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Futurescaping Infinite Bandwidth, Zero Latency

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A B S T R A C T

In the 1990s Castells analysed 'the rise of the network society' but this remains an ever-changing phenomenon. It throws up new concepts and issues. For example, no one foresaw what Mark Zuckerberg would create in terms of on-line social networks with the FaceBook project. Predicting the functionality and utility of the Internet is a mug's game and yet it can be extremely profitable for those who 'guess right' and are able to influence the future applications and organisational forms of the network society.

Next Generation Access (NGA) broadband is promoted strongly by policy makers as underpinning future economic growth. NGA can be thought of as a potential future placeholder, the content and structure of which, while remaining tantalizing, is occupying many contemporary minds. In this paper we describe a process (Imagine/Triple Task Method) and an event structure IBZL (or Infinite Bandwidth Zero Latency), which explores potentially novel applications of NGA and provide some ideas as to the key components of the future inter-networked landscape.

In this paper we present the context of the IBZL initiative, review the 'Imagine' process as an effective method for 'futurescaping' and present some initial outcomes of the project.

1. Introduction

The Infinite Bandwidth, Zero Latency (IBZL) project described in this paper aims to identify innovative areas for research and development relating to applications of 'next generation' broadband networks, using the 'Imagine'/Triple Task methodology [1–3]. The IBZL project takes as its starting point the observation that recent policy has focussed on technological infrastructure rather than applications and users [see for example: 4]. IBZL aims to identify areas for potential R&D and near-to-market collaboration between and among academics and the private sector as well as informing technology policy makers at regional/national levels about local economic and community development opportunities enabled by these technologies [see also: 5].

The Imagine approach draws on soft systems methodology [6–8] and a range of methods taken from the problem solving and psychoanalytic literature and practice [9–15]. Imagine was originally intended to be applied with groups/communities reviewing their sustainability. In the IBZL context we apply the approach to identify potential areas for innovative research and development projects.

The paper is structured as follows. Firstly, we introduce the policy and technological contexts for this work. Secondly, we describe the workshop methodology. Finally we review both the initial outcomes of the IBZL project and the value of the Imagine methodology.

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2. Setting the context – Next Generation Access

In the UK, the 'Digital Britain' report [16] has set the recent policy context for building high-capacity broadband networks. Following the 2010 General Election, it seems that the new government broadly shared the objectives of the previous administration, though the precise policy mechanisms planned to achieve them may change [17]. 'Digital Britain' sets a target of universal access to broadband networks at 2 Mbps by 2012 (relaxed to 2015 following the election). More interestingly, for this paper, it also discusses steps necessary to implement a step-change in the quality of broadband provision, often referred to as 'next generation access' (NGA) or 'superfast' networks.

While there is no universally agreed definition of what qualifies a network to be considered 'next generation', three elements are usually considered essential:

- Firstly, NGA will provide a significant increase in the transmission speeds available to the domestic or small-business end-user. The speeds cited vary widely, but at the time of writing figures from 25 Mbps (e.g. What is Digital Region? 2009) to over 200 Mbps are commonly used. The 'Digital Britain' report [16 page 54] refers to 'next generation service up to' 40 Mbps, and more recently ministers have referred to 50 Mbps and faster [17]. To put this in context, in early 2010, Google (Google, 2010) announced a plan for experimental community networks operating at 100 Gbps.
- Secondly, and in contrast with currently widespread ADSL technologies, it is generally assumed that NGA will offer a step-change in upload as well as download speeds, reflecting the demands of increasingly user-generated content. For some, NGA bandwidth should be symmetrical, though others have a more relaxed view [e.g. 18].
- Thirdly [18] NGA is widely taken to offer improved 'quality of service' (QoS). QoS here is taken to mean not only service reliability and availability, but also indicators of network performance including latency (the time taken for data packets to travel from source to destination), jitter (the variation in latency among data packets) and data loss (the loss of data packets due to network congestion). Latency, jitter and data loss are important aspects of the usability of applications such as internet telephony or video, in addition to 'raw' bandwidth.

The precise configuration of NGA networks will vary but there is a general understanding that fibre to the premises, at least, will be integral to service provision.

3. NGA applications

The case for NGA is usually predicated on one, or both, of two arguments. Firstly, extrapolations of recent developments in bandwidth use are projected forward [e.g. 19]. These usually foresee major growth in bandwidth-hungry video-intensive applications, including high definition TV, video on demand and more recently, 3D TV [e.g. 20]. Some have argued that there are limits to this type of argument by extrapolation, since it is likely that there is an upper limit to likely demand for bandwidth (for example, since there are only so many 3D, HDTV video streams that a family can 'consume' simultaneously) and forecasts do not take account of types of content needed to justify the costs to consumers of switching to broadband from traditional cable or satellite services [19,21]. Interestingly, the other main application area responsible for bandwidth consumption is peer-to-peer file sharing, which in 2009 accounted for 38% of global bandwidth [22] and which has been the target of policy initiatives internationally to protect copyright holders.

The second argument for NGA networks is essentially 'build it and they will come'; the very existence of an NGA network will bring into being novel applications that can take advantage of the features of NGA connectivity. To the extent that the history of earlier generations of broadband is any guide to the likelihood of such applications appearing, we have a mixed picture. Cawley and Peston [23] have argued that earlier generations of broadband did not lead to the predicted widespread innovation in broadband content. However, they rather underplay the most striking development in the use of broadband in recent years, which has been the spread of user-generated content (UGC) central to 'web 2.0'. Interestingly, video-sharing aside, user-generated content does not necessarily demand high-bandwidth – Wikipedia, Twitter, most blogs and uses of FaceBook are primarily text applications for which the ubiquity and 'always on' natures of network connections are at least as important as bandwidth, if not more so.

4. Telecommunications and regional policy

Telecommunications policy is not solely the preserve of national policy makers. Indeed, in the UK national policy [16] explicitly acknowledges the importance of local and regional actors in implementing NGA networks, at the very least as technology 'test-beds'. Since the 1980s urban and regional policy makers internationally have been concerned with the roles of telecommunications infrastructure and applications in economic and social development [e.g. 24–27]. The availability of advanced (however that is interpreted at a particular point in time) infrastructures, they argue, is linked to the ability of cities to remain competitive in a networked world.

Broadly, there are two sets of mechanisms by which telecommunications infrastructures are linked to local economic development.

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- Firstly, knowledge-intensive enterprises demand advanced telecommunications infrastructures (along with, for example, road and air transport networks) to conduct their activities whether at head offices, research laboratories or call centres. If the infrastructures are not available, a city's attractiveness to inward investors will diminish.
- Secondly, and more significantly here, digital networks are at some level linked to the emergence of clusters of digital companies. Paradoxically, this happens not because of increasing levels of telecommunications-mediated communications locally, but because of the intense face to face interactions stimulated by the physical proximity of innovative people and enterprises [26]. In the context of Manchester, local digital clusters are closely linked to the creative and cultural industries which have emerged there over the last 20 years. This impetus is being reinforced by the relocation of parts of that bastion of the old media, the BBC, to the city and the establishment there of significant research and development capacity.

Manchester, the site of the work reported here, has been particularly prominent in policy and debates around municipal telecommunications since the late 1980s. This led to the establishment in 1991 of the Manchester Host, and subsequently initiatives such as the G-MING fibre network, Manchester Community Information Network and related initiatives [28,29]. In the EU, Manchester City Council was a founder member of the Telecities network of European cities, of which it has remained a leading member. Most recently, Manchester has been among the first cities in Europe to implement NGA networks, initially through the 'Manchester Corridor' project linking the city's large higher education base to nearby small enterprises (see http://www.corridormanchester.com/broadband.html).

5. Imagine – 'Infinite Bandwidth, Zero Latency'

The Infinite Bandwidth, Zero Latency (IBZL) initiative reported here was designed as a contribution to regional and national processes of innovation by identifying new applications that are made possible by NGA networks and which may contribute to the continuing development of innovative digital industries. The title of the initiative was not intended to be taken literally but to characterise a world in which, for given classes of application, limitations of bandwidth, latency and other aspects of QoS cease to be limiting factors. Hence it addresses a gap in policy and strategic thought, where relatively little attention has been given to exactly what kinds of novel application are made feasible by networks which tend towards the IBZL. The IBZL process was intended as a means to explore the futurescape and speculate on potential future technologies. To facilitate the process the Imagine methodology was adapted and applied as a form of future workshop for deep reflection on possible scenarios [numerous examples of this kind of work exist, but see for example: 30].

The first IBZL workshop was held in Manchester in May 2010, organised jointly by the Open University Faculty of Mathematics, Computing and Technology and Manchester Digital, a trade association of creative and digital companies in Manchester and the North West of England. It brought together invited public sector, private sector and academic participants, to imagine a digital future.

The IBZL idea was explored by means of participatory engagement making use of the 'Imagine/Triple Task Method'. There are numerous applications and forms of such engagement (These arise in a wide number of fields, for example: [52]; Kalopedis 2007; Kindon, Pain and Kesby 2007; Newig, Gaude, Berkhoff, Kaldrack, Kastens, Lutz, Schlubmeier, Adensam and Haberl 2008; Tompkins 2008; Kangasa, Saarinena, Saarrikoskib, Leskinenc, Hujalac and Tikkanend 2010; Peterson 2010; Zhao 2010). Imagine was originally developed in collaboration with French agency Plan Bleu (see http://www.planbleu.org/planBleu/historiqueUk.html) and building off established approaches such as Soft Systems Methodology (see http://en.wikipedia.org/wiki/Soft_systems_methodology), it is a method which has emerged from research undertaken in the Mediterranean and the UK in sustainable development. The basis for the method is recorded in a number of texts [1,3,31–36].

Bell and Morse described the core of the method as: 'participatory deconstruction and negotiation of what sustainability means to a group of people along with the identification and method of assessment of indicators to assess that vision of sustainability'.

The background of the approach in sustainability analysis provided it with both a deep scoping facility and a focus on scenario making, both considered to be important elements for the group work needed for the IBZL project. For example, for the IBZL context the quote above can be re-worked as follows:

> ''participatory deconstruction and negotiation of what *IBZL* means to a group of people along with the identification and method of assessment of *means* to assess that vision of *IBZL*''

Imagine has subsequently been developed as Task 1 of the Triple Task Method of Group analysis (see http://en.wikipedia.org/wiki/Triple_Task_Method: [37]). In this guise it is intended to take a group of participants through a series of 'events' which allow them to:

- Review the current situation;
- Prioritise issues;
- Envisage future options;
- Develop a forward plan for community development.

In the approach the output of each event is captured and used as feed-in to subsequent stages. Step by step a viable and creative vision is developed and shared by those engaged in the process.

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Table 1
Stakeholder mapping.

	Expected to be a daily/ regular engagement with the technologies	Occasional/rare use of the technologies	Not a user of the technologies but does have knowledge of them
Expert – could be a technical person or a regular technology thinker (at least in theory) of specific technologies	ED (Amber) An obvious stakeholder. But not too many. Of a group of 20 no more than 2 or 3 – this group, if over-represented, can take over the event	EO (Amber) Good stakeholder. Can offer insights and some good grounded potential for improvement. We suggest 3 or 4 in a group of 20	EN (Red) Hmm. Can be a good stakeholder but this needs careful consideration. Will the expert be a 'critical friend' or a disruption? 1 or 2 in a group of 20
Professional/practitioner – maybe a government/agency person or an NGO/private sector person who has a more applied and less 'design' (technical) view of technologies.	PD (Green) Good stakeholder. Commands respect as a user and may have many views for improvement. Maybe 4 or 5 in a group of 20	PO (Green) Really good stakeholder. They know the terrain and maybe occasional because they either want to know more or have had a bad experience (for example). Can add real insights 4 or 5 in a group of 20	PN (Red) OK... adds something... especially if they are 'open' to ideas. Suggest only 1 or 2 in a group of 20
Lay person – person 'in the street' – could be keen but is at least 'engageable' in conversations	LD (Green) Generally a fantastic addition to the group. No specialised knowledge but loads of *Expertise from the Grief of Use*. 5 or 6 in the group of 0	LO (Amber) Another really good group. Why are they occasional users? Uncovering this may lead the group and the research to great insights. But use with care. 3 or 4 in a group of 20	LN (Red) A bit like the PN, the LN needs to be open to really contribute in the intense soft session. Good to have but only 1 or 2 in a group of 20

Stakeholder work requires considerable planning in order to gain balance and productive outputs. In order to encourage this the stakeholders to be included in the IBZL event were categorised in terms of their level of expertise and use of IBZL type technologies. Table 1 provides an overview of this stakeholder mapping.

The colour coding is intended to be indicative for selection purposes. Many stakeholders may span more than one category, for example, the distinction between IBZL 'expert' and IBZL 'practitioner' row categories may be blurred in some cases. However, as a generalised means to assess the makeup of a group to work with, certain characteristics can be assumed:

Low risk selection:

10 green, 6 amber and 4 red = a good group. A group where the range of positive mindsets and engagements are dominant.

Intermediate risk selection:

8 green, 7 amber and 5 red = a potentially good group but could be either unduly negative, e.g.: 'they just won't listen/ learn'; or, unduly passive, e.g.: 'OK. whatever you say'

High risk selection:

6 green, 8 amber and 6 red = potentially explosive or inert, e.g.: 'hate this stuff', or 'all beyond me'

In the process of planning the first IBZL workshop the authors applied the 'rules' of the stakeholder mapping table in order to try to arrive at an overall 'mix' which would include a wide range of different type of stakeholder interests and levels of engagement in IBZL forms of activity. The output from this balance of members to the event will be discussed in greater detail shortly.

6. Process for the IBZL workshops: Imagine/Task 1

The Imagine process applied in the first IBZL workshop was intended to take the stakeholders though a five stage process as set out in Fig. 1.

In the limited time available for the process (1 day in the case of IBZL) the group of stakeholders is first broken into mixed groups and then encouraged to explore what possible technologies with IBZL characteristics could emerge. The primary means to engage the stakeholders in this imaginative and creative, future-scaping process (we knew our risk in this, this kind of activity in inspired guess-work has been described by Naughton as being 'patently absurd'), is the Rich Picture. A rich picture is shown in Fig. 2.

The idea of the Rich Picture is to provide an unthreatening but revealing means for groups to share ideas – in terms of Imagine/Task 1 to 'Reflect and Understand'. Rich Pictures now have a wide-spread lineage. Taken up by Soft Systems users [38–45] and it was widely adopted by information systems developers. More specifically, Rich Pictures have been discussed,

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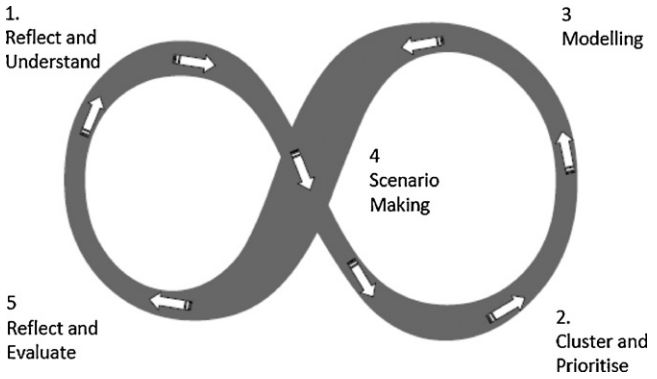

Fig. 1. The Imagine/Task 1 Process.

described and reviewed in a variety of fora; from Nursing [46] to ICT [47]; from care working [48] to the construction industry [49]; from creativity [50] to engineering [51]. The pictures also have been approached constructionally as either free form diagrams or as computer generated output from a software package. Generally Rich Pictures have a conventional representation in participatory group work. Although not labelled as such, they fit into the ethos of participatory work such as that developed by Chambers [52]. In his 2002 book he describes participatory diagramming as follows:

> "Participants draw, elaborate on and analyse their own maps of models. These can represent anything with a spatial dimension – social maps showing people and their types; health maps – people resources and services; mobility maps – where people go for services; vulnerability maps – dangerous places; defectation maps – where people go to go; maps of farms or gardens, trees; maps of buildings ...." page 136.

More recently, Bell and Morse have applied Rich Pictures in research areas and shown them to be rich as both means to elucidate difficult areas and processes to uncover hidden and subconscious group thoughts [45].

In the IBZL context the Rich Picture is 'mined' for ideas – phrased in the workshop as opportunities or dreams.

The group of stakeholders have shared ideas and drawn out the main themes of their collective understanding (in this case re. the IBZL idea in their practice/experience). The opportunities and dreams are related to this reality but importantly build on this and extend their collective understanding (Fig. 3).

In order to gain greater clarity the groups are then encouraged to take their opportunities and dreams and align them on a matrix of achievability and excitement. Fig. 4 shows how this looks in theory. In terms of the approach this corresponds to 'Cluster and Prioritise' as shown in Fig. 1.

The prioritisation process is intended to allow the group to assess the achievability of the ideas that they have been exploring. This, related to the sense of excitement about the ideas may indicate particularly alluring ideas which are

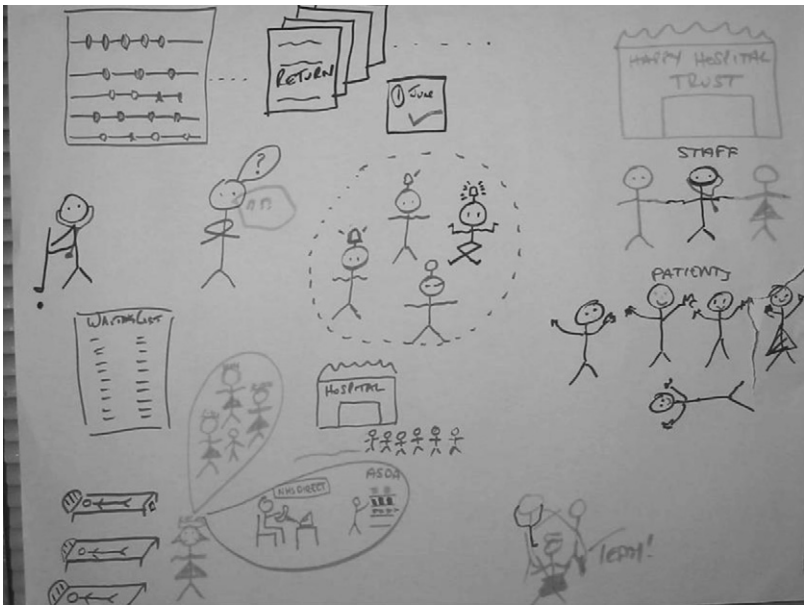

Fig. 2. A rich picture.

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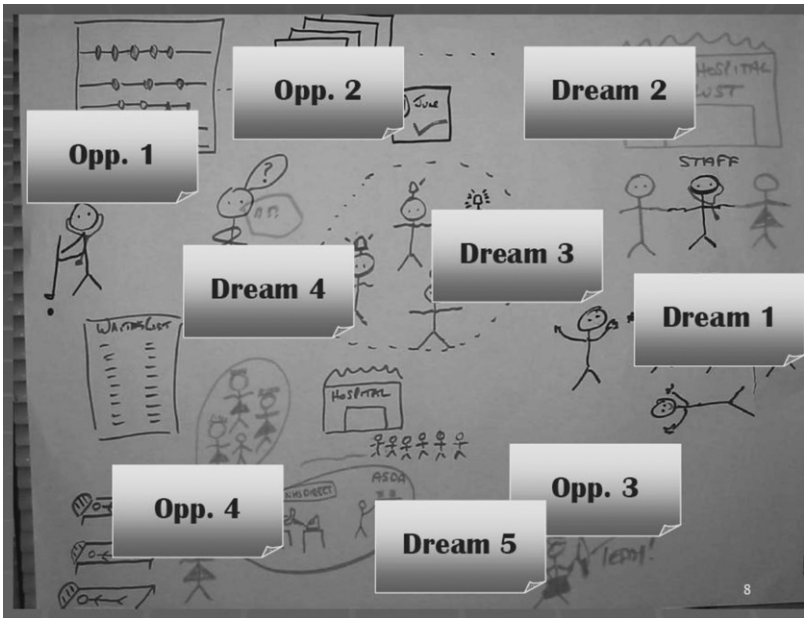

Fig. 3. Drawing opportunities and dreams out of a rich picture.

achievable. By definition of the table, these will appear in the top right hand corner of the matrix. However, this is not the end of the process, the intention of the workshop is to see if atomic ideas (such as individual opportunities and dreams) can be powerfully aligned in collective. In order to explore this the stakeholder groups are now encouraged to look for synergies and relationships between the opportunities and dreams – this corresponds to phase 3 of Imagine/Task 1 and is shown diagrammatically in Fig. 5.

The intention of the stage is to seek big, emergent themes from collectives of creative ideas. Within the methodology the outcome, collectives are known as 'Systems of Challenge' or SoCs. The next stage of the process is to encourage the stakeholders to explore the each SoC as a potential scenario or change object (stage 4 of the methodology as shown in Fig. 1). In this scenario making stage the groups are asked to consider each SoC:

- What is its name (naming is an important aspect of scenario making)?
- What it will do?
- What will the SoC transform?

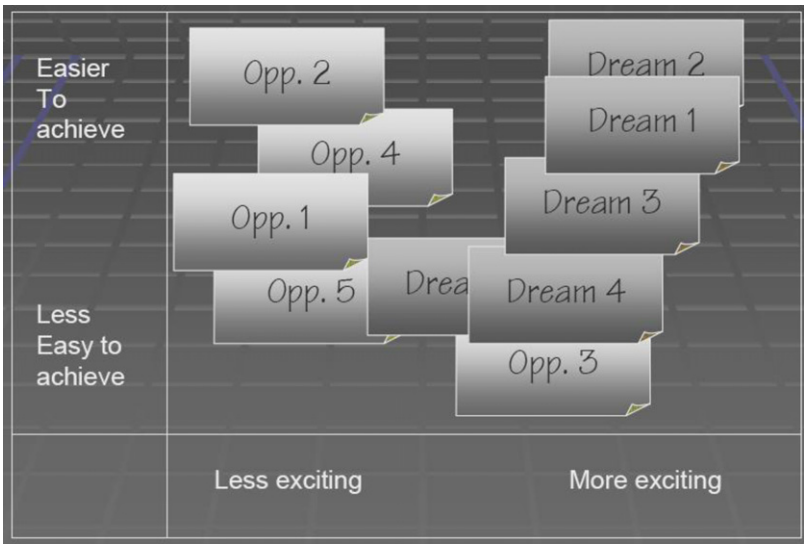

Fig. 4. Prioritising opportunities and dreams.

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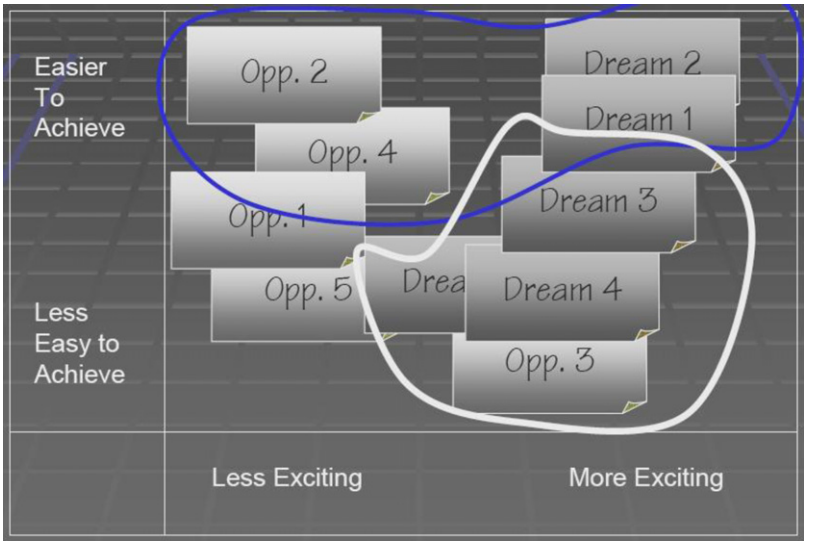

Fig. 5. Collectives of opportunities and dreams.

The method ideally expects another Rich Picture at this stage, however, in many cases groups are hard pressed at this stage and do not necessarily have enough time to develop a full-blown diagram. If they have a narrative sense of an answer to the three questions set out above they are in a good position to move onto stage 5 of the method and explore:

- What needs to happen now?
- What must not happen now?
- How and who can we influence?
- How and who do we avoid?
- What needs to change and what needs to stay the same?

This set of questions should provide the group of stakeholders with a sense of the utility and use-issues around their SoC/idea. This can subsequently be developed into a full-blown project proposal (if this is considered to be viable).

The final stage of the approach is for the stakeholders to consider their work in a reflective mode. In this final stage the groups are asked to reflect on their working processes over the day and to consider how things could develop in future. Central to this stage is a focus on interpreting how the SoC ideas could work in practice and, related to this a realistic assessment of the commitment of all member of the group to their change agenda. Finally the groups are asked to review their outcomes and feed back their observations.

The next section of this paper describes the experience of using Imagine/Task 1 process in two IBZL workshops.

7. Early/Initial IBZL outcomes

Overall, 12 named outcomes were generated by the first IBZL workshop, and 13 in the second. To give a sense of the quality of the work undertaken, five of these emergent ideas are briefly summarised below. We have illustrated three of these with examples of the intermediary outputs associated with each Imagine stage.

'*Always on social space*' – virtual spaces in which the connection is always on/perpetual, supporting the kind of occasional, informal, spontaneous, real-time social encounters ('collisions') that happen when people are co-located, between people living and working remotely. This would not only allow a new level of remote working and collaboration but also the sense of living in proximity with friends and relations which could transform the lives of older people who need to stay longer in their homes as the population ages. Fig. 6 illustrates the initial rich picture used in developing this idea.

Intelligent matchmaking' – bringing suppliers and consumers together optimally for business, social and educational interactions. Behind this would be a thorough analysis of organisations, products and people, made possible next generation networks, in order to synthesise high quality informational and other connections. Fig. 7 illustrates the matrix of achievability and excitement generated used in clustering and prioritising one group's ideas.

'*Real artisans in a virtual world*' – the networked production of artefacts by artisans in multiple locations. Next generation technology could support real-time collaborative generation of product ideas followed by the process of design, development and distributed fabrication. This could turn the conventional trading pattern on its head with artisans in the

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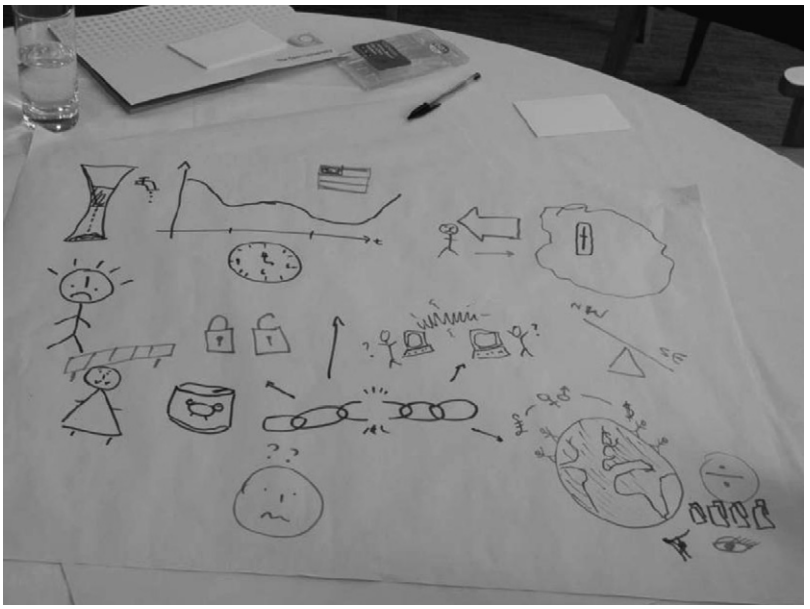

Fig. 6. 'Always on' social space rich picture.

developing world crafting products for "3D printing" in the developed world, effectively re-engineering (or at least, challenging) current craft value chains. Fig. 8 shows the final stage narrative outcome reporting this concept.

Peer-to-peer processor time-sharing using – Projects like SETI@home use the spare processor capacity of millions of personal computers to process batches of number-crunching tasks, co-ordinated among volunteers by a central 'master' application. Next generation networks could allow real time peer-to-peer sharing so that when an application needs additional capacity for processor-heavy tasks, like video rendering, it could have access to effectively limitless extra computing power.

Latency mapping – the evolution of next generation networks will be uneven, resulting in a 'geography of latency' and the disruption of 'simultaneous time'. The kinds of networked application that are feasible between two network locations will be a function of a range of factors including spatial distribution, network infrastructure and the network of relationships

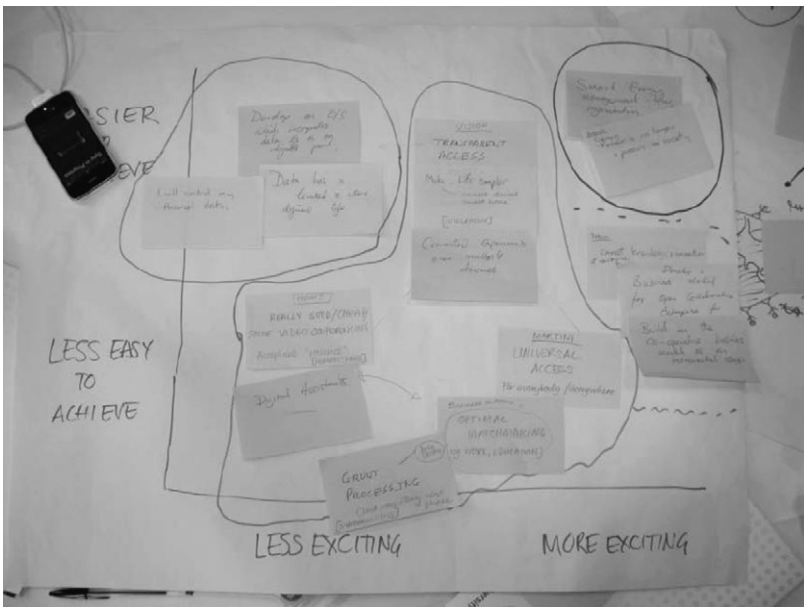

Fig. 7. 'Intelligent matchmaking': matrix of achievability and excitement.

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between service providers. Latency maps would be an enabling tool to identify the kinds of applications possible within/between, technical/geographic, or commercial spaces.

8. IBZL workshop outcomes

Following the process described above, the two workshops produced 25 "key concepts" which can broadly be clustered as follows.

8.1. Digital resource management

Several of the outcomes were concerned with requirements and ideas for supporting the use of large volumes of complex services and data sources that participants expected to emerge. These included ideas such as intelligent matchmaking between individuals, organisations and objects, 'digital butlers' and suggestions for 'alternatives' to searching and browsing for resources, based on users' social networks. A distinct sub-theme here included concerns over privacy and the ability of users to control access to and re-use of their own personal data. Examples included the ability of users to put 'self destruct' dates on their data, and citizen-oriented 'vendor relationship management' applications. The possibility of new metaphors to help people to control access to information about them as well as, for example to support 3D visualisations of complex data spaces more generally, could make the control of data and access to it more intuitive.

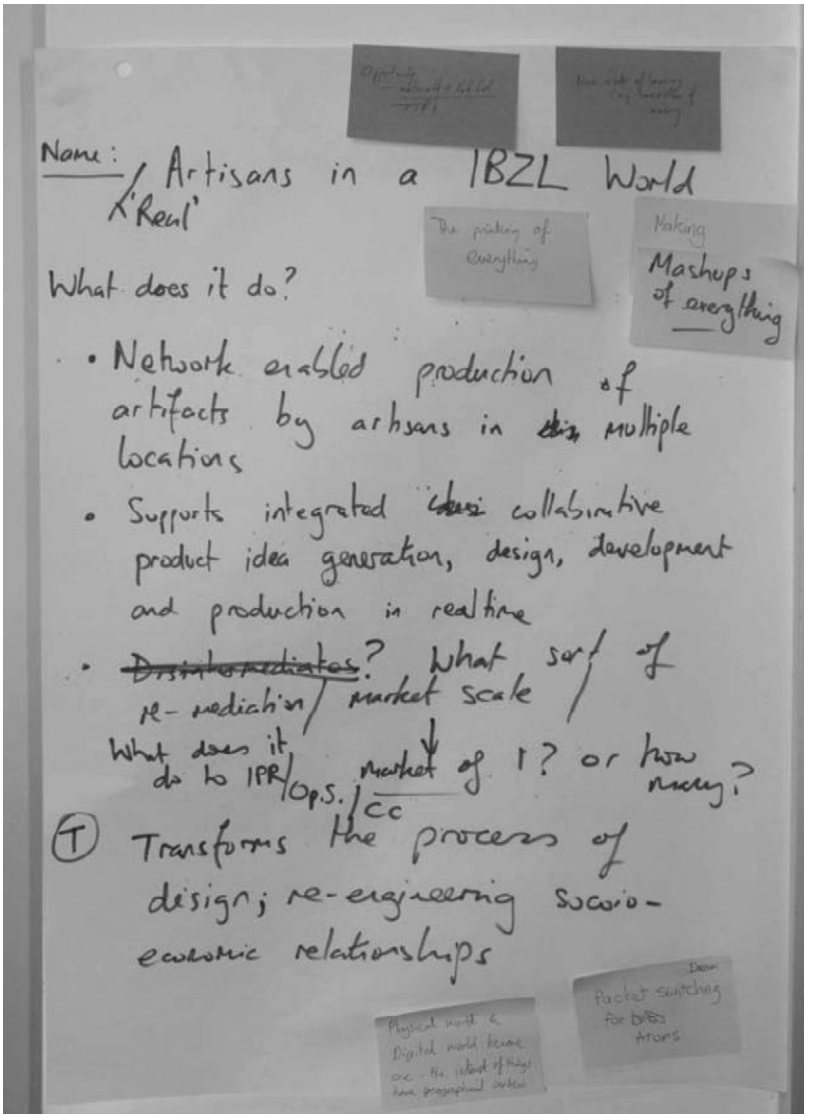

Fig. 8. 'Real Artisans': narrative outcome of the final stage.

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8.2. Telepresence

Some outputs suggested that abundant bandwidth and effectively zero latency would allow for telepresence applications able to offer the kind of rich social presence that could support the kind of ad hoc social interactions to be found in collocated domestic or work settings. Such applications could improve informal knowledge sharing in distributed organisations or counter social isolation particularly for older people as families become increasingly scattered.

8.3. Resource sharing

Several workshop outputs identified various forms of digital resource that might become be developed as highly distributed data storage and processing become feasible. Effectively, these outputs critiqued contemporary 'cloud computing' as being highly centralised in data centres. High bandwidth/low latency networks will enable more effective peer to peer sharing of data storage and access, building on existing peer to peer networks. Perhaps rather more significantly, these networks may enable real-time peer sharing of processing power. Existing applications (such as the well known SETI@home[1] project) work by a centralised master application distributing 'chunks' of data among slave applications which return results centrally. A genuine peer-processing model would allow the distribution of processor-intensive applications (such as video rendering) among network members to be processed as processing time is available. As latency is reduced it may become possible for processors to link together to behave as giant neural networks.

A rather different sense in which resource-sharing emerged as a theme was in the potential for sharing network infrastructures provided by different companies to accelerate development of 'ibzl' networks.

8.4. Internet and things

Several ideas built on the ability of next generation networks to link the material and digital worlds, in real time. For example, a 'citizen's flight recorder' recording everyday life to the cloud to be used as a source of evidence in the event of civil or legal criminal proceedings (an idea which generated particularly heated discussion). Other examples included linking craftspeople in the developing with manufacturing devices (such as 3D printers) in the developed worlds in ways which may transform the value chains of craft product and fair trade, and the use of 'real avatars' in which remotely controlled devices 'represent' the controller in the material world, for example in student fieldwork or farmers in the remote management of sheep herds.

8.5. IBZL theory

The remaining applications were more distinct and, several groups began to develop the underlying concepts and ideas which pervade (in a generalisable manner) artefacts of all kinds. We dubbed this emergent domain 'IBZL theory'. To some extent this covers not just the ideological 'shift' which IBZL might be both part of and encourage, it also is evident in the categorisation which this paper contains. In addition to the 'latency mapping', 'real artisan' and 'peer to peer processor sharing' ideas described above, these included the potential for new theory in business models and the development of methodological tools that would allow for the generation of multimedia applications with which users could have analogous relationships to those of contemporary text-based wikis.

It is perhaps worth noting here that rather than being a next generation network application, 'latency mapping' identified the likely changing shape of network access and the need for tools to map different levels of latency, and hence difference classes of application viable between different locations. 'Location' here is understood broadly to include spatial location, but also for example the routing and nature links between different telecommunications companies' networks. As others [for example: 53] have noted, internet access will cease to be a binary phenomenon, but increasingly consist of shades of grey with different levels of access being able to support different applications between particular locations. Latency maps would provide an important enabling tool in understanding the scope over which particular applications would be viable.

9. Discussion

The IBZL workshops identified a range of issues which we review here in terms of process, outcome and extension.

[1] SETI@Home searches large volumes of data from radio telescopes, looking for regularities which might indicate the existence of intelligent life elsewhere in the universe. Data are sent to participants' computers and analyses the data when the processor would otherwise be unused. Results of the analysis are then sent back to the SETI project servers.

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9.1. The IBZL process

To some extent IBZL cuts against the grain of perceived experience in tracking/encouraging developments in cyber space. The past is littered with agencies and individuals who have tried to 'guess' and plan the future of the internet from an assured view of what has happened in the past, and who have signally failed to make the right call. IBZL could be seen to be a present-day expression of the same planful mindset and thus similarly doomed to failure.

Our confidence in our approach, and our reasons for continuing to work on the IBZL project lies in some of the qualities of our methods.

The method provides the groups with a provocative but largely *content neutral environment* in which to explore the present situation and consider gaps and omissions. This is the method's key strength [as already flagged in a number of publications including: 3, 33, 36]. Many problem solving methods have a tendency, by the very use of the methods themselves, to prescribe in a subtle manner the expected outcome of the learning process. The application of Imagine in this case has been to focus on what is not known, what is not available on the web at present but what is clearly noted by the group members as being a valuable contribution to the growing complexity of the virtual world. In this sense it is no surprise that the current outputs from the IBZL process range from aids to understand the topography of the virtual geography to netsharing technologies. The focus seems to have been on areas which would provide even greater room for exploration and creativity.

One limitation of applying the methodology in contexts such as IBZL is the reliance of the group composition on the knowledge of those organising the workshop (in this case, the authors and a colleague from Manchester Digital). While this helps to improve the chances of a diverse and imaginative group of people likely to generate new ideas, selection involved considerable discussion about candidates. This limits the 'space' from which potential participants are drawn and, by inference, the nature of ideas that might be generated. Particularly from a policy-maker's perspective it might also leave the process open to charges of elitism or discrimination.

9.2. IBZL extension

The First IBZL Workshop was followed by a second (also in Manchester) and a third (in Sheffield). The outputs from the workshops are still in formulation but have been organised into an output model (see Table 2). The main outcomes of the workshops are labelled as 'Presentations'. These 'Presentations' can be organised under Headings, each Heading having a number of themes and a unique description. From each unique Heading/Theme(s)/Presentation cluster emerges potential or 'Candidate Projects' for further development.

Table 2 presents a high level overview of the current outputs of IBZL. It is the intention of the authors to further explore the emergent 'Candidate Projects' in an IBZL Phase 2 event to be run in Manchester early in 2011.

It is also worth noting that while all of the outcomes relied on the notion of infinite bandwidth and zero latency, they were largely linked to other, parallel technological developments. For example, the 'Real artisans' project linked the notion of IBZL to ideas from the 'fablab' personal/community fabrication movement [55] and subsequently to the internet of things. Other ideas drew (either implicitly or explicitly variously on developments in pervasive computing, artificial intelligence and the semantic web (for more details see: http://infomesh.net/2001/swintro/).

10. Next steps

The research team are clearly in mid-process with a number of outcomes from three IBZL Phase 1 workshops and a rich variety of ideas, in the form of 'Candidate Projects' for further development in an IBZL Phase 2 event to be run early in 2011.

The IBZL Phase 1 workshop idea is proposed as a means to explore the potential which Next Generation Access offers. To some extent the IBZL project as a whole is an attempt to provide a controlled and inviting space for knowledge generation to envisage the next phase of development of Castells' envisaged 'networked society' in his eponymous books [56–58].

Certain outcomes are clear at this stage:

1. The IBZL Phase 1 workshop project has a viable process and has begun to develop a significant range of outputs.
2. An IBZL web site (www.ibzl.net) has been set up to support ongoing discussions around the ideas generated.
3. Outputs continue to mount up and, to match the plethora of artefacts suggested there is now an IBZL theory in evolution – to some extent this represents an attempt to capture both the social and technological underpinnings of the IBZL project and its contribution to 'the rise of the network society'. The theory is probably most concisely captured in the three Key Headings shown in Table 2:
   - Creating Ordered Chaos
   - Intelligence in the Network
   - Changing Spaces: the 'Space of Flows'

These three Headings indicate the chaotic, networked and space shaping nature of the IBZL project.

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Table 2
IBZL outputs: headings, themes, presentations and candidate projects.

Heading	Themes	Presentations	Candidate Projects
A1 Creating Ordered Chaos: Creating IBZL	Methods and impacts of infrastructure sharing Business models to affect path dependencies	"Latency mapping" "Network topology"	Latency map Green impact of mobile network sharing study
	Barriers to faster deployment Shifting cultural norms to emergent themes	"Measure green impact of mobile network sharing" "3G/WiFi/Wimax anywhere or your money back" "Making space" "Fair fibre"	Policy development to support super-broadband pilots
How can we expedite the IBZL world? What approaches will enable IBZL that is open to all? Where are the path dependencies? What are the cultural/political/economic barriers?			
A2 Creating Ordered Chaos: An IBZL World	Privacy Equal access Social contract Radical business models–cooperation, collaboration, co-dependency Ownership? New trust relationships Flexible stability	"New business models" "Holding the line" "Acts of imagination"	(To be agreed)
The Internet and broadband access is changing society – for example through the rise of social networking and providing instant access to lots of information. What might be the consequences of IBZL? Some of this theme is about the continuation of trends already present, other new trends may arise because of the special characteristics of IBZL			
B1 Intelligence in the Network: Managing the IBZL interface	New user interfaces Metaphors	"Cyborg life" "Best before" "Help, I need a valve" "Personal control of personal data" "Privacy metaphors" "Information visibility metaphors"	Envisaging new metaphorical user interfaces
Broadband has overwhelmed us with information and challenges our ability to control its flow. This threatens our ability to cope and our privacy. IBZL increases this threat, but may also help provide the tools to control it. How might these tools work?			
B2 Intelligence in the Network: Semantic Management	Knowledge in social networks The knowledge spectrum: data – information – knowledge – wisdom University 2.0	"Vendor relationship management "Intelligent matchmaking "'None of the above" "Beyond wiki"	Context free hyperlinking Inverted customer-supplier relations Structured non textual knowledge
Broadband brought us access to vast amounts of information. IBZL will increase the ability to process more. The low latency will enable new complex connections to be made that help us use and process the information, making it more like knowledge.			

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B3 Intelligence in the Network: Supercloud IBZL will enable the power of computers to be combined in new ways, creating a gestalt effect, bringing to life the maxim 'the network is the computer'. This will enable new ways to process information.	Peer to peer trust and power relationships	"Peer to peer processor sharer" "Data topology" "Real Cloud Computing, or peer to peer virtualisation"	Peer to peer virtualization Real cloud hosting Structured rich content
B4 Intelligence in the Network: Me and my data Citizens' control over data about themselves and their virtual 'presence'. Risk of increased surveillance, monitoring and aggregation of data about us.	Control over our 'presence' in the digital world ourselves	"Best before" "Privacy metaphors" "Information visibility metaphors" "Citizen flight recorder"	Proximity/privacy metaphor
C1 Changing Spaces: the 'space of flows' – Topological Society IBZL distorts space: the significance of physical distance is altered as other factors increasingly influence connections between people. This makes possible new ways of interacting with people and the world.	Social interaction through higher bandwidth connection Group formation and mediation	"Always on' social space" "Perpetual holodeck" "Real artisans in an IBZL world" "Fly my desk anywhere"	Video and 3D social networking metaphors
C2 Changing Spaces: the 'space of flows' – Ubiquity A concomitant feature of future networks, as well as (effectively) infinite bandwidth and (near) zero latency, will be (almost) ubiquitous coverage, or 'Martini bandwidth' – users able to access high bandwidth any time, any place, anywhere. Just as we have seen a wave of innovation from special awareness of mobile devices (built-in GPS, compass), so real ubiquity will unleash new possibilities.	Virtual worlds and real worlds as empowering tools	"Citizen flight recorder" "Stealth shepherd"	Real avatar Real time life blogger
C3 Changing Spaces: the 'space of flows'–Bits and Atoms Being digital as 'virtual' is extended as control of the material at a distance becomes increasingly feasible. Physical avatars can represent us in physical spaces and we can create artefacts at a distance.	Materialising the virtual	"Stealth shepherd" "Real artisans in an IBZL world"	Real avatar Stealth shepherd Remote fabrication and trading network

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As already noted, in 2011 a further, IBZL Phase 2 event is in plan which is intended to flesh out the most 'probable' of the 'Candidate Projects' and to explore how these might be taken to market. We aim to report on the outcomes of the IBZL process during 2011.

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