Report from Dagstuhl Seminar 14042

Do-it-yourself Networking: an Interdisciplinary Approach

Edited by

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Abstract

This report provides a summary of the organization, program, and outcome of the Dagstuhl Seminar titled "Do-it-yourself networking: an interdisciplinary perspective". We first motivate our interest in wireless networks operating outside the public Internet and the selection of the most relevant areas of expertise. Then we describe the process of bringing together a balanced group of representatives from these areas, and the evolution of the seminar over time. An overview of the interactions during the work in groups on specific application areas and explorations of the concept of failure, edited collectively by the members of the different groups, summarizes the main outcomes of the seminar. Finally, we identify some important lessons learned for facilitating interdisciplinary collaborations and conclude with our plans toward building a DIY networking community of researchers and activists.

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1 Executive Summary

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The key objective of the seminar was to bring together a diverse group of researchers and practitioners to reflect on technological and social issues related to the use of local wireless networks that operate outside the public Internet. We managed to bring together a quite balanced group of 32 people with expertise in the design and implementation of wireless ad hoc networks of various types, human-computer interaction, community informatics, urban interaction design, ethnography, media studies, arts and design.

Interdisciplinary interactions took place successfully around specific application areas for which the use of do-it-yourself networks is meaningful. More specifically, we explored the use of such networks for supporting the creation of transient communities of different size and duration, political activism, and similarity matching. In addition, an in depth exploration

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of the concept of failure provided a useful framework for addressing various challenges in bridging the gap between theory and practice, scientific and social objectives.

Our main finding was that there are certain assumptions that need to be carefully understood and important requirements that need to be fulfilled in order for DIY networking to become a feasible, and desirable, option for shaping the hybrid space of contemporary cities. That calls for a closer collaboration between experts from different fields and disciplines. For this, the most important achievement of our seminar was the balanced and productive interactions between engineers and social scientists around a concrete topic, and the general feeling that a new interdisciplinary community around the topic of DIY networking is meaningful and a goal worth pursuing. Indeed, concrete plans for facilitating the formation and expansion of such a community through online communication and face-to-face meetings, research visits, and common projects between participants that met in Dagstuhl for the first time are already under way.

When things get so big, I don't trust them at all
You want some control – you've got to keep it small
D.I.Y. D.I.Y. D.I.Y. D.I.Y. – Peter Gabriel

2 Table of Contents

3 Background and motivation

Wireless technology enables at present the creation of local networks outside the public Internet. Even in cases where the public Internet is easily accessible, such local wireless networks form an interesting alternative, autonomous, option for communication, which

1. ensures that all connected devices are in de facto physical proximity,
2. offers opportunities and novel capabilities for interesting combinations of virtual and physical contact, and appropriation of the hybrid space,
3. enables the serendipitous gathering of diverse people without the need to have any specific application installed or provide any credentials,
4. allows for purely anonymous and privacy-preserving virtual interactions, and
5. can create feelings of ownership and independence.

However, timidity, security issues, and the potential lack of common interests could limit the desire of people to participate in local interactions mediated through ICT. Such psychological barriers and various technical challenges hinder today the creation of plug and play DIY networking solutions with applications specialized for local environments, which can compete with the quality of experience offered by popular Internet applications. Then this fact discourages application developers to invest a lot of effort in building applications, undermining the engineering efforts to solve the corresponding technical challenges, and thus leading to a "chicken and egg" problem.

The vision of developing DIY networking tools could be one toward encouraging more face-to-face communication, information sharing between strangers, and exposure to diversity in contemporary cities. Then more ambitious objectives such as e-participation and e-democracy could be also part of the scope of such an endeavor. This means that the design and deployment of DIY networks and related applications, could touch on areas of expertise and interest of a highly diverse community of researchers, engineers, hackers, practitioners, activists, and artists. More specifically, among others, 1) the research on adhoc, DTN, and packet switched networks, 2) the grassroots initiatives building operational wireless mesh networks in various cities, 3) human-computer interaction (HCI), computer supported collaborative work (CSCW), interaction design, computer mediated communication, 4) sociology, media studies, and other social sciences, 5) the emerging interdisciplinary fields of urban informatics, ubiquitous computing, and community informatics, and related disciplines such as urban planning and urban design.

Although, there are already efforts to create links between some of these areas, there are still many isolated groups of researchers and practitioners. For example, people working on applications and uses of ICT are not always aware of technology's capabilities for building local communication networks. On the other hand, scientists in the field of networking are often indifferent with respect to the actual use and social implications of the technical solutions they devise, as long as they fulfill the minimum academic requirements, and are often abandoned after a few years (e.g., when the PhD student leaves).

Interestingly, the idea of the seminar was born after one of the organizers, Jörg Ott, presented in his keynote talk at the MobiOpp 2012 conference[1] an interesting application, called SCAMPImusic, for sharing music locally anchored on specific locations. This application reminded Panayotis Antoniadis, who was attending the conference, a similar application called Undersound discussed in the book "Divining a digital future" by Dourish and Bell 2011.

[1] http://www.cl.cam.ac.uk/events/mobiopp2012/program.html#keynote2

In the discussion that followed, Jörg and Panayotis, realized that it is a pity that there are not closer interactions between the networking and HCI communities around this type of applications. It was then a matter of a few e-mails to decide together, and also with Andrea Passarella, to apply for the organization of a highly interdisciplinary Dagstuhl seminar titled "DIY networking: an interdisciplinary perspective", with the following objectives:

- The sharing of objectives, values, methodologies, and challenges the different fields of research and practice face today;
- The definition of a research framework that will allow disconnected disciplines to exchange knowledge and interact toward the design of successful do-it-yourself networking applications; and
- The definition of next steps toward a shared experimentation platform and the setting up of a venue for sharing artistic, experimental, and research results.

4 Organization

The key first challenge identified during the preparation of the seminar proposal was to manage to build a really balanced mixture of researchers and practitioners and avoid as much as possible power games between disciplines, as for example the treatment of ethnographers by engineers as "tape recorders", as convincingly described by Dourish and Bell 2011, p. 61-88.

More specifically, the invitations aimed to bring together people from two interdisciplinary groups of almost equal size:

1. Adhoc/DTN networking, p2p systems, security, and engineering
2. Community and urban informatics, human-computer interaction (HCI), media and communication studies, ethnography, urban planning, arts and design

However, since none of the organizers had presence in the fields of the second group that seemed like a really difficult task. Our strategy was to try to invite "clusters" of people working closely between them in selected areas, such as community informatics and HCI, in order to avoid as much as possible isolated individuals. Our assumption was that this clustering would make it easier for people to accept the invitation in the first place and, most importantly, make them feel more comfortable and confident during the seminar.

We were very happy to see that our strategy proved to be effective and, together with the help of chance and the reputation of the Dagstuhl seminar series, we managed to gather an impressively diverse mix of researchers and practitioners with backgrounds in engineering, activism, art, sociology, anthropology, urban studies, community informatics, and HCI, coming from many parts of the globe such as Australia, Denmark, Finland, Germany, Greece, Italy, Romania, Sweden, Switzerland, UK, and the US. We could say that such a diverse participation was unique for the Dagstuhl seminar series. Even in terms of gender, our low diversity score, 6 women out of 32 participants, was unusually high and as Kat Jungnickel mentioned at her blog entry about our Dagstuhl seminar [2], the women of the group "were made very welcome". Interestingly, more than half of the participants participated for the first time in a Dagstuhl seminar.

[2] http://www.katjungnickel.com/2014/02/28/dagstuhls-diy-networking-seminar-making-a-failure-machine/

5 The seminar

The key challenge was to create a common vocabulary and expose people to different ways of thinking in a productive way. For this, we decided to follow three sequential tasks for which only a first step would be made during the duration of the seminar (and hopefully form a basis for future re-iterations):

1. Getting to know each other
2. Working together
3. Summary and future steps

In the following we give a brief overview of the evolution of the seminar around a draft agenda and in the next section a summary of the key ideas and results produced by the different working groups on the second day.

5.1 Getting to know each other

Given that all 32 participants were meeting for the first time a large proportion of our diverse group, the task of getting to know each other was identified as the most important. For this, we tried to optimize the use of the limited available time, by starting with a round table supported by one slide per participant collected and shared beforehand, followed by two seed talks by "representatives" of the two main sub-groups of participants: engineering and urban informatics (roughly speaking).

First, **Gunnar Karlsson** decomposed in a very nice way the do-it-yourself meme and clarified how many differents options for Do (e.g., design, deploy, educate, inspire), It (e.g., spectrum, networks, applications), and Yourself (e.g., individuals, communities, organizations), actually exist. This disambiguation effort provided us with a handy reference during the seminar when there were misunderstandings about key assumptions and the meaning of ambiguous terms, such as "network". Most importantly, Gunnar added one more Y in front of the DIY acronym (Y.D.I.Y) standing for "Why DIY?", which proved to be the most popular and challenging question during the seminar.

It is important to note that a traditional challenge in the field of adhoc and delay tolerant networking has been to provide convincing arguments about the importance of this mode of communication in light of specific applications, especially in situations where access to the Internet is affordable. For this, the second keynote by **Marcus Foth**, was ideal in showcasing a wide range of such applications that go beyond the traditional top-down visions of the smart cities and assume an increased level of engagement by citizens, but which have not until today considered DIY networks as their main communication infrastructure. Ranging from hybrid participation platforms (such as Discussions in Space[3]), to the appropriation of the urban space (like in the SMS guerilla project by the Troika group), and the fabrication of gadgets through 3D printing (like the Maker Bot), these applications offered much inspiration for the following interdisciplinary exchanges centered around the key question, why DIY?, posed by Gunnar.

The introductory part of the seminar concluded with a panel on experiences from the field which gave us a glimpse of real life DIY networking projects seen from the perspective

[3] http://www.urbaninformatics.net/media/dis/

Figure 1 Part of the outcome of the brainstorming meta-session in which we tried to identify important concepts, examples, and ideas, belonging to different categories, such as infrastructure, platforms, processes, and case studies.

of ethnographers (i.e., the account of **Kat Jungnickel** on DIY WiFi initiatives in Australia), activists (i.e., the description of the on-going RedHook WiFi initiative by **Jonathan Baldwin**), researcher communities (i.e., the ExtremeCom conference series by **Anders Lindgren** and Pan Hui, presented by the former), and entrepreneurs (the university spin-off on liberouter by **Teemu Kärkkäinen**). The key message of the panel was that DIY networking is feasible and there are many disconnected efforts today that would benefit from the creation of a community around this concrete design space.

This left us with only a short time to rehearse on working in groups, preparing the field for the next "working together" day. Three groups were formed after a quick decision process with the help of a google doc which was filled with ideas for possible topics of collaboration. Two somehow focused groups, concentrated on the topics of failure and affordable networks, and the use of crypto-currencies, like BitCoin, for local change.

The third and biggest group focused on a more general meta-discussion on case studies, the role of DIY networking, and interdisciplinarity. In this discussion many of the differences in background, assumptions, and ways of thinking between participants manifested and it was often that we had to go back to Gunnar's Y.D.I.Y to be sure that we were all on the same page. Despite the efforts to converge to a classification of concepts that would help us organize our thoughts and proposed solutions (see Figure 1), it was made clear that our task of working together toward concrete outcomes the following day wouldn't be so easy.

5.2 Working together

Before starting working in groups on specific topics, three seed talks were scheduled in the morning of the second day to give us some additional inspiration and put the collaborative work into perspective.

First, **Paul Dourish** talked about the art of interdisciplinary research, the different types of interactions between disciplines (inter, multi, trans) and possible spaces of encounter (solutions, phenomena, epistemes). Paul highlighted the significant amount of time and effort required, the role of language, and the need to "give up something" for interdisciplinary interactions to be successful. He also stressed the inevitability of doing politics through design.

Then, **Jon Crowcroft** introduced the concept of peer-to-peer systems and virtual currencies, a technology central to the implementation of distributed DIY networks, and a rather political one. In this context, he presented on-going research on replacing the energy wasteful BitCoin model with a peer-to-peer storage system, the personal cloud, whose needs for encryption and verification could be used for minting a new virtual currency (DO$H – Decentralized Object Storage Help), which can be used as a basis for a private data economy that allows people to sell their data to service providers and advertisers and buy ad-free services.

Finally, **Doug Schuler**, offered us a number of seeds, starting from asking "Why ask why?" and the key concepts of civic intelligence and the role of the citizens, which are part of the answer, to high-level views of the big picture including how local solutions can grow to a "hyper project", and the role of research readjustment, technology development, and the context (e.g. the increasing power of Facebook and Google and the NSA affair). Note that the seed metaphor is a particularly interesting one in the context of DIY networking, and actually our Dagstuhl seminar was conceived more as a seed for future collaborations than a workshop seeking for concrete results and well-baked ideas.

Following these very interesting and diverse seed talks, a short "walkshop" was organized ad-hoc to give us the chance to relax and prepare for the long-awaited "working in groups" session, whose results are summarized in the following. Judging from the success of these intense collaborations in smaller groups, there was a general feeling that we should have perhaps reserved more time for group work than plenary talks. As Kat Jungnickel mentioned in her blog, "Although discussions were expansive and interesting for the first day and a half, and the walkshop around the local village and forest was great, the event became really productive for me when groups shrunk in size and conversations shifted to more specific topics."

However, given the very high degree of diversity less of "getting to know each other" in plenary might lead to more misunderstandings during the group work and the formation of less diverse groups. It is difficult to know how things would have evolved otherwise, but there is clearly a trade-off, and in future similar events we could try to experiment with even less structure and scheduled talks.

5.3 Summary and future steps

The last day of the workshop started with the presentations of the outcomes of the group work, some of which were very animated and created a joyful atmosphere in the room. Then a quick roundtable gave everyone the opportunity to share his take away message and ideas for the future. The general feeling was that we managed to build links between the different communities, as well as that DIY networking is a good "triangulator" for enabling fruitful interdisciplinary collaborations, and allow the combination of research and action for addressing real problems.

The rest of our available time was spent to discuss on ideas that will help us to "keep one or more balls rolling" and take advantage of the momentum created during the seminar. The

organization of a follow-up Dagstuhl seminar, the creation of an interdisciplinary workshop on DIY networking, possibly attached to conferences of different disciplines and other events, but also the organization of various less formal meetups, research visits, invited talks, an e-mail list, were some of them, discussed in more detail in the last section of this report.

6 Outcomes of group work

Schematically, there were three groups focusing on the design of applications for three different scenarios: transient environments, political activism, and similarity matching (with focus on social medicine), and one group elaborating on the overarching concept of failure.

6.1 Failure machine

Christian Becker, Jon Crowcroft, Paul Dourish, Kevin Fall, Alison Powell, and Irina Shklovski

Failure is a rich topic for discussion as it holds multiple shifting meanings, is culturally shaped and manifest in diverse assemblies of practice. We shared very different experiences from our fieldwork and practice, talking about how failure in some contexts was the key to success and the start of innovative journey; failure in the form of disaster sometimes operates as a catalyst for invention (but things need to be available before); success as an exception. We asked:

- What is failure?
- How is it avoided?
- Who is allowed to fail? Who isn't?
- How is failure understood, subverted and explored?
- How is it represented? How has this changed over time/ in different places?
- In what ways/contexts/articulations is failure reviled? Cleaned up? Ignored? Celebrated?

Drawing on previous experiences of building Enquiry Machines[4], Kat Jungnickel suggested to build these ideas into a 'Failure Machine'. Enquiry Machines are a series of performed artefacts made in collaboration with others that explore ideas or methods. The point is less about materializing answers or prototyping ideas and more about formulating new critical approaches and literally seeing and touching methods in new ways. EMs are not meant to be finished or polished objects that speak for themselves. In fact, most fail in some way. They remind us that mistakes and tangents are just as important to our insights as the things that 'work'.

It seemed a good idea in this context as it would help to ground the discussion and unite our wide-ranging discussion into something physical. Also, the delightful thing about working on failure is that anything we made or failed to make would be productive. Plus Enquiry Machines are fun to make.

We started by simply talking more, writing down ideas, quotes and drawing things that popped up in conversation. Then we coded these bits of paper according to themes, creating more consolidated taxonomies. This working session moved into the evening and

[4] http://www.katjungnickel.com/portfolio/enquiry-machines/

Figure 2 Examples of Châtelaines.

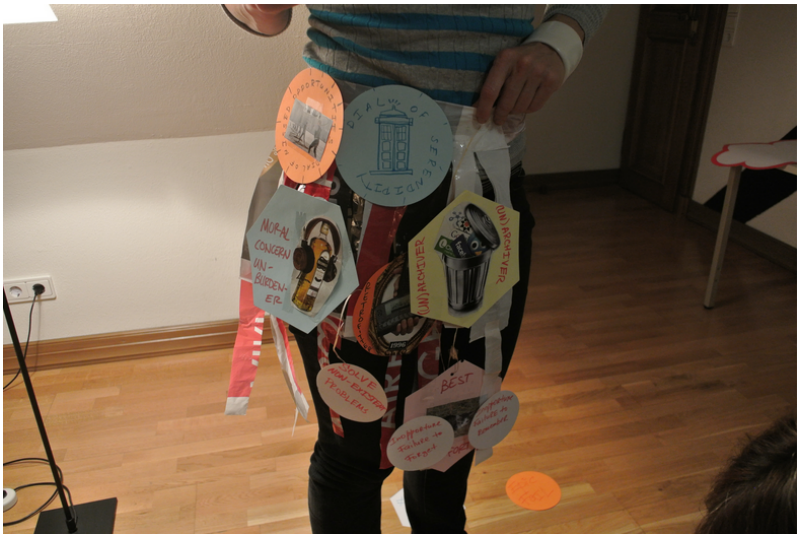

Figure 3 The failure machine chatelaine, made out of paper, magazines, and sticky tape.

was accompanied by some nice local wine, in fine company and to the background of acoustic guitar played by John and Kevin. It'd be nice to work like this more often. Bits of paper, pens and the whiteboard were the tools of choice. Magazines, coloured paper, tape, string and scissors were soon recruited.

During the session Kat talked a bit about her recent obsession with châtelaine, a fascinating technology introduced to her by Genevieve Bell. Châtelaines were practical and decorative devices worn on the belt and hung with a series of short chains at the end of which were objects related to the task at hand (see Figure 2). They were worn by women from the 16th to 19th Centuries, from lower socio-economic workers to aristocracy. Nurses wore châtelaines with clocks, thermometers, bandages and scissors. Seamstresses had bobbins of thread, thimble cases and needles on the end of their châtelaine chains. Society ladies' châtelaines featured highly decorative perfume bottles, purses, fans and even dance cards.

We decided to make our 'Machine of Enquiry' into a digital châtelaine. We called it 'The Battery Operated Wind-Up Merchant', playing on the ideas about technological lineage, pointing to larger dependent ecologies of use and using humour as a deliberate device to bring to life multiple ideas about failure and also the slightly ridiculous method.

There was a lot of DiY hands-on material adaptation going on. We scoured the castle for string and in its absence made use of tape, scissors, some raffia and a plastic bag. The châtelaine featured a series of filters or apps hanging from each chain that reflected some of the critical themes and ideas generated in our discussions (see Figure 3).

Figure 4 The plenary presentation of the failure machine, which was much more animated and cheerful than this figure suggests.

We talked about the apps having both independent and potential interrupting characteristics, so they might overlap, tangle and otherwise interfere with one another causing even more noise in the system/process. The apps included 'Dial of serendipity', 'Dial of missed opportunities', 'Lens of temporality', 'Latency creator', '(Un)Archiver', 'Moral concern unburdener' and many more.

The process and presentation of the machine to the larger group was productive and enjoyable (Figure 4). Although making ideas material constituted a different method for some in our group, everyone was buoyed by the experience of collectively approaching the multiplicity and messiness of failure via gendered, historic, cultural and social actors as well as the technical ones. There was even talk of potentially furthering this as an interdisciplinary project and making the Failure Machine again in different, more developed materials.

For more details and photos see http://www.katjungnickel.com/2014/02/28/dagstuhls-diy-networking-seminar-making-a-failure-machine/.

6.2 Transient communities

Panayotis Antoniadis, Jonathan Baldwin, Marcus Foth, Mark Gaved, Paul Houghton, Teemu Kärkkäinen, Jussi Kangasharju, Gunnar Karlsson, Anders Lindgren, Jörg Ott, and Michael Smyth

This working group focused on relevant applications for DIY networking in transitory environments: people coming together in a particular place for a limited amount of time. It became very quickly apparent that there are different important dimensions that affect the type of applications that make sense and their basic characteristics.

So, our first task was to elaborate on the most important context variables that would affect the choice of application and its characteristics: 1) The number of people involved, 2)

the expected duration of the network-mediated interactions, 3) the size of the target area to be covered, 4) the expected interactions (passive or active, synchronous or asynchronous, broadcasting vs. collecting), 5) the technological dimension regarding the importance of DIY networking: non-existent infrastructure; unwanted infrastructure; insufficient infrastructure, 6) the assumed client devices (smartphones, shared displays, other), 7) the circumstances that would activate the use of the DIY network (disaster, planned event, overlay to existing activities, continuing practice in a space), 8) the legal framework, and 9) the corresponding objectives (pass the time, feedback loops, content sharing and other purposeful activities like alerts, organization of meet-ups, political activism, etc.).

Again, the key question that one would need to answer in many scenarios would be why not just use the 3G network. As one of the participants wrote on our collaborative google doc: "What is the value of very contextualised mobile communication technologies from the standpoint of non-networking guys in this room? I mean: to communicate among us now, is that perfectly fine to use google docs, or any form of DIY network would bring us some additional value? More generally, if one has to design a form of participatory smart citizenship thing, would Haggle-like opportunistic networks (dynamic networks built out of users devices) be useful, or 'global' types of communication services would be enough? And furthermore – how would these things potentially look and feel (to pick up on the mess/materiality point Kat is making)?"

Some of the main reasons for investing on DIY networking instead of relying on the global Internet that we identified during our discussion are the following: Natural localization in space and time, reduced costs (especially relevant for touristic areas and developing countries), privacy issues, inclusive participation (through the use of a captive portal), and feelings of ownership. Interestingly, in our Dagstuhl seminar we had with us three developers of such systems (two of which in our working group, Jonathan Baldwin and Teemu Kärkkäinen):

- http://tidepools.co,runningontopofhttp://commotionwireless.net
- http://www.ict-scampi.eu/results/scampi-liberouter/
- http://occupyhere.org,byDanPhiffer

To test the expressiveness of the set of selected context variables we went through a list of possible examples classified according to the most important variables summarized above.

Meetings and spontaneous gatherings. These could concern up to 50–100 people for a duration of several hours to 1–2 weeks. In this scenario the narrative is critical but also a certain level of required attention. Interestingly, although two such DIY networks were available during our Dagstuhl seminar (occupy.here and liberouter), there was limited use, perhaps because of the intense interactions and limited engagement of people in online activities, which was considered actually one of the achievements of the seminar.

Traveling together (airplane, train). This is a similar setup as the above in terms of participation and duration, but in addition to the option of ambient, unannounced nodes, as in the case of the L-train notwork, one could consider also the possibility of a more official setup supported by the transport company. In this scenario however, potential participants are assumed to be mostly bored and having access to their mobile devices which makes it relatively easier to attract their attention. So, activities could range from content sharing to recommendations for the destination, chatting, and various short-term games.

Long events (music festivals, cruiseships, camping sites). Here the participation might increase significantly, from a hundred to several thousands of people or even 500000 as in the cross country skiing championship. The duration would be also also very variable, typically

from 3–4 days up to a month. Due to the repeated interactions in this set-up, in addition to content sharing more significant social interactions like meet-ups can be initiated. Note also, that in many cases there are international visitors, so relying on 3G would be problematic (both because of individual costs and load). This means that even the important task of sharing official data (such as broadcasting results, announcing on-going events, etc.) would benefit from a DIY networking setup.

Short events (a music concert, a football match). In this scenario the whole duration wouldn't be more than a few hours and one would expect different modes of operation during the actual event and during breaks. Contributing to building shared footage (e.g., during a music stadium event, you may be in a seat with a poor view, and would like to see somebody else's view.

Public transport nodes (bus stop, train station, airport). In this scenario one would expect limited participation (from 10-20 people in a bus stop to a few hundreds in an airport terminal) and limited duration (from a few minutes to a few hours).

Communities of practice (construction site). This is a long-term scenario, at the range of years, which involves a large and possibly changing population of people working together. In this case a DIY network could be used for safety reporting, synchronous communications, and sharing documents at the specific place they are needed.

After exploring the space of possible application areas, we chose to focus on two somehow "extreme" examples: a construction site with 3000 people over three years in one square kilometre; and a bus stop, with up to 20 people for up to ten minutes, in a few square metres.

We identified that a DIY network scenario for the construction site would be the need for workers to anonymously report on unsafe working conditions and bypass the official company network. This is not just a hypothetical scenario since, Jonathan Baldwin informed us that he has been approached by a group of migrant workers that want a way of reporting dangerous work conditions to the national health and safety people but bypassing the employer: if you go through the employer you may lose your job. So, there are many situations in which real safety of the workers may be orthogonal to the company's actual purposes of achieving health and safety inspections, and there is a need for workers to be able to independently report as actual conditions which aren't being seen by the health and safety inspectors, bypassing official channels and company procedures.

In our detailed discussion of this case study, we assumed that there is an official infrastructure (e.g, 3G) but not all workers may have phones, such as migrant workers from another country. The DIY network could have in general both official and unofficial purposes, which may be in conflict as mentioned above:

- *Official*: sharing documents, safety assessments, tracking work, scheduling for the use of specialized tools
- *Unofficial*: social communication (sharing jokes and pictures, chatting), informal learning (getting expert advice, information), anonymous communications alerting on dangerous conditions

While the use of a DIY network was obvious for the unofficial scenario, the possibility for official uses of a DIY network, lead us to reconsider the key question: Why DIY? Why a company should build its own network rather than rely on the use of the existing infrastructure? We identified the following reasons why even in an official scenario DIY networking might prove useful:

Figure 5 The plenary feedback of the "transient communities" group, whose members literally presented the outcomes of the discussion as written on paper by Mark Gaved, who also animated this unconventional male chorus :-).

- No network coverage in shipyards due to large amount of metal, also true sometimes on construction site when concrete is wet, large amounts of water present.
- Push to talk too expensive without wifi
- Multiple channels (not sure what we discussed here?)
- Supporting small teams/ gangs or workers

Then the discussion shifted to the bus stop scenario. We wanted to think how an occupy.here style ambient and unannounced network node (or phone-to-phone network) could trigger initial, light steps towards community interaction, helping to start interactions between the different people in your neighbourhood, "achieving the initial smile". Michael Smyth referred to the concept of "smirting" – smoking and flirting; caused by the smoking ban – , to highlight the potential of people meeting and engaging with others that they might otherwise not meet. Some ideas on possible applications in this setup included the following:

- Sharing music: letting other people know what music you are listening to, not sharing the actual music but the titles and artists [31], or to listen to music that a group of people brings to a venue [7].
- Bus stop as fabric for displaying some of this information (smart city approach)
- Aiming for the initial shared smile, starting community interaction. Getting different people from the local community interacting: young, old, those who share this space but wouldn't normally interact.
- Situated sharing economy: a local web portal where locals can say if they've food or other things to share (like in freecycle), which would be easy for someone waiting to take the bus back home to carry.
- "Snapchat for buses"
- Community/art approach to triggering community
- Arriving to leave, but maybe on the same bus "the Bus 25 community"

An interesting question that arose during this very creative brainstorming session, was whether some of these applications can make the little interactions at the bus stop so

interesting that people decide to come a little bit early to participate in them. Would a bus company like this? How about the municipality?

The final task of this session was to make a roundtable for all to suggest one thing which would make such a DIY network a success, which resulted to the following list (not all in agreement with them all):

- Unofficial/subverting
- Effortless
- Useful and usable, without requiring a PhD in Computer Science ;-)
- If people who used it told their friend about the network
- Makes you smile, want to do it/use it again
- Help people to open up to strangers and get exposure to diversity
- Making the familiar strange (getting people to think of the place in a different way)

6.3 Political Activism

Ileana Apostol, Fiorella De Cindio, Per Gunningberg, Christian Nold, Dan Phiffer, and Volker Wulf

This group's discussions could be summarized in two streams pertaining to 1) security, trust, and ownership with respect to political uprisings, and 2) design issues for the case of participatory online platforms. The issues of surveillance, security and trust came forth in response to the question: why the DIY networking model may be a better solution for platforms used in political activism?

The ICT advances enable multiple opportunities for hybrid spatial uses that open up new dimensions of political activism and can strengthen social movements. Recent political uprisings in the Middle East or the Occupy Wall Street movement in New York have shown that, and the same holds with numerous other examples of participatory processes. What is important in the context of DIY networking is that both the online and offline spaces that political activists use for gathering and organizing their actions are subject to different ownership structures, and thus one needs to be aware of their limitations and potential threats.

First, in the online world, private social networks like Facebook may give access to their recorded information to entities of their choice, including governments or secret services, like the NSA surveillance programs uncovered by Edward Snowden. Governments could close down or even take possession of central servers like in the case of the seizure of Indymedia servers by the FBI. They can also limit people's access to certain servers either permanently as in the China case, or temporarily as in the case of the Arab spring, where governments managed in certain circumstances to cut the access to the whole Internet. There are, of course, many places in the world where popular platforms like Facebook, and Twitter may not be easily shut down or censored, as demonstrated by the recent (unsuccessful) effort by Tayyip Erdogan to ban Twitter in Turkey. However, these platforms in addition to their questionable privacy policies and vulnerability to surveillance, they use generic social software which does not allow to customize its design for specific uses, e.g., not allowing to retrieve old information easily. This is an important issue because the large variety of actions implied

in political activism require more options for customization, from reaching out to new people to working inside the movement.

Similarly to the case of the private online spaces used for online interactions between political activists, social movements often use private gathering places as in the case of the Zuccotti Park in New York for the Occupy Wall Street movement. As the spaces for public life are more and more privatized in western cities, one should be aware of the dangers that arise when private spaces are used in terms of surveillance, possibilities for eviction, etc.

DIY networking solutions can provide more flexible solutions both in the virtual and the physical space. For example, local networks hosted in a simple wireless access point, such as occupy.here, can support truly private communications through highly customized user interfaces, and allow for flexible choices of physical spaces, even where Internet connectivity is not available or censored. Additional flexibility, independence, and resilience could be guaranteed if, on top of a DIY network, web-based applications with a decentralized architecture, such as Diaspora, are used to manage the information shared between the participants.

The biggest challenge is that such solutions need to be prepared and configured in advance. That might be a problem due to the spontaneous nature of political activism, which leaves little room for preparation in terms of risk evaluation for communications before or during organized action. The same holds for example, in the case of PGP keys for securing private communication, despite the efforts of the media and institutions like the Electronic Frontier Foundation (EFF) which offer best security practices that may become a prerequisite for better-protected political action.

One suggestion highlighted in the group discussion regards a student or university based model/culture to make technologies for political activists, a DIY sort of network technology that could be build in academic context (despite the problems of wide distribution at the political moment).

The second stream of discussion concerned more mainstream political action, which could give inspiration on the suitable design of the applications built on top of a DIY network like the organization of a 500.000 people Demonstration in Italia by Populo Viola or the Movimiento 5 Stars by B. Grillo. Another example from the US is a CSCW meetup platform serving in the organization of local groups (it enables people to meet in the physical space) was used for US government elections by H. Dean to organize physical meetings. On a different line, applications such as 'fix my street' may be seen as democratic intermediary between citizens and local governments while more sophisticated e-participation tools such as OpenDCN.org developed by the group of Fiorella De Cindio facilitate brainstorming and petitioning and can enable deliberations on complex issues.

6.4 Similarity matching and social medicine

N. Asokan, Ahmed Helmy, Marcin Nagy, and Amalia Sabiescu

The initial idea was to explore technical solutions for assisting members of communities of place to find each other, interact and share resources based on common interests. Social medicine (what was to become the short name for our group) was proposed as an area of application for these support groups. Social medicine had also been approached in prior discussions among some of the group members.

We started with a general discussion of our core idea and why it was interesting to work on it from the perspective of social science. We used social medicine initially as application area, and then came up with additional applications in education. The most important points that emerged were that local communities have hidden resources that are seldom known to people in close proximity. These resources are nearby people who are experts in a given field, or have a great deal of passion and interest in certain domains. The local community could benefit in many ways by uncovering these hidden resources. We explored several ideas.

Firstly, people could learn from community experts. For instance, a mother wanting her son to learn Portuguese may discover a nearby Portuguese teacher, instead of enrolling her son to a distant language school. This approach may also bring money savings, as such "teachers" may not always be professionals, but also be a language hothead doing his job as a hobby, or favor.

Second, people could form local communities to provide assistance for its members. For instance, a group of working mothers with small children may form a group in which every day one of them stays home to care for all their children, while others may go to work. Such a group may be the answer to existing problems for women that want to join their motherhood and career. It provides money savings in comparison to day care costs, and may also be a more trustworthy solution for mothers that are afraid to leave their children in a daycare facility.

Third, and actually most promising, we explored support groups, people liaising with others who share common passions and interests to get motivation and drive for continuing to nurture their passion, pursue their interests, or solve their problems.

We then went on to bridge the social science side with the technical side, concentrating on finding compelling incentives for deployment, and asking: why and in what community contexts could these types of similarity-based encounters (and associated technical solutions) be needed? Arguably, there are many contexts where people would love to get together, share resources and learn from each other on topics they are interested about. The issue here was to understand why they would need a local network? Why not an Internet-based group using existing infrastructures?

So why a DIY solution? To explore this, we went on to list conditions and constraints by which a community may go for a DIY solution to allow its members to get together based on similar interests. The list included:

- Lack of infrastructure (poor communities)
- Privacy concerns (public sharing of data, avoidance of monitoring, importance of keeping data locally)

In addition, we explored potential technological solutions that could address the main goal: support identification and matching around common interests. Ahmed proposed that one possible road to explore, promising also for research advancement, is the usage of behavioral sensing for creating similarity metrics. There are many challenges to make behavioral sensing usable, so we spent a significant amount of time trying to address usability issues. Firstly, many potential users may be opposed to the idea, as they may be afraid of being tracked and having their privacy violated by personal information reveal. Therefore technology must support user anonymization and if some data are stored on the server, such servers must be well-protected. Ideally, whole computation and data analysis can be run on personal devices to avoid these issues. A second important issue is the problem that people are usually dishonest with themselves and at the same time there is no, and will never be created, an ideal behavioral sensing algorithm. Thus, a successful system must find a right trade-off between proper behavioral sensing and openness for user feedback. The feedback must be

designed in such a way that it is nice, usable and doesn't cause irritation to the users. A user's profile would be fed jointly by feedbacks and through behavioral sensing. The role of behavioral sensing would be, in particular, to allow updates of the user's profile (e.g. potential new interests discovery) and user notification about possible life changes (e.g. lack of social activities as a possible sign of potential bad mood). We explored several scenarios to shape and refine the supporting system, in particular a community yoga class, and support groups for mild cases of depression. Obviously, for any cases relating to illness treatment, the role of professional doctors is irreplaceable, and behavioral sensing works only as a helpful tool.

In a nutshell, the core concept was using similarity metrics for uncovering hidden community resources. Assuming that communities have hidden resources under the form of people with special expertise, interests and passions, we proposed a network for allowing these people to group around shared goals and interests and engage in local activities.

Similarity matching is done based on a combination of user choice and behavioral sensing. A user can complete a profile with their data, goals, interests, etc., and decide which part of the profile they want to make public. When made public, the profile is matched with other people in the community who have similar interests. Matching profiles can be done using cryptographic techniques that do not reveal any information in case there is no match. Behavioral sensing would be used in the private sphere, and its scope of action is regulated by the user. The role of behavioral sensing is to help the user discover aspects of himself that aren't noticeable to him, and which s/he may not be ready to sincerely acknowledge. Also, behavioral sensing is used as feedback provider to allow the user to track progress towards set goals, or nascent tendencies he is trying to fight against.

The main value of such a network is located, however, out of the user's private sphere and also out of the virtual sphere, in the space of real-life sharing and exchange afforded by using the system. By networking with people with similar interests, the user can pursue her/his passion, increase motivation and commitment, join family life with professional career, and benefit from other people that are animated by similar drives, or experts that can provide expert advice or counseling.

Regarding interdisciplinarity, although the group was formed by three computer scientists and a social scientist, this did not entail a heavy orientation towards technical rather than social considerations. The initial idea came from a computer scientist and it was formulated in full consideration of its social value. During discussions, we constantly shifted from social to technical considerations. We started our group work thinking about communities and why our idea could be valuable to people. Then we shifted to a discussion of supporting technologies, and while discussing them, we realized we needed to go back to our discussion of communities to understand in what contexts a DIY solution could be more acceptable than an Internet-based network. The advancement of the concept can be tracked in its continuous transition between social and technical perspectives, until it came out shaped by both sets of considerations. This was a first, visible benefit of interdisciplinarity: conceiving technology that fits in life, and allowing those life areas that need a new technology to speak out their needs.

A second benefit was due to exchanges by which obscure terminology was clarified (especially for the social scientist) and novel perspectives considered (both sides). The exchange also revealed the advantages of employing a fluid process for conceiving a technical solution fit for a real-life context, by drawing jointly on computer and social sciences expertise.

Our proposal generated a lively debate. The concept was disputed from both a social science and a technical perspective. It was questioned whether this type of support groups

were not bordering too much on activities that would be better handled in professional environments (e.g. for depression). Issues of privacy were raised with respect to the use of behavioral sensing, and there were arguments that some users would refrain from using it, and that it could generate feelings of lack of control and agency. We discussed to what extent the benefits of behavioral sensing would make up for this type of concerns, and also how its pitfalls could be avoided by strengthening the sphere of user control and a net distinction between what is kept private and what is shared. There were also positive comments suggesting that local networks can become more important in the future, as public services may become scarce.

7 Interdisciplinarity

It seems that there are two main strategies to approach the task of bringing together people from different disciplines to collaborate on a specific topic. The first is to expose their differences in vocabularies, methodologies and objectives. The second is to focus on their commonalities, as for example their interest in specific case studies and applications.

During our Dagstuhl seminar we tried to do both, but it was mainly the latter which proved to be the most productive strategy. As pointed out by one participant "My biggest insight is that even when people come from different disciplines, different vocabularies, and so on, when there is a problem at hand, and there is an issue, and an idea, and people start working together, it just kind of works and if there is a misunderstanding you just solve it because people communicate." Many participants stressed the importance of case studies and application areas as a common ground for interdisciplinary exchanges. For example, "I believe that one of the big things that I got from the workshop has been examples, case studies, and going to the future I would like that we find a way to share these experiences, to share these case studies, ... just to know that one of us see that this case study is interesting because there are so many around, the selection that each one of us can do, look at this because it is interesting, would be a great way to continue the work, especially for real life examples." But it is not only that a common problem fosters efficient collaboration, since "Working with other disciplines helps you uncover problems that are probably worth addressing", as another participant stressed.

7.1 Learning from each other

Indeed, our interdisciplinary exchanges provided valuable information to social scientists on the capabilities of technology. For example, a social scientist stated that "This idea that from a network point of view DIY means creating your own channels of communication, I think it is useful of thinking later. I learned something new. That's very cool." And another, that "I really appreciated the opportunity to ask very technical questions to those that actually have the expertise and have better insights and go through a specific case study of a DIY network."" But for engineers it is also very important to interact with social scientists that have a different understanding of the everyday life problems that need to be addressed. As put by an engineer in our group, "I think this is maybe the thing that we lacked during the last years when we were trying to find the applications, trying to find the right use cases without asking other people what they think about it." For another, "the key take away ... was that it is probably time ... to be completely problem driven instead of being technology driven. There were small snippets of very interesting and useful things that I

picked up from people, especially from other fields. Like, if it looks like a microwave people will use it like a microwave."

Similar were the feelings of some of the activists in the group: "My take away now is that I feel I want to make some kind of flow chart for troubleshooting user issues, introducing ethnography and prototyping towards apps and networks, so create these low barriers of entry and immediate relevance for the communities." Or "I think I have slowly come to realize that I need to like step back a little bit, document and talk to more people about how this could be used, and work with people more directly to see how they can not be reliant on technologists for obvious stuff."

Summarizing this process, one of the few representatives from the industry in our group concluded: "It was interesting to watch two very different academic disciplines meet, get to know each other and over a few days start to warm to and learn from each others' approach. The process of working together on simple tasks broke down the initial posturing about the proper way things should be done and ended up working toward a new understanding that I found enriching. It is not often we get such a paradigm shift in how we view what we have been doing from the outside, it takes several days of working closely with highly skilled people looking at the world differently to make that possible."

7.2 Breaking the ice

It is not always obvious, however, how to break the ice and make a first step in interdisciplinary collaborations, as well as to integrate diverse preferences and encourage individuals to get out of their comfort zone. For this, there are three important lessons learned during our seminar.

First, it is important to minimize the constraints and allow for self-organization. As described by an engineer, "I would like to congratulate the organizers on the laissez-faire anarchist approach, basically we were self-organized, so that was good." And by a social scientist, "We move from philosophy to real practical cases and this is really good and it has given me some real practical ideas to take away. I was a bit worried about how open it was but I think that openness actually sort of caused some really interesting things happening."

Second, it is very important to create a pleasant atmosphere and allow oneself to have fun while working on complex scientific problems. A regular Dagstuhl participant said: "I have been in six or seven or something Dagstuhls. This is by far the funniest one ever. I realized that working with social scientists, which I did in a bilaterally basis a little bit, behave differently in groups. Like build things they wear, stuff like that. I think that this is a new methodology of implementation, that probably can be used in subsequent meetings. It was quite interesting." And another, "From a personal perspective who didn't join us yesterday cannot imagine how creative this was. This was one of the best experiences of my professional life ... [audience: it was just the wine] ... it was not the wine, it was not the company, it was not the things we talked about, it was the combination of all of it. And this was so awesome. I have the impression that you had similar spirit in the other groups. So, please organize this again. Bring us together again and see what we will follow up."

Third, it is equally important to avoid setting rigid objectives and be overly ambitious, since interdisciplinarity takes time and the phase of "getting to know each other" needs to give enough space and time to all parts to expose their point of view. "Diversity without objectives, just giving out information can make us happy. This is how I feel about DIY networks, that they can create these spaces of sharing. This is actually where ideas come

from. From just putting the information in your head and not trying to do anything specific. I mean . . . the brain does it by itself. So, I think that if we just keep sharing and putting things on the table in a diverse way, we will be happy and everything will be formed by itself." Or put slightly different by another participant, "I have to admit initially when I saw Dagstuhl and the kind of reputation that has, that I felt there was a lot of pressure, a very tight structure, having to deliver something really, something substantial. I think I appreciated and I actually relaxed much more when I realized, no, this is an opportunity to for us to actually to just get together, have very open and creative interdisciplinary discussions, and also I appreciated this kind of agility for us and lots of people going between the theoretical to the applied."

7.3 Open challenges

The debate that followed the proposal for a social medicine application revealed the important challenges faced by interdisciplinary research, especially when it tries to bridge the "two cultures", on the one hand, the world of arts, humanities and interpretive social sciences, and on the other hand the world of science and technology, between which, according to C. P. Snow (1959), there seems to exist an unbridgeable gap (see Frodeman et al. 2010, p. 213).

Perhaps a social scientist's request toward the engineers of the group, "don't be too creepy", best summarizes one of the most challenging tensions between the two cultures today, due to the important threats posed by technology on privacy and self-determination. But there are also more fundamental differences, related to vocabularies and methodologies. As mentioned by another social scientist, "I really like interdisciplinary working and collaboration but it is tough and it can be really frustrating at times and it can feel like so much extra work but it also pushes me to think what it is that I do, what it is that I can learn from other people in terms of thinking differently about the words that I use or the words that I don't use. So all of that has been incredibly rewarding." Or as put by an engineer, "I always teach my students to try to think out of the box. I came here and I find that whatever box you are out of, you always find another box . . . there is always room to learn new things."

Another example of tension was related to the recordings of 1-min final statements coming from all participants, from which the quotes in this section are taken from. More specifically, one of the organizers decided to take these recordings without asking the consent of the participants, inspired by a short debate on privacy issues generated by the presentation of the social medicine application and the concept of a failure machine, which could cause accidental or voluntary leakages of information by friends or companies. When participants were informed about the existence of the recording, and asked whether they would wish it to be deleted, a debate started regarding the appropriateness of this action. This debate made for an illustrative case for the various tensions existing between disciplines and individuals, and pointed to differences between theoretical concerns regarding privacy threats posed by technology (or the lack thereof), and the personal engagement in a real situation.[5]

The question of consent and deception in scientific methodology is a rather challenging area where important differences between disciplines and individuals manifest. For example,

[5] One could say that this was an example of an "artistic intervention", which aims to create impact, a "real" emotional reaction either positive or negative, in face of a certain situation. This is a fundamentally different means to evaluate a product of design than the typical rational approach, which establishes concrete performance criteria based on the maximization of a quantitative metric, such as the level of participation, measured as the number of clicks, ratings, etc.

one of the main debates between the fields of behavioural economics and experimental economics is that the former allows "deception" in laboratory experiments, which can ensure "truthful" behaviour, but which according to experimental economists is only a "short-term" achievement. In the long-term, if subjects become aware over time that deception is part of the game, they will not trust the experimenters and the whole scientific methodology will be rendered invalid. Similarly, the requirement of consent for storing and using private information is only meaningful for the short-term. Those giving their consent for their private information to be used for various purposes, assuming they really read the corresponding text or pay attention to the conditions, cannot be aware neither of possible future, different, uses of this information nor of their own respective position in the future (that might change but it will be late to take back the information made available). As an urban planner in the group stressed in relation to the concept of failure, "in planning, the perspective is a long term one, usually we may see the failures in 50 years or so."

So, despite the very positive feelings that our seminar generated regarding the possibility to bridge the gap between the "two cultures" around the design of DIY networks, we are aware that there is still a long way before resolving fundamental differences between disciplines and individuals, in the way of thinking, ethics, and attitude toward critical trade-offs and dualities that new technology brings into our life.

8 Interesting ideas to keep in mind

In the following we list some additional ideas exchanged through discussions at the seminar and contributions at our collaborative spaces (wiki and google doc), which we think is worth to keep in mind.

8.1 Lessons from the past

Sometimes less than more ICT is needed. As Mark Gaved stated: "the two technologies that turned out to be important for social networking were 'tea' and 'cake' ".

Sustainability is a key challenge. Experience says that you need to campaign for a sustained period to get stuff adopted, which is why relatively short lived academic projects (3 year PhD) don't typically get adopted much unless they get lucky. This is why we should think in terms of "initiative" (open ended) rather than project (closed time period).

You need to build before the disaster arrives. For example, as Jonathan Baldwin informed us, Redhook WiFi was built for community but was mostly used upon Sandy hurricane. As framed by Jon Crowcroft, the carrot is that you get a network you don't have to pay for but it isn't very good most the time, but if the internet is broken (or stick: your data coerced into a government vault) you can fall back on it, and be assured there isn't some operator who have embedded spies (like all the telcos and big cloud providers do:)

8.2 Looking toward the future

Collaborative experience creation. How/what tools and list of basic service capabilities to put in a community which facilitate unplanned applications to emerge based on local needs, art skills, creative commons enhancement. What elements of this experience are best served

by local networking links to provide sufficient advantage over traditional net tech. It often isn't enough to be "mine", must also be "better" in some way.

Creativity. We'd need development tools suitable for this environment, including running on mobiles (rather than always using monster design infrastructure, libraries, etc.). Applications themselves could also serve as building blocks for more complex functions (on individual devices or in the local net). It'd be nice if one could fix or adjust things that don't quite work for her needs.

Toolkits and hybrid design. Jon Crowcroft would like to design a toolkit that has both h/w and s/w components – could also have pieces that need to be 3D printed – then we'd have a (liberouter stored decentralized) appstore where people upload stuff they've designed so others can download, as in the Internet of Things project (see hubofallthings). The intention would be to let stuff emerge from what people do with this – so one needs to do a design which deconstrains what people can do (and therefore own) but also constrains interfaces between components, just enough (not too much) so most combinations do something, whether useful or not isn't determined (who are we to say?).

9 Conclusion: Toward a DIY networking community

If there was one clear take away message from this seminar, it was the desire to continue our effort and try to build an interdisciplinary community of research and action around the concept of DIY networking. There were various ideas discussed regarding specific next steps and possible meet-ups that would help us advance slowly in a self-organized fashion. The smiles, hugs, and promises for keeping in contact during the farewell phase gave us confidence that there are big chances that the seed placed by this short seminar will eventually produce exciting results.

Our first post-Dagstuhl meeting took place in London, in the context of the IETF meeting, where we tried to refine some of the ideas discussed at the end of the seminar about future steps. One of the key challenges identified was how to give incentives to people to participate in events of different disciplines. One option could be to motivate the collocation of major conferences (as happened recently with the Infocom/CHI collocation in Toronto in 2014) and provide "single registration" options. Since this wouldn't be very easy to implement in practice, the idea to fund specific people that could play the role of "representatives" in conferences of various disciplines was discussed. Another ambitious option could be to set-up a nomadic workshop on DIY networking, which could be collocated every year with a conference of a different related discipline.

Another set of ideas discussed was related to the organization of more action-oriented events targeted to specific locations in cities where workshops, hackathons, etc., could aim to produce specific solutions satisfying local needs. For example, an "urban" ExtremeCom conference taking place in challenged neighbourhoods of big cities, where DIY networking can be more than an alternative option to the Internet. Toward this direction, people from our group participate in a summer school, titled "From Smart Cities to Engaged Citizens", which will explore the design of specific solutions, including DIY networking, targeted for the city of Volos, Greece, in collaboration with local urban researchers and authorities: http://www.internet-science.eu/summer-school-2014.

Finally, Jon Crowcroft proposed a nice metaphor for interdisciplinary exchanges, the Potlach gift-giving feasts, which gave us a playful and ambitious vision to imagine: The organ-

ization of a big dedicated potlach event for interdisciplinary exchanges between researchers and activists a la Burning Man :-).

As an easier, and obvious first step, we decided to build an e-mail list which would allow us to expand our network and help us to exchange related announcements, case studies under progress, etc. Jörg Ott, has already reserved the **diynet.net** domain, which will be inaugurated soon.

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