networks are typically built by large organizations in a top-down process that involves making many ex ante assumptions about how the services will be used, by whom, and at what price. However, these assumptions are easier to make in the case of well-understood, single-purpose networks (such as roads and sewage) than in the case of ICT networks, where applications and uses often result from the accumulated experience of users themselves (Bar and Riis, 2000). Moreover, outside wealthy urban areas, demand for advanced ICT services is complex to aggregate and difficult to predict.

New WLAN technologies create an alternative to the top-down network deployment model associated with traditional telecom infrastructure. Because of the relatively low fixed capital expenditures, the use of unlicensed spectrum, the wide acceptance of open transmission

standards, the scalability of the technology, and the lack of significant economies of scale in network deployment and management, infrastructure investments in Wi-Fi networks are within the reach of a variety of local actors—from private entrepreneurs to municipal governments to agricultural cooperatives. Moreover, these investments are for the most part in increasingly powerful wireless terminals capable of adapting to their operating environment, which allows for more edge-base control of network uses and innovation. This allows for a flexible infrastructure to expand from the bottom-up, without a preconceived plan, and driven by those who best understand local demand for advanced information services—local users and organizations.

Moreover, it is possible to imagine a future in which ad-hoc networks spontaneously emerge when enough Wi-Fi devices are present within an area (Benkler, 2002; Agarwal, Norman, and Gupta, 2004). Today, most Wi-Fi networks are deployed to replace Ethernet cables within homes and office, with the simple goal of allowing mobility for users within a confined network environment and physical space. This is similar to the way cordless phones allow limited mobility for fixed telephony within a limited range of the base station. Yet because there is no fundamental difference between Wi-Fi access points and clients, all Wi-Fi devices can be programmed to detect other devices within range and create ad-hoc connections. Traffic can then be routed through a series of short hops, bouncing from one device to the next until it reaches a backhaul link, and effectively bypassing much of the existing wired infrastructure at the local level. Of course, this only works if there are enough Wi-Fi devices in an area, but this becomes increasingly possible as Wi-Fi prices come down and as Wi-Fi radios are built into more user devices.

Assuming a dense enough distribution of such radios, network coverage would become nearly ubiquitous. Collectively, the end-devices would control how the network is used.

New communication services could be invented and implemented at the edge of the network, and propagated throughout the network from peer to peer.

Consider the prediction that by 2008, 28 million cars will come equipped with local networking devices.[6] These would not only serve to connect various systems within the vehicle, but to support communications with outside systems, for applications ranging from telephony to safety and cashless payment systems. Ultimately, since cars are typically always within less than a hundred feet from one another (and have a built-in power supply), one could imagine how they would provide the basis for a mobile networks. Of course, many technical issues remain to be solved for such networks to become practical, including the development of adaptive routing software that can keep up with intermittent mobile nodes. But the rapidly growing number of Wi-Fi devices present in the environment creates at least the theoretical potential for such wide-area wireless grids to emerge, with wires progressively receding in the background.[7]

The evolution of WLAN technologies is today at a critical juncture, with many possible trajectories lying between two extremes. One represents the extension of the established deployment model to the world of wireless broadband communications: licensed by the state, wireless service providers deploy centrally controlled, closed-architecture networks, their economic strategies resting on tight control over spectrum and on the ability to raise massive amounts of capital to secure licenses, build out networks, and subsidize terminal equipment. The other represents an alternative approach whereby users and local institutions make small-scale investments in radio equipment to build local networks from the bottom-up, in an unplanned manner, and collectively organize to exchange traffic and share common network resources. While there is much theoretical debate about the feasibility of such alternative network deployment model (e.g., Benkler, 2002; Sawhney, 2003; Benjamin, 2003), we take a different approach by examining the actual evidence of such bottom-up network deployment in the case of Wi-Fi networks.

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[6] ABI Research, 2003, Automotive Wireless Networks Opportunities for Wi-Fi, Bluetooth, RFID, Satellite and Other Emerging Wireless Technologies (http://www.abiresearch.com/reports/AWN.html).

[7] There is much historical precedent about the displacement of older technologies by new technologies once considered complementary or feeders to the incumbent system. It is worth recalling that railways were once considered appendices to the canal system, that the telephone was once considered a feeder for the telegraph network, and that the direct current (DC) and the alternating current (AC) electricity systems were once considered complementary (Nye, 1990; Fisher, 1992; Sawhney, 2003).

Our focus is on three types of local public Wi-Fi networks, each driven by different sets of actors and based on different logics of deployment: wireless cooperatives, small wireless ISPs, and municipal governments.

Decentralized models of wireless broadband deployment: Reviewing the evidence

Wireless cooperatives

Some of the most publicized grassroots efforts to provide wireless Internet access to the public have been led by so-called wireless cooperatives. Though wireless

cooperatives come in many colors and flavors, these are generally local initiatives led by highly skilled professionals to provide wireless access to the members of the cooperative groups who build them, to their friends, and to the public in general (Sandvig, 2003).

These for the most part comprise little more than a collection of wireless access points intentionally left open by these wireless enthusiasts and made available to anyone within range, although there are more sophisticated architectures generally based on backhaul connections made between these access points. For example, the Bay Area Wireless User Group (BAWUG) operates long-range connections (2 miles and more) linking clusters of access points, while in Champaign-Urbana a wireless community group is building a 32-node mesh network that will function as a testbed for the implementation of new routing protocols.

Wireless cooperatives pursue a wide variety of goals: some simply provide a forum for their members to exchange information about wireless technologies, while others are actively engaged in building wireless networks to experiment with the possibilities of Wi-Fi technologies, such as the Champaign-Urbana group referred to above. While the exact number of community networks is difficult to establish (in large part precisely because these are small community initiatives that do not require licensing by a central authority), there are over 100 documented initiatives in the U.S. alone, each typically rang-

ing from a few nodes to a few dozen nodes.[8] Interestingly, many of these free wireless cooperatives operate in some of the wealthiest U.S. cities such as San Francisco, San Diego, and Boston. There are also many individuals (or organizations) who volunteer to open their access point to the public without necessarily belonging to an organized cooperative, and advertise this fact on directories such as nodeDB.com.

Despite much publicity, the assemblage of these community networks is today of small significance in terms of the access infrastructure it provides. Further, it is unclear how many people are effectively taking advantage of them. In cases where the community organizations track usage of their open networks, there seems to be relatively few takers.[9]

Anecdotal evidence indicates that the main users of these community networks are the wireless community members themselves (Sandvig, 2003). Nevertheless, these networks are playing an important role in the emerging ecology of Wi-Fi. If nothing else, they represent a clear disincentive for investments in commercial hotspots operations.[10]

Moreover, much like in the case of radio amateurs in the 1910s, wireless enthusiasts have made significant improvements to the reach and functionality of Wi-Fi networks, including routing protocols for mesh networks, authentication tools, and the real-life testing of signal propagation and interference problems.[11]

Somewhat surprisingly, coordination among the various community wireless groups has been relatively limited, with different groups often duplicating efforts in terms of basic access provision over the same area or development of competing software protocols.

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[8] For a seemingly thorough listing see http://wiki.personaltelco.net/index.cgi/WirelessCommunities.

[9] See for example the usage statistics of Seattle-wireless at http://stats.seattlewireless.net.

[10] 10 Verizon cites the availability of free wireless access in several areas of Manhattan as the reason why it decided to offer free Wi-Fi access to its existing DSL customers.

[11] It is interesting to note that the notorious Pringles "cantenna" used by many Wi-Fi enthusiasts has a precedent in the history of radio, for early radio amateurs often used Quaker Oats containers to build radio tuners.

However there are recent signs of increased cooperation to pursue common policy goals (e.g., availability of unlicensed spectrum) as well as technical cooperation. [12] There are also grassroots efforts to connect small local networks to share backhaul capacity and exchange traffic in a mesh-like architecture. For example, the Consume project is a London-based collaborative effort to peer community Wi-Fi networks. The group has developed a model contract for cooperation called the Pico Peering Agreement, which outlines the rights and obligations of peering parties (in essence, it is a simplified version of existing peering agreements between Tier 1 backbone operators).[13]

Much like in the case of open source software, wireless community efforts are based on the voluntary spirit of like-minded (and technically-proficient) individuals who agree to provide free access or transit across their network. While simple contracts such as the Pico Peering Agreement might prove useful for peering among small community networks, more complex financial and legal arrangements are likely to be needed for scaling-up the current patchwork of community access points into a larger grid that provides a true connectivity alternative for those limited technical expertise and for local institutions with more complex service demands. Yet, while the impact of wireless community initiatives has yet to match that of the open-source movement, experimentation with cooperative models for the deployment and management of WLANs has exciting opened new possibilities for network deployment at the local level.

Municipal governments

A second category of non-traditional actors that are increasingly engaged in building and managing wireless broadband networks are municipal governments. This is certainly not the first time in U.S. history that municipalities are engaged in the deployment of telecommunications networks or the provision of services (see Gillett, Lehr, and Osorio, 2003). Yet the advances in wireless technologies discussed above have created a more attractive environment for local government involvement in the provision of wireless broadband services,

[12] It is worth noting that the inaugural National Summit for Community Wireless Networks was held in August 2004.

[13] Available at www.picopeer.net.

particularly among those communities neglected or poorly served by traditional broadband operators (notably cable and DSL providers). The impetus is particularly strong among communities where municipally-owned public service operators are already present—for example, among communities with Municipal Electric Utilities—for the existing resources (such as trucks and customer service and billing systems) significantly lower the cost of municipal entry into broadband wireless services. In pursuing these deployments, municipal governments have a considerable advantage over commercial entities or community groups: they control prime antenna locations in the form of light posts and traffic signs, all of which have built-in electrical supply that can serve to power wireless access points.

The number of cities deploying wireless broadband networks has been growing very fast in recent years. According to one estimate, as of June 2004 there were over 80 municipal Wi-Fi networks in the U.S. and the EU, with more in the planning stages in large cities such as Los Angeles and Philadelphia.[14] The scale, architecture, and business models of these municipal networks vary widely. Some municipalities are simply building so-called "hot zones" (essentially a small cluster of public access points) along downtowns, shopping districts, and public parks. By providing free Wi-Fi access, these cities hope to help attract businesses to these areas, boost customer traffic, or lure conference organizers to their convention centers by making it easy for conference-goers to stay connected. This was for example the explicit goal behind the launch of free Wi-Fi access by the city of Long Beach, CA in its downtown, airport and convention center areas.[15]

A more ambitious model involves generally small municipalities that seek to deploy citywide wireless broadband to service government buildings, mobile city workers, security and emergency services. This is for example the case of Cerritos, CA, a small Southern California community without cable broadband and only limited access to DSL services. The city partnered with wireless access provider Aiirmesh to

[14] Munirewireless.com First Anniversary Report (June 2004). Available at www.muniwireless.com.

[15] Interviews with Chris Dalton, City of Long Beach Economic Development Office, February 6, 2004 (see also John Markoff, "More Cities Set Up Wireless Networks," New York Times, January 6, 2003). It is also worth noting that during our visit to downtown Long Beach we detected several private access points open for public use.

offer access to local government workers (in particular mobile employees such as city maintenance workers, code enforcement officers and building inspectors), while at the same time allowed the company to sell broadband services to Cerritos' residents and businesses. Similar publicprivate partnerships are mushrooming in a number of small and mid-size U.S. cities, including Lafayette, LA, Grand Haven, MI, Charleston, NC, and others.[16]

A significant number of these municipal networks use a mesh architecture: rather than connecting each Wi-Fi base station to the wired network, as in the case of residential access points or commercial hotspots, devices relay traffic to one-another with only a few of them hard-wired to the Internet. They are programmed to detect nearby devices and spontaneously adjust routing when new devices are added, or to find ways around devices that fail. Municipalities have an inherent advantage in pursuing a mesh architecture since as noted they control a large number of prime locations for antenna locations, such as light posts, traffic signs or urban furniture, dispersed through the city and equipped with power supply. A prominent example is Chaska, MN, a city of less than 20,000 where the municipal government built a 16-square miles mesh network and operates the service on the basis of an existing municipal electric utility.

Municipal wireless networks drew little controversy when confined to small cities or communities underserved by major broadband operators, or when these initiatives primarily addressed the needs of government employees. Yet, as soon as larger municipalities announced plans to build metropolitan area networks (MANs) that would cover large geographical areas, the debate over the proper role of local governments in the provision of wireless broadband erupted, and incumbent operators swiftly sought legislation blocking municipal Wi-Fi projects.

The theoretical case in favor of local government provision of wireless broadband rests on three key assumptions: first, that broadband access is part of the critical infrastructure for communities to prosper in economic and social terms; second, that for a variety of reasons market forces cannot adequately fulfill the demand for broadband

[16] For descriptions of these municipal wireless projects in the U.S. and elsewhere see http://www.muniwireless.com.

access within the community (for example, because externalities prevent private operators from fully capturing the benefits of widespread broadband access); and third, that under these circumstances local governments can run wireless networks and deliver these services (either directly or under a franchise agreement) more efficiently than private firms (Lehr, Sirbu, and Gillett, 2004).

While the first assumption seems plausible, the other two depend on a number of specific circumstances that prevent overarching generalizations (such as those typically made on both sides of the debate). In communities underserved by existing broadband operators, there is clearly a role for local governments to play in spurring the availability of broadband at competitive prices. This is particularly the case when other municipal utilities already exist, so that economies of scale and scope can be realized in the provision of a bundle of government services (e.g., electricity, water, broadband). At first glance, the market failure rationale is less convincing for areas where a competitive broadband market exists, although even in these cases it is entirely possible to argue for a limited government role in the provision of wireless broadband (for example, in running the fiber backhaul, in specialized applications for government operations, or in conjunction with economic development projects). Ultimately, a better understanding of the potential costs and benefits of municipal wireless initiatives under different contexts is needed to allow conclusions about the appropriate role of local government in the wireless broadband environment.

Wireless ISPs

A third category of new actors taking advantage of the properties of new WLAN technologies are the Wireless Internet Service Providers (WISPs.) These are new forprofit companies providing internet services to residential and business customer over wireless networks, including internet access, web hosting, and in some cases more diverse services such as virtual private networking and voice over IP. Over the past two years, the FCC has taken a keen interest in WISPs, seeing them in particular as a way to bring broadband internet access to rural areas. This regulatory support is further strengthened by rural development funding programs, such as the USDA's Community Connect Grant Program aimed at providing "essential community facilities in

rural towns and communities where no broadband service exists."[17] In November 2003, the FCC held a *Rural Wireless ISP Showcase and Workshop* to "facilitate information dissemination about Rural WISPs as a compelling solution for rural broadband service."[18] In May 2004, FCC Chair Michael Powell announced the creation of the Wireless Broadband Access Task Force, to recommend policies that could encourage the growth of the WISP industry.

In the U.S., WISPs are present in a diversity of communities ranging from large cities (like *Sympel, Inc* in San Francisco or *Brick Network* in St Louis), to rural towns (like *InvisiMax* in Hallock, MN). However, their impact is perhaps most significant in rural and small towns, where they are often the only broadband access solution. While there is much enthusiasm about this new segment of the ISP industry, little information is available.[19] Different sources cite widely divergent numbers of WISP providers. In September 2003, analysts In-Stat/MDR estimated there were "between 1,500 and 1,800 WISPs" in the U.S.[20] During the *Wireless Broadband Forum* held in May 2004 by the FCC, Margaret LaBrecque, Chairperson of the WiMax Forum Regulatory Task Force claimed there were "2500 wireless ISPs in the U.S. serving over 6,000 markets."[21] At the same meeting, Michael Anderson, Chairperson of part-15.org, an industry association for license-free spectrum users, said there were "8,000 license-exempt WISPs in the United States actively providing service"[22], most of them serving rural areas. The FCC's own Wireless Broadband Access Task Force puts that number at "between 4,000 and 8,000."[23]

While these numbers obviously lack precision, they are also strikingly large. Considering there are about 36,000 municipalities and

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[17] See http://www.usda.gov/rus/telecom/commconnect.htm.

[18] See http://www.fcc.gov/osp/rural-wisp/

[19] The authors gratefully acknowledge research help from Namkee Park, USC, in tracking down some of the available information.

[20] Cited in Bob Brewin, "Feature: Wireless nets go regional," *CIO*, September 14, 2003.

[21] Transcript of the FCC Wireless Broadband Forum (5/19/2004), p. 63. Available at: http://wireless.fcc.gov/outreach/2004broadbandforum/comments/transcript_051904.doc. 22 Ibid. at p. 89.

[22] "Connected on the Go: Broadband Goes Wireless," Wireless Broadband Access Task Force Report, FCC, February 2005, p.5.

[23] *2002 Census of Governments*, at http://www.census.gov/govs/www/cog2002.html

towns in the U.S., of which the large majority are small (29,348, or 82%, have less than 5,000 inhabitants; 25,369, or 71%, have less than 2.500 inhabitants)24[24], and considering that there are several WISPs serving more than one community (Table 11.1), the coverage that this new breed of access providers are providing in rural and small communities is remarkably extensive.The small scale of these operators is illustrated in Table 11.1 While the larger WISPs serve less than 10,000 subscribers, the majority of them are mom-and-pop operations serving only about 100 customers each.25 This indicates an extremely fragmented industry structure, largely resulting from very low entry costs: with an upfront investment as low as U$10,000 in off-the-shelves equipment, a small entrepreneur can build a system able to serve about 100 customers, with a payback ranging from 12 to 24 months.[25] In fact, many WISPs have been started by frustrated customers fed up with the difficulty of getting affordable high-speed connections in their small communities, and who decide to front the cost of a T1 connection and spread that cost by reselling the excess capacity to neighbours over wireless links.[26] However, one common problem is the availability of T1 lines (or comparable) for backhauling traffic. Unlike urban ISPs, many WISPs have to pay additional long-haul charges to interconnect with Internet POPs located in major cities, which raises provision costs significantly.

The WISP sector is an infant industry, with most players entering the market in the last three years. The availability of both private and public financing, coupled with the slow roll-out of broadband by traditional carriers in most rural and small communities, has fueled the remarkable growth of this segment. For the moment, there seems to be significant demand from customers, and ample policy support, to

[24] Stephen Lawson, "Wi-Fi brings broadband to rural Washington," NetworkWorldFusion, *08/23/04*.

[25] See for example "How Much Does a WISP Cost?," Broadband Wireless Exchange Magazine at http://www.bbwexchange.com/turnkey/pricing.asp.

[26] As *Part-15.org* Chairman (and CIO of WISP PDQLink) Michael Anderson recalls, "I think most of the WISPS, the licensed exempt guys, the smaller, less than 10 employees, 100 miles from any metropolitan area, those guys, for the most part, started their business because of the frustration of not having the availability of broadband in their areas, which makes them either suburban or rural. I think in '98, '97, when I started wireless from ISP, I had the same frustrations. I was paying U$1700 a month for a T-1 at the office and four blocks away at my home the best I could hope for was a 288kb/s connection." Transcript of the FCC Wireless Broadband Forum (5/19/2004), p. 117.

sustain the current growth rates. Yet, at least two factors call for attention. The first is the entry of traditional wired broadband providers, such as cable operators and telcos, who in several cases have come to rural areas to challenge WISPs with lower priced offerings. The second is the long-term sustainability of these small-scale operations which often depend on a few larger customers. In early days of telephony, grassroots efforts were also critical to extend telecommunications to rural America, yet after a wave of consolidation in the early 20th century only a few remained independent (Fischer, 1992). While new WLAN technologies have similarly spurred a new generation of small telecom entrepreneurs, it remains to be seen how sustainable these networks will be in the long run.

Table 11.1 "Top 10" Wireless Internet Service Providers

Headquarters	Wireless ISP	Subscribers	Communities served
Omaha, NE	SpeedNet Services, Inc.	7,000	235
Prescott Valley, AZ	CommSpeed	4,579	–
W. Des Moines, IA	Prairie iNet	4,001	120
Amarillo, TX	AMA TechTel Communications	4,000	–
Erie, CO	Mesa Networks	3,000	_
Moscow, ID	FirstStep Internet	2,709	16
Lubbock, TX	Blue Moon Solutions	2,000	_
Owensboro, KY	Owensboro Municipal Utilities	1,550	_
Orem, UT	Digis Networks	1,516	_
Evergreen, CO	wisperTEL	1,000	31

Source: Broadband Wireless Magazine (at http://www.bbwexchange.com/top10wisps.asp, as of 2/23/05) and company data.

Conclusion

David (2002) has aptly described the Internet as a fortuitous legacy of a modest R&D program which was later adapted and modified by various economic and political actors to perform functions never intended by its pioneers. Wi-Fi has similarly emerged from a rather modest experiment in spectrum management launched by the FCC in 1985 that has unexpectedly resulted in the proliferation of local wireless networks in homes, offices, and public spaces. Much like the Internet challenged

traditional telecom networks, with this new architecture comes a new distribution of control over wireless networks. However fast new wireless technologies evolve, this will be an evolutionary process whereby various stakeholders, not simply equipment manufacturers and incumbent carriers but also local governments, start-up providers and especially endusers, will interact to shape the technology in different ways. While some battles will be market-driven, other will take place in the courtrooms, in regulatory agencies, and within standards-setting organizations. Having outgrown their original purpose as an appendix to the wired infrastructure, Wi-Fi networks now stand at a critical juncture, for they embody technical possibilities of potentially disruptive character, and yet it is in the decisively social realm of economic and political interactions that their future is being cast.

With tens of millions units sold in just a few years, there is now a critical mass of Wi-Fi radios in the environment. All signs point to the continuation of this trend in the coming few years: Wi-Fi devices are becoming very cheap and embedded in a wide array of consumer devices, from cell-phones to televisions, appliances and cars. Once density reaches a certain threshold, the traditional deployment architecture and models of control will need to be revisited, for the system is likely to reach capacity as too many devices compete for scarce resources such as frequencies and backhaul links. This will inevitably lead to regulatory battles about how to reform the existing legal edifice for wireless communications, largely based on the broadcast model of a few high-power transmitters connecting to numerous low-power, limited-intelligence devices. The ongoing debate between unlicensed vs. property rights-based models of spectrum management illustrates this point.

One of the central questions for the evolution of WLANs is whether the large, and fast growing, number of radio devices in the environment could be coordinated differently to create a fundamental challenge to existing networks. We believe we are fast approaching a point where this might happen, because of two related developments. The first is the bottom-up dynamics associated with Wi-Fi deployment discussed in this paper. As households, grassroots community groups, small entrepreneurs and local institutions build their own networks, the incentives will increase to share resources, reach roaming or peering agreements, and devise new cooperative mechanisms to manage

this decentralized wireless infrastructure as a public grid. The possibility to do just that is tied to the second development, the recent emergence of open-source mesh protocols that can knit together neighboring Wi-Fi devices into a single network. At this point, mesh technology has been worked out for centrally deployed network devices, and much technical work remains to be done for ad-hoc mesh networks to become a reality. Nonetheless, as with other technologies, experimentation by users and corporate R&D will eventually result in a workable solution. More challenging, however, will be to create new organizational arrangements to manage the wireless grid. As noted, because it was conceived under assumptions drawn from an earlier generation of wireless technologies, the existing regulatory regime limits the growth of and stifles experimentation with bottom-up WLAN deployment. Revisiting these assumptions is a necessary step to allow these exciting new ways of building and running networks to flourish.

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Chapter 12

Free Software and Social and Economic Development

Marcelo Branco

Introduction

We live in a period that has become known as the "information age," in which we have the possibility of interacting with new technologies that establish new forms of communication between people and between people and things. We are experiencing a revolution, at the center of which are the information and communication technologies.

As a result of this, we are also witnessing profound alterations in our social, political and economic relations, heightened by the permanent expansion of communications hardware, software and applications that promise to improve economic results, provide new cultural impulses and incentivate personal improvement through the use of the technologies for educational practice.

Far from fulfilling that promise, the cyberspace or the Information Society—which is materializing today with the growth of the Internet—has instead increased the inequality between those who have and those who do have access to the benefits of the network.

For those of us who want a better world, understanding and reflecting on this new level of capitalist accumulation and examining the contradictory potentials of this new period in history, are fundamental factors for updating both are theoretical concepts and our practices as public managers.

Our Life in Cyberspace

The thus far dominant technologies for the supply of information, communication, entertainment and ways of doing business are being replaced by a second technological generation using broad instead of

narrow band. The objective is to supply a greater volume of multimodal (sound, image, text) and multiplexed information simultaneously, which can be transmitted at increasingly higher speeds. Digital codification is the process that makes it possible to converge information stored on a computer (data), cultural products (music, films, books), telecommunications and radio and television transmission processes in one and the same format. This converging technology combines technological capacities that were once separate, meaning that the telephone, the computer, the TV and the sound system will be operating as one unit—a unit that is much more powerful and with a much greater presence in our lives than we could imagine. The Internet is the materialization of this new scenario, fuelled by the efforts of manufacturers, investors, academic researchers, hackers and government policies. Before the advent of the network of networks (the Internet), traditional communications were divided into two categories: one to one or one to some (fax and telephone) and one to many (TV, radio, the press and cinema). In the new environment, in addition to these categories, the possibility of communication of the many-to-many type has also emerged. This not only brings access to greater quantities of information, but also transformation of the economic and social relations—which interact in all branches of capitalist production—in an endeavour to adapt to the "more economic" way of doing business and new form of relations with people. New forms of relationships emerged, and also new communities without precise geographic definition—new producers, new distributors and new consumers with a global and no longer merely local or regional positioning. These new economic, political and social relations—we can call them virtual—are faceless and territory-less. They are now part of our daily routine—our life in Cyberspace.

Digital Exclusion

In the new economic order resulting from the decline of the manufacturing industries and the expansion of the services sector, we have witnessed the birth of the information age and its growing importance as a sources of products, growth and the creation of wealth. "Moving bits instead of atoms is a lot cheaper." The value of knowledge as a "universal good" has forfeited space to the marketing of knowledge. Knowledge/information has become just one more product in the

globalized market. This new technological level of capitalist accumulation has ramifications in terms of employment patterns, contributing decisively to the high degree of obsoleteness of jobs in the production industries and, more acutely now, in the services sector. New social agents, new forms of work relationships, new professions are emerging. The possibility of locating production closer to cheaper sources of labour gives rise to new international labour divisions, new forms of control and increasing competition. Capital surfs the cyberspace in search of new business opportunities and new markets, with greater productivity. Brazil and some of the peripheral countries are regarded by those who control the international market as being of vast potential for the consumption of proprietary technologies and contents from the countries of the Northern Hemisphere. This phenomenon reduces us to the role of mere consumers of technology and contents and not protagonists in the new global scenario. We enter the digital scenario as subordinates to the interests of the policies of the central countries and global corporations. Our scientific, technological and economic development also plays a subordinate role, and at the social level, digital exclusion is increasing instead of decreasing. Our countries and regions are becoming even poorer in economic terms and a new poverty dimension is emerging—digital information and knowledge poverty. "The exclusion of people from active participation in, the privileges of, and responsibility in, the information society is perhaps greater than exclusion from access to the privileges of the ruling classes they were subject to in the past." The most visible example of this exclusion is that almost one half of the country have never had their own telephone line and only some 5% of Latin Americans have home access to the Internet.

Digital Consumers, Proprietary Software

The trend towards universal access of the population to the worldwide computer network with technologies we do not master and contents we have no influence on guarantees neither digital democratization nor the socialization of the economic and social benefits provided by the technological advances. On the contrary, we are experiencing a heightening of the inequalities and technological dependence on the central countries. "In the concrete field of information technologies, an age-old phenomenon is being repeated since

the 1980s: knowledge, transmitted via a written language code, is being zealously guarded by some, who use it to maintain a power structure that has survived over the centuries. In the 1960s and 1970s, the development in information technologies was due, in part, to the specialists sharing their knowledge. Computer programming codes were shared, meaning that the advances achieved by one were used by others to improve the programme in question. Today, a large part of the computer applications we use has a secret code. They belong to their proprietors and we cannot copy them or share their development. Only the proprietors can modify and improve them. If that is in their interest, of course."[1] The high cost of the software used in computers and the barrier to free scientific and technological knowledge imposed by proprietary licences have hindered and even prevented some regions of the world from benefiting from this revolution in order to provide better quality of life for their citizens.

The Free Software Movement and a New Paradigm for Our Development

In this new scenario, in which the Internet and the information and communication technologies assume a vanguard role, new possibilities of social intervention and new economic relations are also emerging. We can create new spaces for the practice of citizenship and democracy, new spaces for educational practices and bring our technological, scientific and economic development up to new heights. To this end, we must put an end to dependence and subordination and actively develop a new model, with the help of public policies and alternative practices. Some important initiatives are being implemented to invert the dominant trend, offering alternatives with a view to ending digital exclusion. One of the most important of these initiatives is the Free Software Movement, which is building a concrete alternative to the hegemonic model and has proved to be more efficient in scientific terms and more generous at the social level. "For a number of years a group of specialists has been working with the aim of sharing their work. They communicate via the Internet and work on joint projects, no matter what part of the world they are in. They have developed a technology that is so solid that institutions and corporations such as the Government of Brazil, the Regional Government of Extremadura, Google, AOL, Time Warner, Amazon and others use it without

problems. We are talking about "free software applications," which can be legally copied. Improvements to a programme are made available to all."[1]

Due to the solidarity aspect—i.e. the fact that it helps open up knowledge to all citizens, that we can adapt computer programmes to each individual need without requiring the permission of large corporations, that in the 21st century our regions and countries can take a leap forward towards technological equality, that we can use, develop and investigate state-of the-art technologies in real time, with the state of development of first world technology—this new paradigm is more in line with our development interests. This movement, supported by thousands of autodidacts working in cyberspace—the hackers (not to be confused with crackers),— is shared by our young graduates and local companies and offers us the possibility of developing our technological autonomy and independence without the risk of isolation from the international community. On the contrary, we will be in perfect synchronization, with a high degree of knowledge sharing. Our concrete experience with the Brazil Free Software Project[2] and the Brazilian government initiatives has shown the social amplitude and the strategic importance of having public government policies in similar projects. Instead of sending billions of dollars for licences for the use of proprietary software and protected technology to the countries of the North, as we do today, we can transfer those resources to the internal market and further the development of the local economy and the modernization of other sectors of our economy. We must develop a public policy of incentives for the creation and strengthening of local and regional companies that operate in this new paradigm of the information technology market. With the information technology products and services—free from the restrictions imposed by the licences of the software giants—we will make our digital inclusion more accessible and more adapted to our reality, we will boost our local and regional economies, we will make use of the local knowledge coming from our universities and schools and we will share our latest-generation technological knowledge in real time with the other countries on the planet.

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[1] Regional Government of Extremadura—text on the launch of GNU/LinEx

[2] A non-governmental initiative: www.softwarelivre.org

What is Free Software?

Free Software is computer programmes written in cooperation by an international community of independent programmers communicating via the Internet. They are hundreds of thousands of hackers who reject all associations with "security breakers." "That is a confusion on the part of the mass media," says Richard Stallmann, Chairman of the Free Software Foundation.[3] These software developers reject the pejorative meaning of the term hacker and use it as meaning "some who loves programming and who likes to be capable and inventive." In addition to this, the programmes are handed over to the community an open source, accessible code, thus making it possible that the original ideal can be developed and perfected further by the community. In conventional programmes, the programming code is secret and the property of the company that developed it, so that it is almost impossible to decipher the programming language. What is at stake is the control of technological innovation. For Stallmann, "free software is a question of freedom of expression and not just business." Today there are thousands of alternative programmes developed in this way, with a user community of millions around the world.

Software can only be considered free if it guarantees the four fundamental liberties[4]: a) freedom to use the programme for whatever purpose; b) freedom to modify the programme and adapt it to one's needs (to make this liberty possible, one must have access to the source code, for modifying a programme is very difficult without the code); c) freedom to distribute copies, both free and at a fee; d) freedom to distribute modified versions of the programme, so that the whole community can benefit from the improvements. The most high-profile example of software following this concept is the operating system GNU/Linux, an alternative to Windows developed and enhanced by thousands of co-programmers around the globe. For this reason, its quality has been proven to be superior to that of the software industry rival.

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[3] www.fsf.org

[4] http://www.gnu.org/philosophy/free-sw.html

A New Form of Production

The main leaders and protagonists of the movement are the hackers—very capable programmers who have gained notoriety for having developed an important programme or useful tool for the movement. The most well known are Richard Stallmann, the head of the movement, and Linus Torvalds, who wrote the kernel for the GNU/Linux operating programme. These "cyberproletarians" who make life hell for Bill Gates, work mainly on a voluntary basis and are responsible for more than 80% of the work effort that has gone into the thousands of free programmes used in the world. The reasons why a hacker may develop a programme on a voluntary basis are the most varied possible: the quest for fame and recognition, the desire to create something useful, indignation at Bill Gages, insomnia… or all of these together. Less than 20% of the free programmes are developed by programmers working in companies with conventional structures. Another reason for the optimal quality of the products is their development in cooperation. From the conception of the software project through all production states, a team of programmers, from all around the world, is very actively involved, communicating via the Internet. All documentation and codes are made available without secrecy, guaranteeing development 24 hours a day, 7 days a week. Another important feature is that unfinished and incomplete products are made available to "user groups" and to any interested party for assessment purposes. The user groups are made up of professionals from other areas, as well as programmers, who detect bugs, suggest modifications and request new functionalities. The product is thus constantly improved. They are not like proprietary products, which, once completed, then seek consumers in the market. They are products that seek to be of use to the community, made to order to attend to already existing needs. Another important lesson to be learnt from the movement is the creation of distributors. In order to undermine the blockage of distribution of these programmes, several international distributors were created that are responsible for the "packaging" of the programmes copied onto CDs and the instruction manuals and for providing support services to the users. It is they who place the "packs" in the shops, making life easier for the users and avoiding that we have to spend hours downloading the programmes from the net to able to set up our computers. This is one form of doing business in the world of free software, given that selling the licence is prohibited.