A Social Informatics Intervention: theory, method and practice

Mike Martin, Sarah Walsh, Rob Wilson

KITE Research Group, Newcastle University

Abstract

Based on eight years of action research in the area of partnership formation and multi-agency working in the public sector, this paper presents the outcome of a multi-disciplinary approach to the design of interventions which have the dual purpose of building trust and understanding and specifying complex ICT infrastructure.

keywords: co-production, participative design, systems architecture, socio-technical systems

Part I

Intervention and Co-construction

The managerialist concept of enterprise is one of goal directed behaviour. Strategic processes generate a plan on the basis of explicit visions and objectives. Appropriate and available resources are deployed in the implementation of the plan and measurements and criteria for success are applied in a monitoring process which compares performance with visions and produces learning: a deepening and broadening of knowledge. This feedback process is designed to manage risk within a defined conceptual frame and is represented in the lower loop of figure 1.

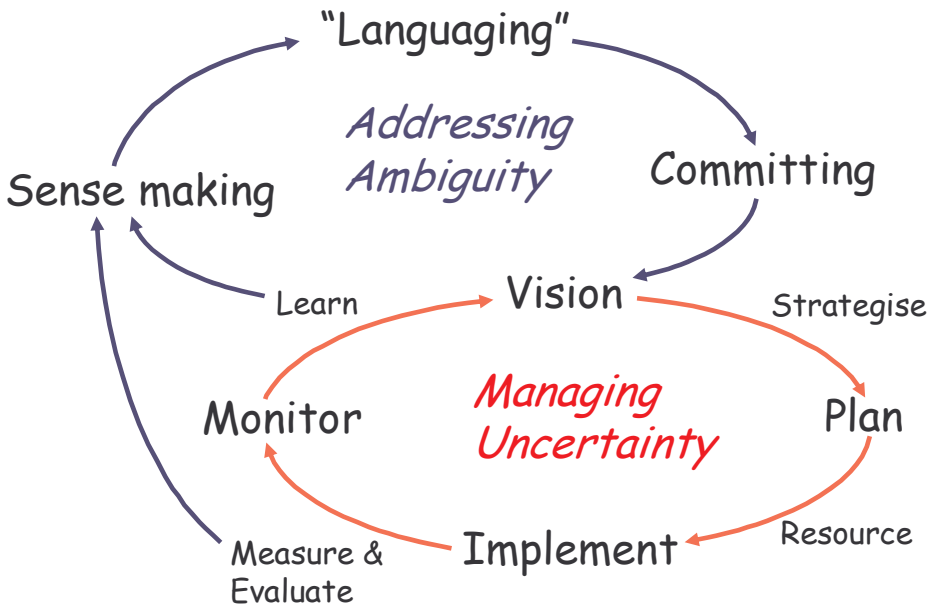

Fig 1: a second order cybernetic concept of enterprise

Real world experience, however, sometimes presents a very different situation: we observe that we have started doing things that we previously thought

impossible and have stopped doing things that we thought were mandatory. The assets that we protected jealously have been discarded and things that we thought were impediments and barriers are now recognised as opportunities. We are measuring things we did not previously know existed and our "learning" has involved forgetting! In retrospect we recognise that a transformational change has taken place. Representing this on our conceptualisation of the enterprise process involves an escalation from the first order loop. Paradox, contradiction, inspiration or discovery initiates a process of sense making, this is to say re-conceptualising, working on the system rather than in it. And in this process, what counts in the situation changes. A sign that this is happening is that language also changes. New terms are adopted or adapted and, to the outsider, this can appear as annoying jargon. The new language allows new commitments to be articulated and shared. This second loop is concerned with addressing ambiguity and making the transition from the first order to the second order involves a reflexive objectification, a first step back in Bourdieu's terms.

When this conceptualisation is applied to the formation of a new enterprise, rather than in the context of an existing one, a number of important aspects of collective change and development become apparent. In particular, when we consider the process of partnership formation and the dynamics of groups coming together to plan coordinated activities in pursuit of some emerging shared interest, questions of leadership, facilitation and intervention take on a new significance. In these circumstances someone may be in the chair but no one is in control. This is not a "North – South" situation of hierarchy and direction which can be understood in terms of top down or bottom up initiatives. It is "East-West", peer to peer and, often, agonistic. In the single enterprise context, paradox and contradiction can, and often are, suppressed by recourse to authority and transitions to second order operations are characterised as scope creep and rendered illegitimate. In contrast to this, the objective of the multi-agency partnership formation process is to develop new ways of seeing and new shared language, to promote effective and productive transitions between first and second order and to capture, represent and legitimate the progress that is made.

If our concern is with first to second and second to first order transitions then we are placing ourselves outside of the first and second at the third order. This represents a second step back and corresponds to an objectification of the objectification (Bourdieu again). To make this clear we can consider the nature of the roles and relationships which are involved. Referring to fig. 2, at the first order we have the manager/executive while at the second we have the innovator/entrepreneur as paradigmatic roles. In the formation of partnership and enterprise, the balance between these must be appropriate with respect to the uncertainty and ambiguity of the context and environment. Interventions to establish and maintain this balance are the province of the philosopher/therapist although, in practice, it feels more like gardening.

Finally we might observe that there is a fourth role and order where we meet Badiou's revolutionary subject whose only interest is whether the academic is going to join the barricades to build the next order.

So, we have constructed the outline of a theory of intervention in the co-construction of partnership and enterprise. This draws on Bateson's concepts of second order cybernetics and deutero-learning and on Pierre Bourdieu's reflexive practice. At its core is Badiou's concept of the event and of new things coming to count in the situation. Because our intervention is concerned with partnership formation rather than operation within established enterprise - in what we have characterised as an "East-West" context - we have also to maintain that any intervention must be based on the nurturing and encouragement of co-construction among participants: trust can not be mandated or imposed.

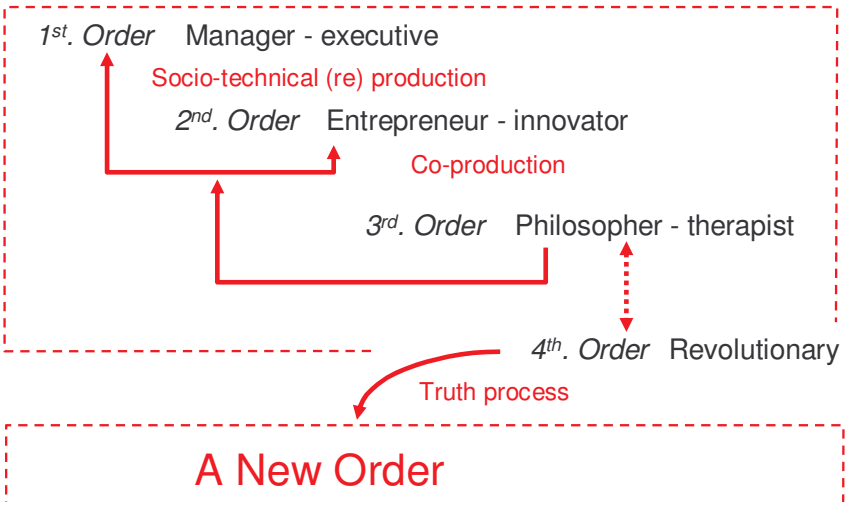

Fig 2: Orders of change

Initiating engagement

We have distinguished between "North-South" and "East-West" contexts and have indicated that the occasions in which partnership formation takes place must be situated in the latter. If they are to take place, however, they must be provided with appropriate auspices: this can only be delivered through a North-South initiative and process because it involves permissioning and enabling within a power structure and the outcomes involve the institutionalisation and infrastructuralisation of partnership working. The context in which the formulation of partnership building interventions that we are presenting here has evolved have all shared the characteristic that the process has been initiated by a policy or legislative imperative concerning public services. Participating individuals have been designated by their respective agencies, many of which are, themselves, partnerships, to represent them in the formulation of new shared plans procedures and structures. We have been faced with a willingness and interest in working together but with many difficulties and barriers to communication and understanding across disciplinary, sectoral and agency boundaries. It is also the case that the project and technical management of these initiatives have only enterprise integration concepts and first order operation at their disposal and, in the absence of an appropriate intervention of the type we are describing here, are able to produce, at best, a local response which is limited in scope and flexibility and which neither creates nor benefits from any externalities from many other parallel and overlapping partnership initiatives which are similar in scope or shape and are going on all around them.

We have indicated that partnership formation occasions and processes have to be provided with an appropriate aegis and the participants have to be appropriately empowered in a context which does not present insurmountable external barriers to the building of trust and coordination. Given these conditions, the challenge is to initiate a process of sense making by the participants of both the situation they are presented with and also of each other's worlds and practice. The orchestration of initial engagements involves the deployment of a particular sort of boundary object which functions as a mirror, in which a particular set of the participants can see their concerns and world view affirmed. The other participants, however, experience a window. They may be challenged by a view that they do not recognise and, on this basis, discussion, explanation and exploration is encouraged between the participants.

The construction of these exhibits, which take the form of pictures, diagrams and stories, requires careful ethnographically informed research of the participants and their respective environments: the material must be grounded. It is gathered and organised ethnomemetically, into exhibits and displays rather than presentations and accounts: the objective is always to encourage creative engagement and sense making. Often contradictions and paradoxes within and, almost inevitably, between views are identified and explored to encourage appropriate transitions to second order analysis. In practice, the use of multiple screens, so that exhibits can be juxtaposed, has proved valuable, emphasising simultaneity and the recognition of different views of the same complex reality or indeed, contradictory views and different realities.

The Social-Informatics intervention

So far, the discussion of the theory of intervention in partnership formation has focussed on the *how* and the *why*. As is usually the case in the literature of organisational learning the *what* is regarded as local and specific. However, the pervasiveness of information and communications systems and services means that, in these specific partnership formation contexts there is always the generic problem of the shaping and governance of a technological system. Indeed, the deployment of such a system often becomes the criterion of success and fruition in a narrow, first order manageirialist and technically determined perspective on the development process.

The challenge then for the design of an intervention is to move from an initial mutual sense-making, understanding and commitment building process to a one in which real specificatory work is being done on an emerging shared vision of a socio-technical system. Here the rather 20th. Century concept of the socio-technical of Trist and Emery [1] is being redeployed to denote the deep implication of electronic channels, media and devices in all aspects of economic, social and cultural life.

This brings us to the consideration of the epistemology and a generic ontology of the socio-technical system, the concept of architectural discourse and of representation of this complexity through projections.

Part II

Conceptual models and systematisation

The objective of this section is to provide a framework for the architectural discourse which is concerned with socio-technical systems. An initial requirement is to provide a conceptual model of the process of systematisation and we start with the notion of a relationship between rhetoric – what was, for Plato, non philosophical discourse, and the mapping of the terms in that discourse onto phenomena in the world. This is, by definition, not science; we will call it art and craft. To be scientific and to be able to make a claim to be systematic we need at least to generate a set of concepts and to apply them with consistency. This corresponds to qualitative science. Linnaeus, for example, systematises in terms of species and genus, and we transform the art and craft of the herbalist to the science of the botanist. We now know what counts as a plant and, with this knowledge we can, in fact, count and calculate. If it is the result of our calculations – a statistical analysis, for example - is mapped onto the world, we have quantitative science.

The formalism that supports our quantitative science is a formalism of the count itself. If, however we select a formalism that maps onto the specific conceptualisation of a domain and map its algebraic or logical structure back onto the world as an hypothesis to be tested by experiments with instruments we have empirical science. Finally, if we take our specific formalisms and perform calculations which generate transformations that we then map onto the world we are engineering. An example would be the calculations of stress and strain on a proposed mechanical structure as part of the construction process.

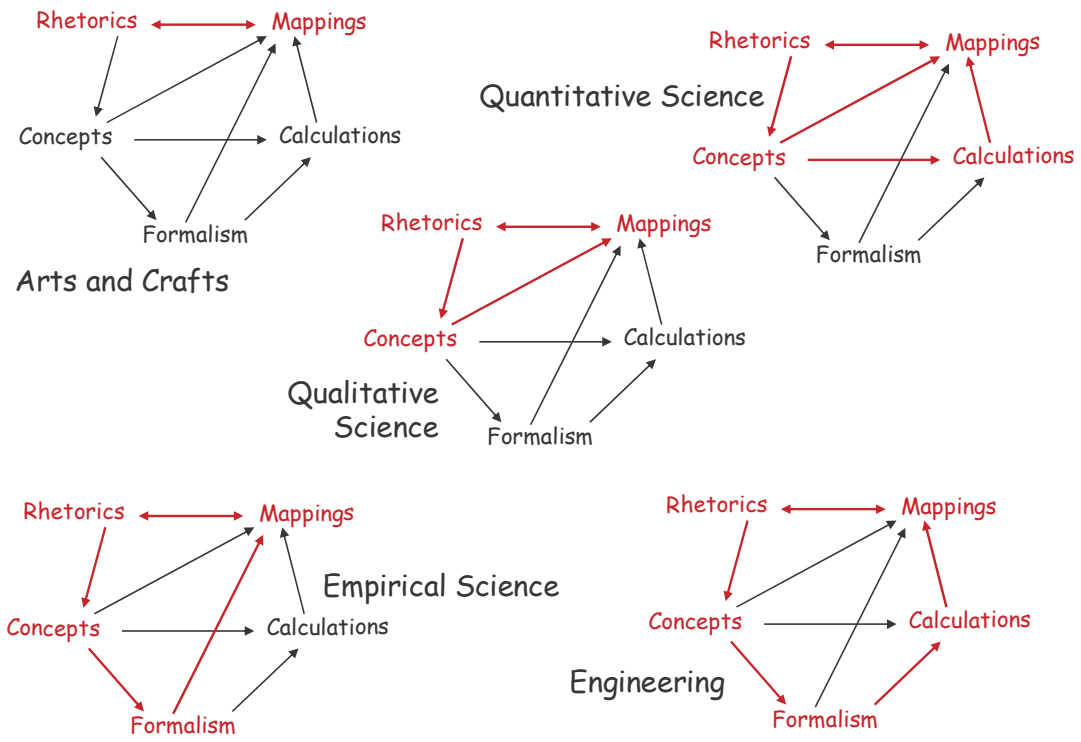

Fig 3: the manifold of architectural discourse.

We have generated another directed graph, Fig 3, which represents a manifold of discourses of systematisation which we will call architectural discourse (AD).

The limitations of the single conceptual frame

Systematisation is reduction. Expressive power is sacrificed for gains in generalisation, predictive value and perspicuity of representation. It requires conceptualisation which defines what counts in the situation and, adopting Badiou's ontology, we must admit that there is a transfinite infinity of other theoretical possibilities available. In the case of complex socio-technical systems, there is a constant struggle between achieving the benefits and avoiding the problems of systematic reduction. In practice, the range and complexity of the issues that require to be represented, analysed and synthesised in the planning of socio-technical systems are such that there is no single formalism that is both adequate and tractable and it has been this experience that has driven the development of architectural language.

The proposal of Herbert et al [2] regarding the use of projections was one attempt to improve the expressive power and scope of systematic representations. In this approach, a socio-technical complex may be described in several distinct systematisations, each characterised by its own conceptual frame, formalisms and programmes and each addressing a particular set of concerns. The promise of projections is that it supports a meta-systematisation, allowing us to construct cogent links between projections and claim that they are coherent and consistent among themselves.

The specific projections of *enterprise*, *information*, *computation*, *engineering* and *technology*, were defined by ANSA and taken up in the Open Distributed Processing standards [3]. Parallel approaches were taken in [4] which generated a somewhat looser and more informal set of views upon, and ways of representing, the system.

Current ICT systems development methodology has focussed on three projections each of which supports its own architectural discourse and a set of principles and pragma have been developed to support a practical engineering practice. The first of these correspond to a functional projection of behavioural description. What counts as behaviour and as state, is predetermined by the technologies in use: items can be presented to,and buttons pressed by users, objects (units of functionality in software) can be instantiated and invoked by other objects. The second is a resource or platform projection in which the units that are capable of delivering the behaviours defined in the previous projection are configured and deployed. Here what counts are capsules and platforms, servers and clients, hubs and networks, etc. Finally, in this projection oriented architecture of the ICT system, we have the concepts, formalisms and calculi of scaling, capacity and performance. Thus the projections of function, capability and capacity are each articulated in its own technical terminology.

What we have described here is the basis for current systems development methods in terms of three extensional projections, that is to say, projections that deal only with physical concepts and entities. The only material which is

acceptable and useful as input to this process of systems definition is expressed in terms of function: the business process or the use case. And this limitation represents a major problem in the contexts of transformational change which we have been discussing.

Two further projections are required to provide the minimum necessary expressiveness to respond to the deliberative and co-productive processes of partnership formation and the creation of new enterprise. These concern, firstly, the definition of roles and the conversational relationships, responsibilities and accountabilities which link them. In this projection issues of the combination and allocation of roles is discussed and the possible conflicts and synergies of interest are examined. The second of these intentional projections concerns the instrumentalisation of the conversations defining what counts as evidence for particular conversational acts and transactions. In this projection, the need for a commitment at some point in a relationship would be identified. The offer of a notorised signature would then be assessed as adequate and acceptable .

If we take the idea of the representations of systematisation and the projections together we produce the 5x5 matrix of architectural discourse.

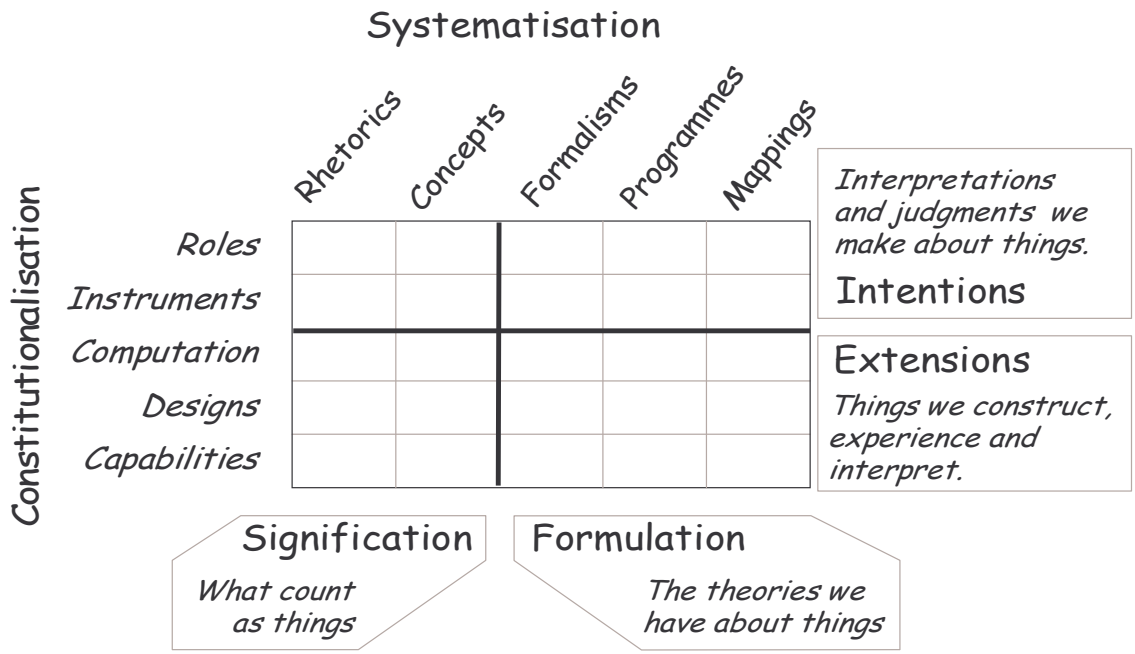

Fig 4: the 5 X 5 matrix of Architectural Discourse

Partitioning the architecture of the socio-technical system

Two important cuts can be made on the matrix. The first, which has been implied in the discussion above, is a horizontal Cartesian cut which partitions the extensional projections from intentional ones. The relationship across this cut is that we take this (a physical thing or behaviour) to mean that (an assertion of values or significance). The second is a vertical cut between significations (what counts in this projection) and formulations (the theories we have about things that count).

While the introduction of intentional projections significantly increases the expressive power of the architectural discourse of the socio-technical system it introduces a new challenge: how do we know that the systematisations which take place in different projections could apply to the same complex reality? There is always a praxalogical answer to this question: build it and see what sense people make of and with it. In the exploratory and design stages, however, we must rely on the structure and properties of a generic ontology of enterprise to provide a means of analysing the relationships between proposed intentions – i.e. roles and conversational relationships – and offered intentions, i.e. processes, channels and procedures. In the next section we will explore this ontology before returning to the issues of intervention and how windowing and mirroring to nurture engagement and sense making can be channelled to the co-production of projection oriented (pre)specifications of a proposed system.

Part III

An ontology of enterprise

The IS and Computer Science literature is cavalier with the term "ontology" using it to denote the chosen conceptualisation and consequential data model of the domain of any particular application. The concept of an ontology offered here is not quite that local and structural: it is an attempt to define the categories of entity required to systematise a conceptualisation of enterprise. It provides a language of types and, as a consequence, the basis for a discipline of separation of concepts into consistent and coherent projections. It succeeds if it provides this categorical framework while not restricting the signification processes of the real stake holders and participants in the co-production of their strategic visions. The limitation it does place on these processes is that what is produced will represent a socio-technical system the elements of which interact and transact conversationally and where conversations themselves can be the subject of conversations. This is equivalent to asserting that the system is at least a second order cybernetic one as described in the first part of this paper.

The ontology of enterprise which is presented here [5] is based on three fundamental categories, corresponding to the:

- Locus and unit of identity (Role)
- Locus and unit of value (Resource)
- Unit of process (Activity).

Each exhibits a reflexive relationship: roles engage in conversations, resources exhibit mutual schema and processes interact.

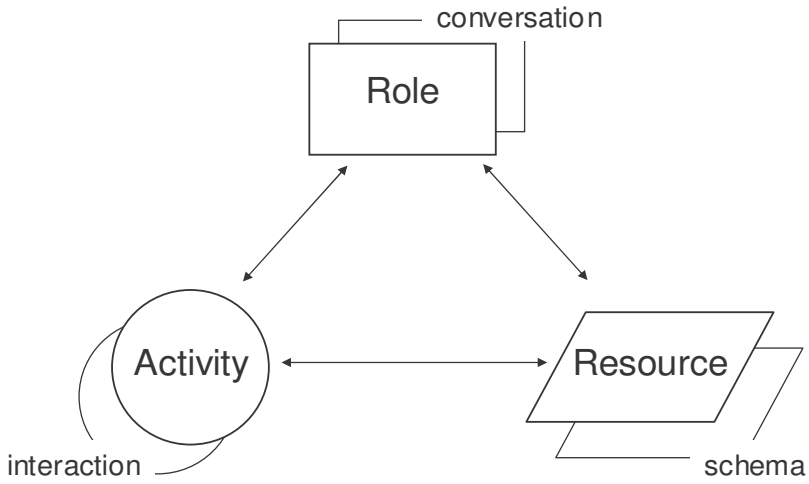

Fig 5. The "sub-atomic" concepts of Enterprise

These concepts are, however, "sub-atomic" in AD terms. It is only when we get to the level of "molecules" that we can start to do work in useful projections. We achieve this by introducing some simple regions, or encapsulations, into our ontological diagram. First we combine a role and an activity (or the potential to perform) to generate an entity referred to as an agent. This externalises a resource and unfolds two relationships between it and the agent. The first of these is that of performing acts, an intentional concept, the second is the extensional concept of executing an action. Thus an agent may execute the action of writing and will, by so doing, be taken to be responsible for the act of generation of content in the role of author.

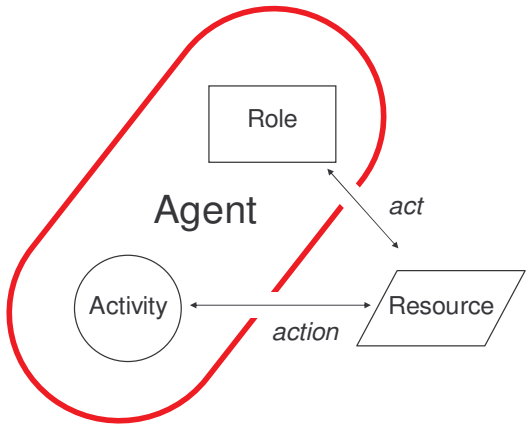

Fig. 6: the Agent encapsulation

If we connect two agents (our first "molecule") we have a conversation linking the roles and we have a shared resource through which the conversation is instrumentalised. This provides us with topological rules which define the mapping of functional projections, representing communicative actions, onto other projections representing networks of intentional relationships. In other words, by associating roles with activities we are situating each instrument in its own conversational setting.

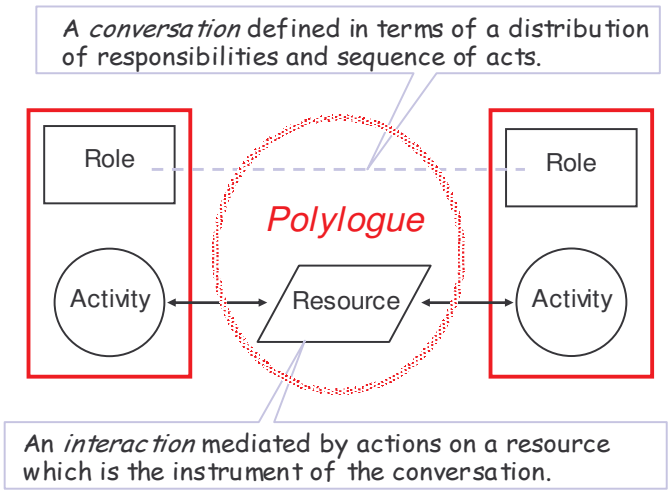

Fig. 9: linking agents

The first stage in the modelling process is to define a network of role relationships: this is an enterprise projection. We then identify the instruments which are generated and interpreted in each of the conversations identified. In this instrumental projection, each conversation is reified in a set of acts of generation and interpretation by the role holding parties. We can then reason about composing roles together and the resulting implications for instruments and processes: we have a way of reasoning between projections and across the intention-extension cut. This ordering is a retrospective logical one, in reality the process is both iterative and generative.

Agents and institutions

The agent orientation, described so far, foregrounds resource. As a framework for conceptualising enterprise, it takes the stance that *what* will be undertaken is uncertain, the main strategic requirement is to maintain and organise the arsenal, i.e. the set of resources which are considered appropriate and are available to face any eventuality. There is another frame of representation of enterprise which is based on the encapsulation of role and resource to foreground activity or process. Here we know what we will be doing and the flexibility concentrates on interchangeability of who will perform any given instance of the process by following well established rules and procedure.

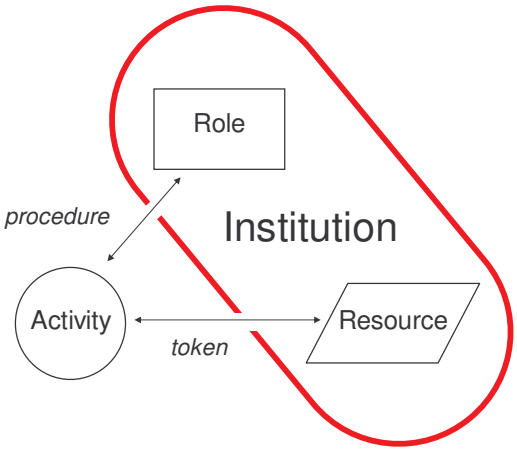

Fig. 10 The Institutional encapsulation

In this encapsulation, the composite relationship unfolded between the institution and the activity is that the role is linked through procedure and the resource betokens or signifies the institutional means when used in or for the activity. Thus, we have the role of judge and legal procedure, with the notion of the court and its procedures, which are taken as of the dispensation of justice.

When we represent two institutional elements in conversation we generate the concept of a protocol which again is a linking between an intentional and extensional concept and is mediated and made concrete by the observable activity.

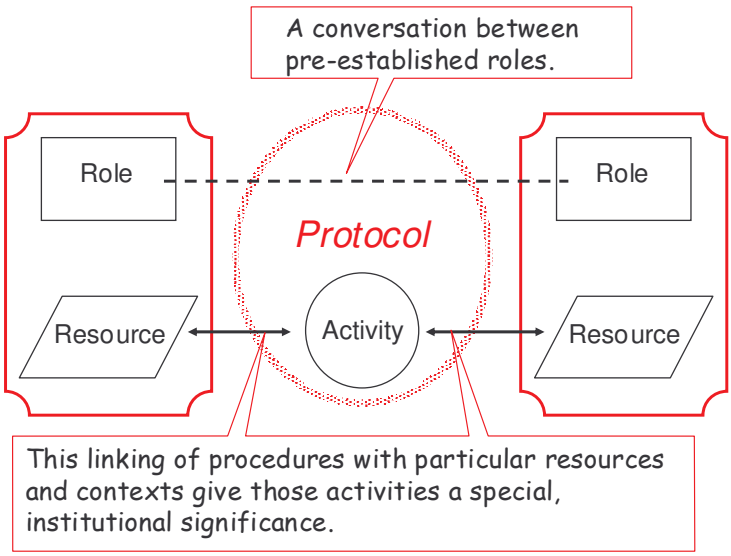

Fig 11: linking institutions through protocols

It is a feature of these diagrams that they provide a basis for mapping nodes to nodes and edges to edges in compositional comparisons between projections. The node concepts of agent and of institution generate the composite edge concepts of the protocol and the polylogue. Each of these maps together an intentional concept and an extensional concept of a link or edge. Thus, in a set of well formed projectional diagrams each extension has an intension and vica-versa.

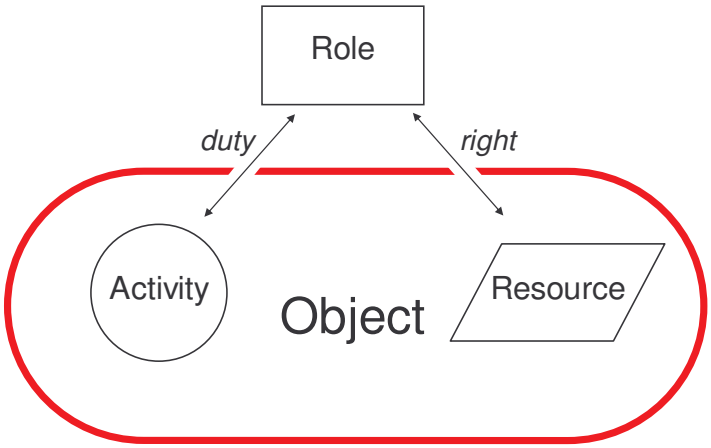

Fig 12: the object encapsulation

There is a third encapsulation possible in our triadic ontology. This time activity and resource are linked into the composite concept of an object, which

externalises the role, unfolds two more relationships: the first, between a role and a resource, is a right, such as ownership. The second relationship, involving the activity part of an object, is an obligation, duty or permission to perform a set of actions. Following the practice of the last encapsulations, we place objects together and create another composite link which is usually called a binding.

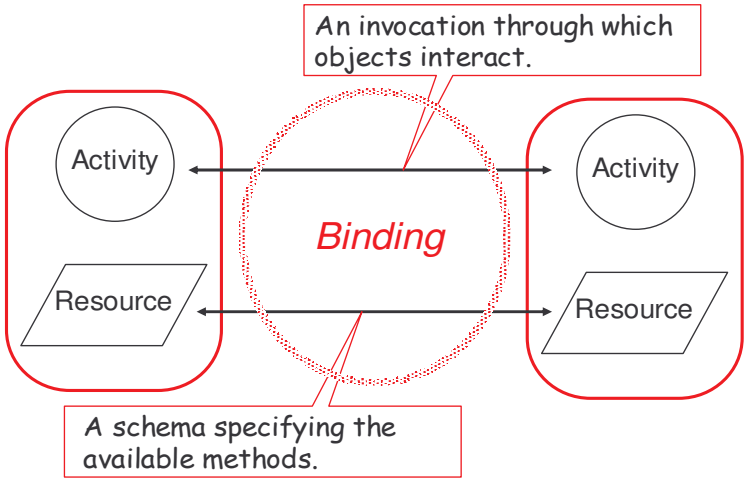

Fig 13: object binding

There is an interesting asymmetry, however, in this particular encapsulation. The role does not intermediate either of the aspects of a binding and its linkages to the relevant objects are implicit not explicit. If an object model is offered as a functional or behavioural projection of a socio-technical system, then there is no explicit link to a concept on the intentional side of the cut.

Before we return to the practicalities of co-production and how these theoretical considerations inform practical approaches to interventions, we can observe that current practice in systems development concentrates exclusively on the extensional region of the AD matrix: there is a language of objects and their states, behaviours, encapsulations and distributions. Designers deal with functions, configurations and capacities, aspects of the system that are amenable to a positivist, empirical metaphysics. The upshot of this is that, in our partnership formation context, the technical systems supplier demands use cases and business processes. These, of course, do not yet exist, there is no shared language in which they can be articulated and no authority to call on to impose a "solution". The resulting confusion and frustration usually causes pain and anxiety for all concerned.

The issue here is to partition the appropriate division of AD activity between the "technical" and the "non-technical". It is the role of the co-producers and governors of the system to undertake the signification of both the intentions and extensions of the proposed system: they decide what counts. The technical roles respond to these significations with appropriate formulations and designs which are then offered back into the co-production space and an assessment is made whether, the intentions that were signified are (legally, ethically economically) coherent and then whether they accept that these technical designs and artefacts are an acceptable and appropriate means of implementing the roles, relationships and conversations that are implied.

Part IV

Applying Architectural Discourse while not being an architect

The forgoing description of the architectural discourse of the socio-technical system and the generic ontology of enterprise has been presented as a theoretical underpinning for an intervention approach. It does not figure explicitly in that approach and is not something that participants in a co-productive, partnership formation process should be exposed to. Its purpose is to provide a basis for organising and re-presenting the material that is generated in the participative process and to track and guide its evolution and progress. This is in marked contrast to the usual roles and relationships where the possessor of the architectural understanding becomes the expert supplier of solutions to the problem owning users. The philosopher/therapist/gardener has to be constantly monitoring these delicate aspects of the relationship and process.

In practice, an exercise in network and partnership development and in the configuration of ICT infrastructure and services to support it, comprises a series of events which progressively cover the different aspects of partnership initiative and the different projections in which the co-productive work of the signification of the socio-technical system must be undertaken. The initial sessions are informed by field work and this will continue in support of the intervention process. The use of visualisation and animation over a number of screens becomes increasingly important as the complexity of the emerging shared vision grows, the fact that animations can be coordinated reinforces the idea that ***this*** – a representation of the behaviour of users and systems components – on one screen means ***that*** – a transition in a protocol which involves a granting of consent and a transfer of responsibility represented on another screen.

An example

In the final part of this paper, we will present a small gallery of exhibits with commentary which was the outcome of a real exercise in a social informatics intervention. It concerns directories of children's services. In 2003/4 one of the key targets for local government in the U.K. was the introduction of a web based directory of children's services. The exercise we will describe was ostensively a review of these directories, their use and the processes that supported them. In fact we had proposed this study because we knew that the directories were not of much value to users and that this was inevitable because no real information economy and publication network had yet emerged. The exercise would provide us with an opportunity to bring together the various actors and interests in our Region and promote some co-productive learning.

The Information Officer and service provider view

Our initial explorations produced some clear observations:

1. The Local Authorities regarded the directory as a simple process of collecting information, organising it and posting it on the web.
2. There was considerable resentment among the voluntary and charitable sector who were commissioned to deliver service: the directories were disintermediating them, failing to signal their identities, ethos and brands

and creating considerable administrative cost and overhead in responding to demands for data.

3. "We must be client centred" was used as a means of suppressing supply side unrest.

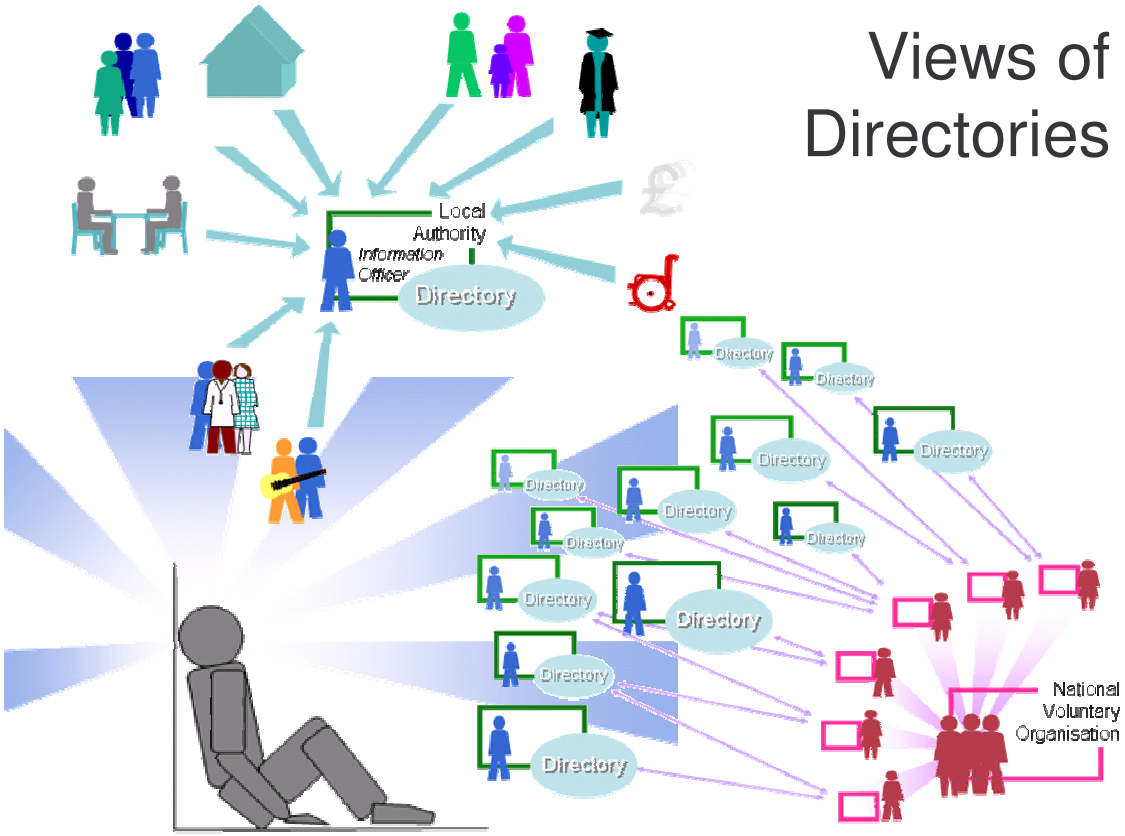

Fig 14: directories

The first half of the first session involved the revelation of three pictures and discussion around them. Their purpose was to allow participants to make talking about the unease and difficulties admissible.

Having raised the tension, the next stage in intervention is to offer something that might help. In this case, provide concepts and language in which alternative relationships in the "directorying" process could be explored. This was achieved by a simple progressive reveal of an enterprise model of the information infrastructure value chain. No extensive explanation of what the roles and responsibilities are or could be was presented, simply the question "what could that mean?" was asked. Each figure generated a new discussion. At an early stage one of the members of the voluntary sector turned to his Local Authority colleague and said "You are just treating us as informants! Where is our editorial control and responsibility?"

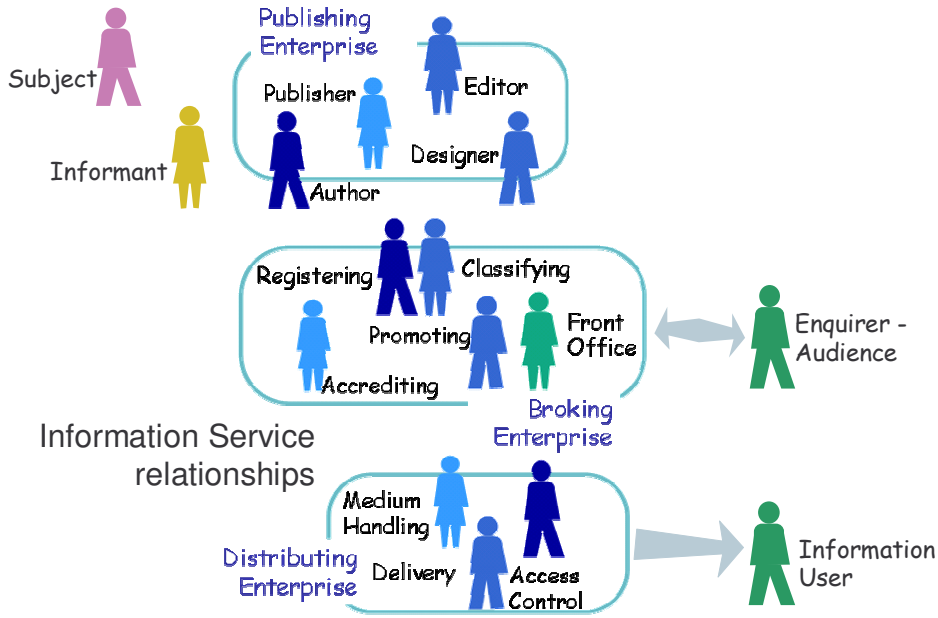

Fig15 The information service value chain

Note that in AD terms, each little figure is a role defined in terms of a set of rights and responsibilities regarding information and content. Each new information technology from Gutenberg and Caxton to the World Wide Web and Wikipedia has involved a renegotiation and reconfiguration of these roles and how they are instrumentalised. This was the process we were trying to seed.

The practitioner's view

The next session built on the first and looked at what practitioners need from a Directory. The picture we used is one that has evolved over a number of years and is a response to the inadequacy of process mapping a role such as care coordinator or lead professional in a multi-agency service environment. Again it represents roles and responsibilities and identifies the "conversations" which must be instrumentalised. The discussion at each stage in the unfolding of the picture is "What does that mean to me? How do we do that?" remembering that we have a number of very distinct areas of practice in the room from pastoral teachers to nurses and child protection officers: the differences in perception and experience were significant.

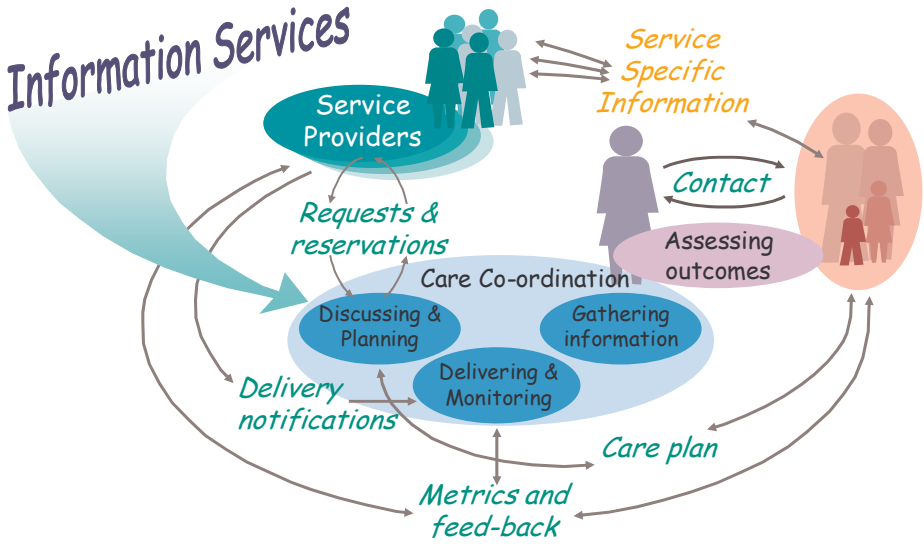

Fig 16: care coordination: practitioner – client conversations

The second picture presents concepts that belong to a different projection. They could best be described as "application service components" and denote functional capabilities. One of these two pictures represents intentional concepts of responsibilities and conversations (even if they are identified as processes such as "gather" and "discuss", the implication is the duty to gather and to discuss) while the other represents the tools and channels needed to undertake the conversations.

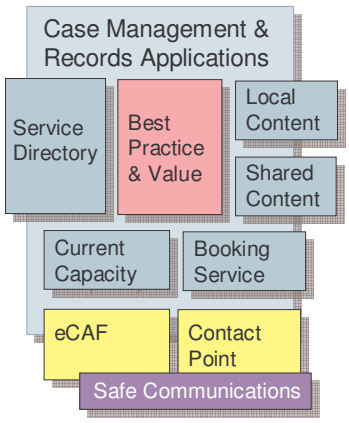

Fig 17: Applications functions to support care coordination

Again, this material creates a problem in the mind of the audience who were discussing it: the reality of children's services, particularly in the area of social work, is that the information tools are crude and simple and the informatisation is concerned with management reporting rather than care recording and delivery. The intervention must find something that might transform the discourse: we used Amazon where effective and lively catalogues and directories are a side effect and a consequence of an emerged information economy which publishes prices, availabilities, alternatives and approvals. References were made back to things like editorial responsibility and brokerage and for may of the participants there was a dawning of realisation of what an information economy

is, what it can do and, most significantly, how it should be governed if what is at stake is the wellbeing and development of children and young people.

The service Commissioners view

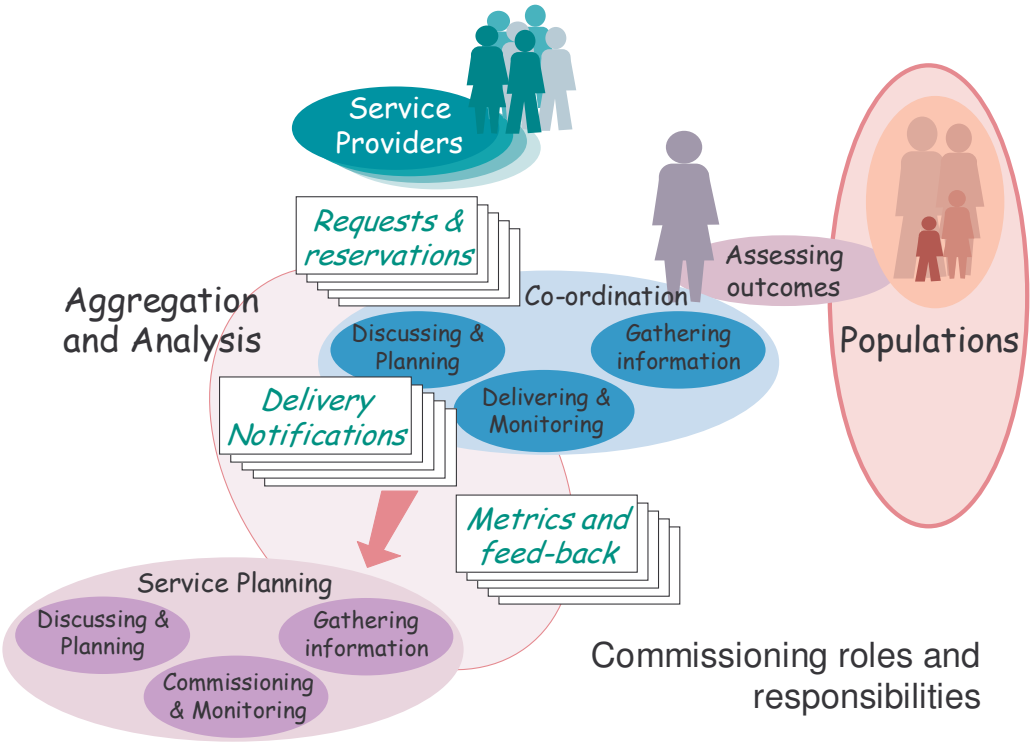

Fig 18: commissioning roles

The next area we examined was that of service commissioning and, to do this we built on the two previous pictures observing that commissioning is like care coordination but operates at the population level rather than that of the individual case. We then augment the applications component and service view. It was particularly striking how the commissioners appropriated these pictures and started positioning all of their current projects and initiatives within them.

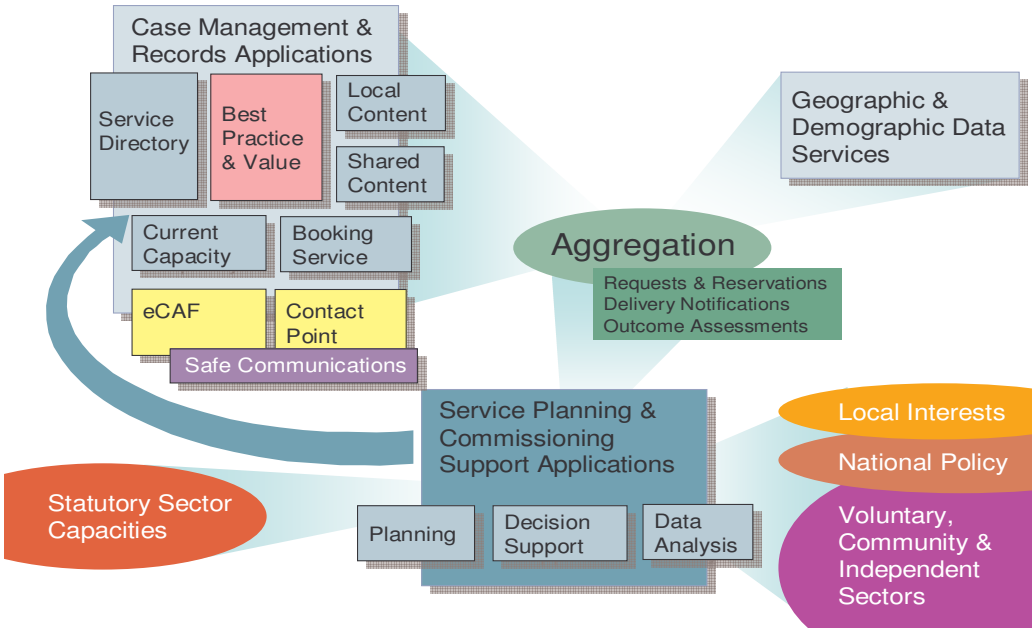

Fig: 19: Commissioning tools

The technical infrastructure view

The final session included IT strategists and architects from the Local Authorities and some of the other agencies. The AD process which is addressed here is, given the enterprise and functional/application views that had been developed in the previous workshop sessions, how could we represent the IT infrastructure resources over which this sort of configuration could evolve and be delivered. This stage is particularly challenging because we need to make representations that are realistic to the technical people but which still remain accessible to the non technical. We will not describe this diagram in detail but only remark that it represents the key functionality of middleware (publishing information, coordinating process and correlating identities) in the concept of the hub and avoids the almost universal tendency in these sorts of diagrams to present an enterprise view. We consistently use the phrase "We Are not alone" and show that there is more than one of almost everything except the root "federation service" and that this is a service which limits it's the functionality and value it offers to just that necessary to provide the third party coordination possibility. This corresponds to the federation principle of subsidiarity. The result is a representation of multiple domains of ownership. Partnership in the enterprise projection corresponds to configuration round real or virtual hubs in the design/conformation projection; another example of this meaning that.

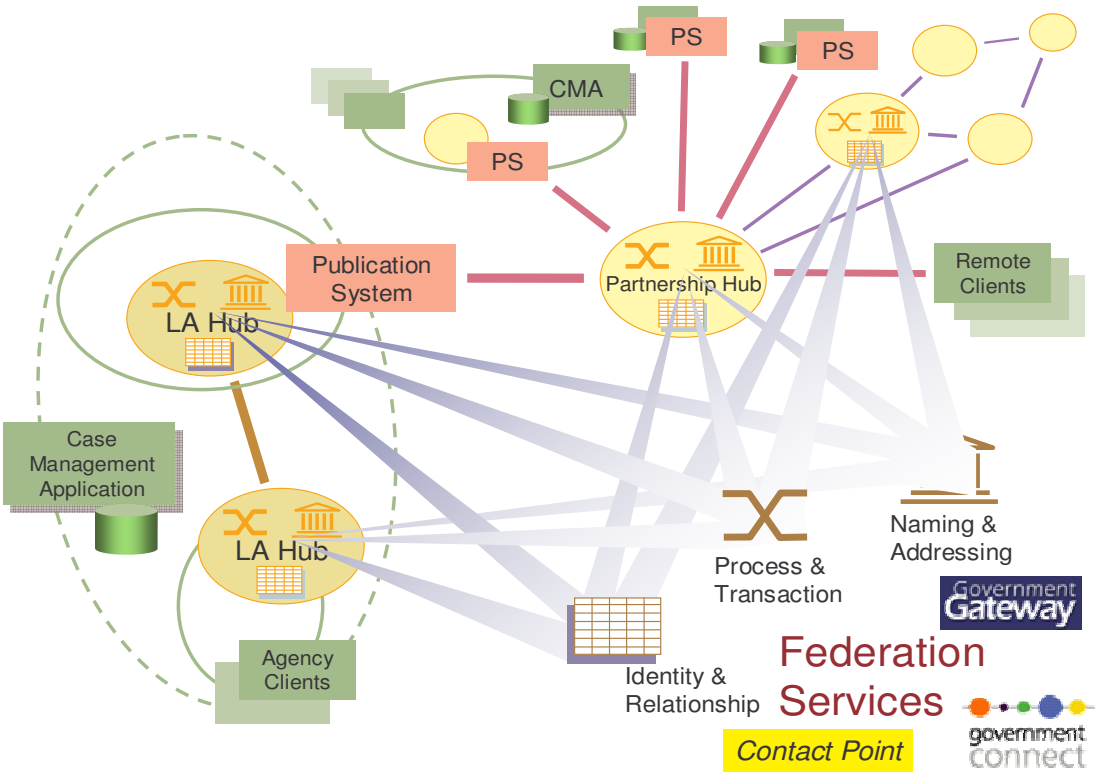

Fig 20: network infrastructure

The key concept that emerges in this final discussion is the significance of "federation services" provided by trusted third parties. By sharing the use of these, first and second parties can co-ordinate and partner.

Conclusion

We have tried to provide a theoretical framework, some rigorous methodology and an example of grounded practice in what has emerged as a social informatics intervention in nurturing partnership and multi-agency working and in the co-production and governance of the ICT infrastructure upon which it can be delivered. In doing so we have questioned some of the fundamental assumptions and practices associated with the role of the systems architect and the whole process of requirements engineering. This questioning has been forced by the realities of the contexts in which we have been undertaking our work which have not been situated in enterprises and concerned with integration but have been concerned with concepts of partnership, trust and federation.

Acknowledgements:

The authors acknowledge the contribution to this work of their colleague Roger Vaughn and other past colleagues in the Social Informatics Group of Newcastle University Business School.

References

Three works have been central to the development of the theoretical underpinnings of this work:

Gregory Bateson: Steps to an ecology of mind, Chicago University Press; New edition edition (23 May 2000)

Alan Badiou: Being and Event, Oliver Feltham (Translator) Continuum (March 1, 2006)

Pierre Bourdieu, The Logic of Practice Richard Nice (Translator), Stanford University Press; 1 edition (August 1, 1992)

Other references:

[1] Emery, F. & Trist, E. (1965). The causal texture of organizational environments. Human Relations, 18, 21-32.

[2] [ANSA 1989] ANSA, ANSA Reference Manual, Release 01.00 , Architecture Projects Management Ltd., Cambridge, 1989.

[3] [ISO 1993] ISO, Open Systems Interconnection, Data Management and Open Distributed Processing, Draft ODP Trading Function, Report No. ISO/IEC JTC 1/SC21/WG7/N880, International Standards Organisation, 1993.

[4] [Sowa and Zachman 1992] J.F. Sowa and J.A. Zachman, Extending and formalising the framework for information systems architecture, IBM Systems Journal, vol. 31, no. 3, pp. 590-616, 1992 .

[5] [Martin and Dobson, 1997] M.J. Martin, and J.E. Dobson, *The Ontology of Enterprises and Information Systems.* Americas Conference in Information Systems, Indianapolis, USA Indianapolis, Association for Information Systems, pp - 296-299, 1997.