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Inter-organisational systems: a personal history

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Inter-organisational systems: a historical perspective.

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Abstract

The observations reported in this paper are based on an auto-ethnography of a participative engagement in the emergence of the globalised automation, media, information, and communications technology environment in Europe, over the last four decades. The conclusion is that, in the often disruptive and un co-ordinated coalescence of the publication and mass communication, telecommunications and information systems sectors, which has been a characteristic of the emergence of the global information economy, key aspects of centuries old learning about the nature of the roles and responsibilities associated with information and communications have been lost.

Keywords: Inter-organisational systems, information systems, telecommunications

1.0 Introduction

As outlined in a companion paper[1], the data Processing and Distribution (DPD) paradigm was developed to create the Integrationist approach to enterprise information systems. The emergence of the Universalist approach of the Internet was initially resisted by the existing information sectors but, eventually, the Universalist and the Integrationist approaches have found a mutual accommodation in the Cloud Service concept and have become dominant. The fundamental distinction between the Data Processing and Distribution (DPD) paradigm and the IC paradigm is the ability to make intentionality, role and responsibility explicit in the definition of a socio-technical system. The first part of this paper examines the historical processes of the emergence and evolution of the systems paradigms in the creation of the Global Information Economy and infrastructure. The final sections present a conversational model of the traditional roles and responsibilities of Information Communications and Broking infrastructure which emerged over centuries in the evolution of successive information and communications technologies and media. It is these roles and responsibilities which have been diluted or ignored in current approaches to information infrastructure and the argument that these need to be understood and reapplied if these infrastructures are to be used is contexts such as the support of wellbeing, care and development.

1.1. A personal history

There have been many accounts of the emergence, over the last half century, of the global, electronic based, information industry and economy. Some take an historiographic perspective tracing the origins, emergence and diffusion of techniques and technologies and the commercial and social impacts they have had. Others take a more critical perspective, casting the innovators as heroes and public benefactors fighting the stubborn and selfish resistance of commercial incumbents or, alternatively, casting resisters and critics as forlorn defenders of personal identity and privacy against the attacks of the parasitic exploiters and purveyors of surveillance capitalism.

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[1] Inter-organisational systems: a neo-socio-technical perspective, Martin and Wilson. In this conference. We refer to this as “the first paper”.

This paper adopts none of these genres; it represents an auto-ethnography or participant account from a vantage point which was an accident of the author's career path and which provided a particular, but quite privileged, access to the traditional information sectors' responses to, engagements with and eventual disruptive transformation by the sequence of innovations and developments in automation, media, information and communications technologies (AMICT) which have taken place over the last five decades.

The vantage point was created by the following sequence of events: after training as an electronics engineer in the late 1960s and early 70s, the author spent the first part of his career in the U.K. computer industry, involved in the early developments of speech technologies and other, more conventional aspects of Human Computer Interaction. Then, as a consequence of a change of employment, he became involved in the series of large, collaborative, industrially based research projects which developed architectures for distributed computing systems and the integrated development environments that supported them. Initially, this remained in the UK, associated with the Advanced Networked Service Architecture project (ANSA) and the series of Integrated Project Support Environment (IPSE) projects funded under the Alvey Programme (1977 to 1984). This then influenced and interacted with a series of European Esprit projects including Communications Systems Architecture (CSA), COMANDOS and CIM-OSA. Each of these took an applications sector and attempted to generate a distributed enterprise platform, which comprised both a development and an operational environment to support integrated management information, planning and manufacturing and logistics applications. The reference implementations which were produced by these initiatives became the origin of the Data Processing and Distribution (DPD) systems paradigm discussed in the first paper. They still provide the foundations of the technical and business architectures of the information systems supply sector and were the origins of the middleware based approach to systems integration.

In 1986, a new programme was initiated by the European Commission entitled Research into Advanced Communications in Europe first in the RACE Definition Phase then in the RACE Main Phase. The objective was to stimulate innovation in the European telecommunications sector which, at this time, consisted of national monopoly network operators and a set of large national communications equipment suppliers each with its own Research and Development Laboratories. A small group of individuals, including the author, who were known to the Commission and had a track record of developing and delivering precompetitive, collaborative research programmes and projects in the Esprit Programme, were encouraged to participate in the new programme. The prospects of higher bandwidth and processing power was seen, form the traditional telecommunications perspective, as an opportunity for the development of value added services and such services would require investment in software development and management capacities, and the creation of new software service architectures. Our task was to transfer both experience in the development and management of industrially based collaborative research to the new sector and also to transfer relevant background from the architectural work of the Esprit Programme.

The experience of being parachuted into telecommunication from information systems was a deeply confusing one! While there were many terms that seemed familiar, the underlying technical and business architectures were profoundly different. The RACE Definition Phase projects (1986-7) laid the basis for the architecture development work of the RACE Main Phase in the Telecommunications Integrated Network Architecture project (TINA) which attempted to apply the architectural principles which had been developed in the IT sector to value added services in Communications. Before any real understanding of the deeper underlying issues and differences between the sectors' architectures emerged, however, the

external “threat” of the development of the Internet Protocol and then the World Wide Web became a dominant and profoundly confusing issue.

The RACE programme was augmented and eventually succeeded by the sectorally themed Telematics Programmes which addressed the application of the new communications, media and processing technologies in different contexts such as health, education and the support of the elderly and disabled. But while this was happening, the whole edifice of the national telecommunications operations approach was being dismantled and the sector de-regulated and privatised.

The Telematics Programmes also involved actors from the publication, media and broadcasting sectors and many projects came up against the conflict between traditional and very well established intellectual property rights, publication responsibilities and information curation and brokerage concepts, on the one hand, and the open source, best effort, universal access philosophy of the emerging Internet, on the other. It was only quite late in this process that the balance of participation in the programme shifted to the wider inclusion of the academic sector. The information that was being generated moved from being the commercial intellectual property of the participants, recorded in commercial in-confidence deliverables, to open publications. So the data, insights and understandings generated in the earlier stages, which have just been described, went largely unpublished except in overview and in grey literature; it is largely forgotten. In the following sections we will explore some of the factors that resulted in the forced and often chaotic coalescence of the telecommunication, publication and mass communication and information processing sectors and the consequences this has had on the current configuration of global networks and on the information and communications service provisionings.

1.2 The traditional information sectors and collaborative research

While the first significant stages in the developments we have been describing commenced in the early 1980s, they were based on a pre-history of two decades which involved the adoption of electronic, stored programme technologies in what had previously be the electro-mechanically based industries. These were tele-communications, publishing and the broadcasting and computer based information processing and industrial automation. It was in this period that the European Commission invited representatives of the twelve major, then nationally based electronics and computer supply companies of Europe to sit down together to explore the possibility of a joint research programme. This process originated the then radical idea of collectively planned and jointly funded programmes of collaborative, pre-competitive research and resulted in ESPRIT and all the subsequent Commission funded research programmes. While even the most enthusiastic supporters of EC intervention in this area would not claim that these initiatives were necessary for, or even significant contributor to the industrial convergence we are discussing, they did represent a major context for contact and cross-fertilisation between the previously rather distinct industrial research and development communities and cultures within these sectors and provided a vantage point to observe the maelstrom of innovation, sense-making but, more usually, confusion and dissent in the emerging AMICT supply sector.

As we have observed, the coalescence which we refer to was often deeply disruptive and resulted in uncoordinated, piecemeal combinations of different aspects of the technical and business architectures of the three sectors. In the ensuing periods of adjustment and accommodation, many aspects of the original models, and the wisdom derived from long evolution and experience that they contained, have been forgotten. In this discussion we will contend that the greatest casualty has been the understanding of the roles and relationships of

publication and communications and how, these could or should be adapted and applied in the virtualised world of pervasive electronic media.

We will return to the roles and relationships of a communications environment in the last sections of this paper. Next we will consider the evolution and convergence of AMICT and the emergence of two dominant systems paradigms, the Integrationist and the Universalist.

1.3 A participant account of a history

Those (of us) who joined the already rapidly developing computer industry in the 1960s were mentored and managed by a generation of engineers who's objective, after the exigencies of the second world war, had been to get computing machinery to work for months or even years on end rather than for hours or days at a time. The required mean-time-between-failures would only be achieved, as von Neumann predicted, when the technologies for processing and memory converged and this moved from vague prospect to reality during the late 1960s with the development of small and medium scale integrated circuits on an industrial scale. In parallel with the convergence of technologies, the development of software engineering techniques and of programming languages and tools resulted in a world of mainframe computers with their many proprietary operating systems, timeshared applications and batch processing and later on-line access capabilities.

In the following decade of the 1970s the primary research question had been how, in some generic, architectural sense, we could get my computer to interwork with your computer. This was initiated by Government and large corporations who possessed more than one mainframe serving large departments but soon included the need to connect to external systems in industrial supply chains, for example. The parties were regarded as having some autonomy and separate responsibility which demanded a peer to peer approach. What emerged from the *de jure* deliberations of the industry was the ISO seven layer model. This was the basis of all subsequent protocol stacks, providing a generic structure for the solution to problems of point to point interconnection and exchange as a platform for interworking. Together with the further development of high level languages and database technologies and tools, these represented the main achievements of that decade in IT.

It was not long however, before computers became not only more powerful but also smaller, more robust and numerous. In the 1980's, the question changed from how my computer could talk to your computer to one of how I get all of my computers to talk to each other and to form a coherent enterprise wide resource that I could configure, manage and exploit as an integrated whole. We spent that decade inventing and refining the distributed object oriented systems approach in response to this need. Because we were assuming a single domain of control in which the function and purpose of both ends of any particular connection have been defined and in which resulting structures will remain relatively stable, we did away with the upper levels of the OSI model which involved the mechanisms to initiate and terminate communications sessions by establishing who the parties were and, within these sessions, to establish shared presentation conventions. Instead, we simply exploited the lower four standard layers to create the basic more or less static "plumbing" of local area networks. On the basis of this simplification, our focus was on the problems of the heterogeneity of the proprietary operating systems and the coordination of operations across networks.

A significant consequence of this work was the emergence of "middleware" which, in its original form, was a software service layer that translated the facilities of different operating systems of computers owned in a single domain but procured from different sources, into a uniform, common platform. The outcome of this was that applications, such as inventory, accounting, payroll, etc., later referred to as "back office systems", could be constructed out

of software components that did not need to all be on the same physical operating system but could reside on different systems within an enterprise network. The initial objective was not to integrate the applications together but, the fact that they made use of shared components, such as databases, meant that middleware soon became the means for linking applications together as the need for this emerged.

Before we move on to the next stage of development, however, we must underline a subtle but very significant shift in significance here which is not apparent if we look only at technical functionality. Communication across boundaries of ownership and responsibility – peer to peer communication between my computer and your computer – is an entirely different proposition compared to communication within the boundaries of ownership of a single enterprise. In the former case the purpose of the connection requires an agreement between parties, that is to say, it implies some shared intentions and meanings. In the integrated enterprise solution I am pursuing my own intentions and am the single point of agency, control and design authority. In addition to the vertical demarcations between the layers of a protocol stack we have established the inside – outside boundary of an enterprise. These two types of demarcation between structure and infrastructure on the one hand and the enclosure of a boundary on the other, represent the most fundamental architectural constructs of both social and technical systems. Note that, in the original ISO model, level 7, the application layer, where the purposes of the interconnection were realised, was deliberately empty: the OSI standard represents the definition of those aspects of specification and design that must be shared for inter-working to be possible. In this sense, it was a specification of an abstracted infrastructure.

What we are observing here is a shift from an Information Communications (IC) paradigm approach to the Data Processing and Distribution (DPD) paradigm of the (distributed) enterprise solution.

1.4 The emergence of Universalism

At the same time that these developments were diffusing through the industry, a subversive alternative question was emerging: how can we connect every computer to every other computer irrespective of who owns them? On the one hand this was a military issue of the survivability of the network when parts of it were destroyed and on the other was the concern to provide a universally open infrastructure for “Big Science”, particularly particle physics. These, together, resulted in the concept of the universal messaging and publication space and the emergence of the Internet Protocol and the World Wide Web. Note that this has nothing to do with the idea of an “enterprise solution” in which a boundary with an inside and an outside is established, it was, again, fundamentally infrastructural, concerned with the establishment of a sheared layer of functionality. Most significantly, the Universalist approach assumes that the world is reliably self-governing and that there is no ambiguity. This is largely the case for the contexts of its origin in the world of particle physics and engineering. Against the expectations and prognoses of the highly sceptical commercial Telecommunications and the Information Systems communities, the Internet flourished and the outcome was the global network and the idea that a computer is something that is connected to the rest of the world by default.

We have observed, the “requirements” that drove the original design of the Internet were not those of commerce but, over the first decade of this century, a mutual accommodation of the Integrationist and Universalist architectures emerged and this has involved a subtle change in the position and the meaning of the term “middle” in middleware. Originally, as we have observed, it was an internal layer of software services between the many proprietary operating systems of the 1980s and the distributed, object oriented applications of enterprise

computing. Faced with the growing ubiquity of IP and the Web and the economies and opportunities this was generating, the objective of the systems supply sector became the provision of safe and secure areas of control within the internet which supported the operation of a possibly globally distributed enterprise and provided visibility from, and access to, the emerging global network and market place.

In the resulting architectural transformation, the applications that constituted enterprise solutions were reconstructed as "back office" services which were accessed by front office clients. These could be connected locally, within the boundary of the enterprise through an intranet or remotely over the Internet through boundary monitoring and safety preserving facilities such as fire-walls, extra-nets and encrypted channels.

The "glue" that allowed this front office – back office integration formed the new "middle" and comprised a core set of services. But these services were precisely the same ones that formed the original concept of middleware. In basic terms they are:

- *"Portal" functionality*, which is concerned with discovering, accessing, exchanging and publishing content and other internal and external resources.
- *"Switching" functionality*, which is concerned with orchestration processes, business logic and transactions (think of the telephone exchange or the marshalling yard making the required connections and getting things to the right place at the right time and in the right order).
- *"Indexing" functionality*, concerned with the registration of identities and relationships to ensure that the different parts of the system are talking about the same things when they make references.

A number of "enterprise integration services" are grouped under each of these headings in what came to be called "Service Oriented Architecture" and the proprietary control of the implementation and delivery of these services became a key strategic issue in the systems integrator – corporate client relationship. Terms like "enterprise bus", "integration hub" and "Web Services" became part of the language of systems procurement and supply referring to this functionality of the new middleware.

To complete our story, by the mid 1990's the two architectural concepts of the universal infrastructure and the bounded and integrated enterprise solution had emerged and begun to coexist interdependently. By the early 2000's the universally connected computer, some of which had now shrunk to a single chip or small collection of chips, became a component to be put into almost any device or appliance while wired and wireless networking became pervasive so that potentially anything could communicate with everything else irrespective of where it was or how it moved about. We had the possibility of an "Internet of Things". At the same time, the concept of "transparency", in which the underlying complexity of systems and infrastructure is hidden, is taken to its logical conclusion and the ownership of AMICT platforms and facilities is, itself, virtualised and made into a "cloud service" at the level of a whole integrated enterprise solution, of a software application or of a computing platform. These technologically lead developments were situated in the Universalist camp of AMICT architecture and, as usual, represented a challenge to the integrationist camp with its insistence on boundaries and the clear demarcations of ownership and control. An outcome of these developments is that the very concept of the perimeter boundary, which is grounded in physicality, becomes an abstract service concept figuring in a supply contract. In the world of commerce, where value is by definition monitory in nature, the initial resistance to this apparent loss of agency and control is overcome by the logics of economy and flexible scaling.

The tensions and contradictions between the two architectural camps have been reflected in the adoption of AMICT by government and public service. On one hand, aspirations for "big data" and "data.gov" reflect a Universalist approach while identity schemes, government transactional portals and electronic health records reflect attempts to apply Integrationist concepts on national scales. At the same time, the surveillance capabilities of the universal infrastructure have been fully exploited by the state, justified on the basis of security and the response to internal and external threat. But all of these efforts remain tied to an essentially DPD paradigm and present the sort of problems discussed in the first paper when applied to multi-organisational systems that are based on partnership relationships and shared purposes in the context of complex multi-faceted and dynamically changing needs.

In the final sections of this paper, we will examine the roles and relationships associated with a communications service infrastructure bearing in mind that it is precisely these roles that must be made explicit in the governance of an IC based system. As was discussed in the first paper, these intentional models represent the system in a conversational projection.

2.0 The roles and responsibilities of communications services

The models presented here were first developed in the late 1990's in the context of the initial emergence of eCommerce. They were an early part of the process of analysing and making sense of the coalescence processes of the emerging AMICT sector which we have been describing. They have been used in many different contexts of public and commercial activity since then and have evolved as a result. As with all such models of conversational networks and of intentionality, the job that they do is to help to identify the responsibilities that are involved. They provide a framework and a language for defining which of them have been made explicit and which remain implicit in any real operation and also to help identify where and to whom the responsibilities have been allocated. Another way of expressing this is that they represents the units of success and of failure of information communications service enterprise.

We will present the models as an historical narrative because we want to continue to underline the nature of the transformation that the AMICT coalescence represents. The creation of the World Wide Web involved an abnegation of the precise responsibilities we now define and explore and we are arguing that it is only through a reintroduction and reallocation of these roles and responsibilities that communications service based federation infrastructure can be constructed operated and governed. This is not an argument to reform the Internet as a whole but to create the possibility of a richer and more diverse set of information spaces, built on the universal foundation, which provid different sorts of governance arrangements to support different sorts of relationships and conversations. Such spaces represent the capacity to coordinate between and among domains of integration in the context of the wider external society and markets.

The concepts of publication, editorial control and authorship originally emerged, at least in the West, in the 15th. Century with printing technology and Gutenberg's introduction of movable type.

We identify three roles that are internal components of information publishing enterprise and a fourth which is placed at its boundary. As we will see, responsibilities associated with the organisation, curation and distribution of publications are considered as separate aspects of the information value chain and, at this stage, are simply indicated by the big blue arrow. They will be elaborated and analysed in the following sections.

The publisher is the locus of responsibility for what is published in terms of its content and for the intended and actual benefit or harm that is caused by its interpretation and use. In the

world of commerce, the publisher also responsible for the costs and has the rights and duties to administer any financial proceeds of the sail of publications according to the contracts of production. The global communication infrastructure has resulted in the ability to publish in units of individual data items in a database service all the way up to complete works and sets of works. We have represented examples of the traditional channels of mass communications in our model which correspond to a time when the responsibilities we are discussing were well established, stable and widely understood.

The publishing agent has relationships with three roles which are considered as part of, or associated with, publishing enterprise. We have noted that the most traditional context for these roles has corresponded to paper based publishing and broadcasting, however, the underlying division of responsibility is independent of medium. The publisher has the right and duty to articulate a publication mission.

Publication

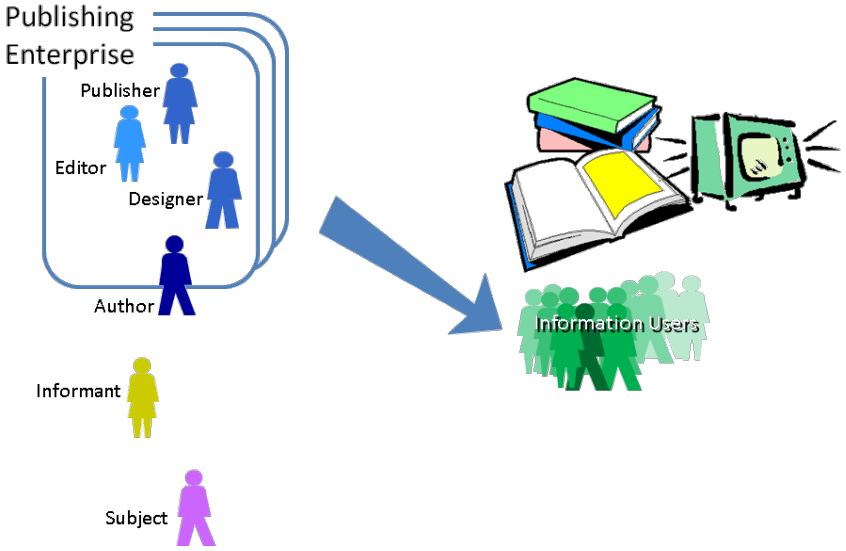

Fig: 1 Publication enterprise

The author is concerned with generating and assembling content to meet the communications objective in the publication mission under the direction and with the support of the editor. The product of the discharge of this responsibility takes the form of a publication brief. Authors may be in contact with informants who are the sources of the information that will be incorporated in the copy or the roles of author and informant may be composed together. Being an informant is associated with the requirements, rights and duties to provide information in some social, administrative or commercial context, for example, a company offering a commercial information service or an administrative department meeting the obligation to provide public information, both include this role. A role named “subject” is represented in this part of the model as the locus of the rights to privacy and good name which apply in a regulated information economy. Again the composition of this role with those of informant and author happens in the case of an auto-biography.

The designer is concerned with the organisation and presentation of the copy into a draft in a way that will meet the intended information users’ needs and the publishing enterprise’s standards and house style.

The editor is responsible for the formal aspects of the draft and applies sets of editorial rules which have been defined by the publishing enterprise. The scope of editorial responsibility may extend to ensuring that new material is coherent and compatible with other sources and policies.

Note that we are using a completely generic language here. Seeing how these responsibilities apply to the generation, exchange and use of, for example, clinical information in primary or secondary care is itself an architectural process of signification. It relates to the questions about what counts in the situation and what does not. For example, the ability to correct what is regarded as a mistake, and to either destroy or retain a record of the original is an editorial act. In certain clinical and legal situations in relation to certain sorts of information, the duty to maintain the original or to destroy it is a matter of policy associated with roles such as nurse, responsible clinician or, indeed, the patient/subject. The setting of objectives and principles, and the creation of rules to uphold and achieve them are the matter of information governance and it can be seen that our model of the information roles and conversations provides a language by which governance can move from the necessary rhetorics of consent and privacy to the specification and design of structures, functions and operations.

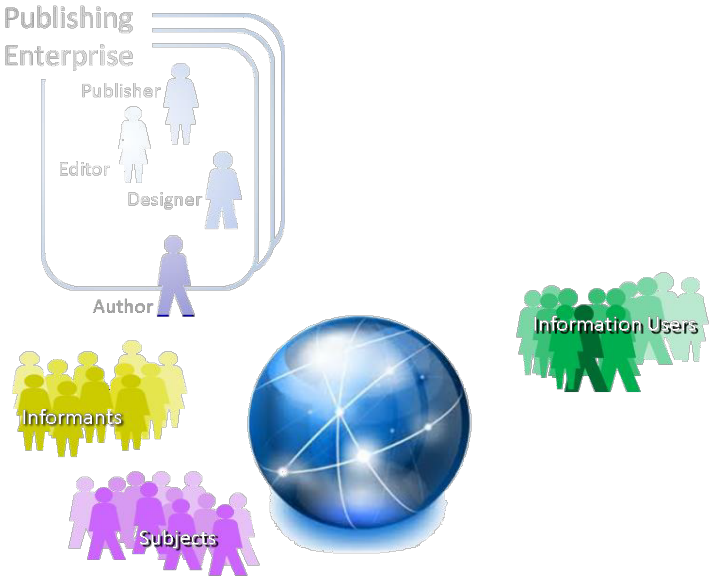

Fig 2: The World Wide Web

2.1 The World Wide Web

The roles and responsibilities of publication have been modified and redefined in detail and practice with each new communications and information handling technology that has emerged. The most recent and drastic of these has been the global spread of the Internet and the World Wide Web. The origin of the Web was at CERN: a place where physicists, computer scientists and engineers do Big Science. Now in Big Science as in big, or small business, things may be complicated and uncertain but they are not ambiguous. The meaning and significance can be established by looking in the peer reviewed journals or at the balance sheet.

Paradoxically, with the CERN situation we were back in the Middle Ages with respect to our description of information distribution: then, there is only one significant source (publisher), the Church, and there is no doubt about authorship and provenance while design and editorial work took place in the monastic scriptoria. In the new situation of Big Science, the roles and responsibilities of publication, which we have just described, cease to add any value and can

be safely ignored together with the need for provenance and recourse (all content has been generated by the accelerator which is a club good). These represent the contexts and requirements that conditioned the definition of the World Wide Web.

The initial reaction of the traditional publication, information and communications sector to the best effort, open and uncontrolled approach of the early Internet was one of rejection as a mere academic toy. With the continued growth of the network and its use, incredulity and derision were replaced by a desire to control but this was resisted for long enough to secure the ultimate spread and critical mass of the network. The outcome of these tensions has been a sort of mutual symbiosis between the Universalist and the Integrationist approaches with the establishment of bastions of integrationist control, as monopolistic walled gardens within the global open network. New forms of business were created on the ungoverned or, at best, indirectly governed universal platform which have been the results of the struggle to secure and control local intellectual property and market relationships while exploiting an emerging global reach.

Inevitably, the new platforms and networks were applied to Government and public sector services, a process that was ultimately effective for transactional services but one which has been problematic in the more sensitive contexts of relational services of care particularly in the contexts which involve the combination and coordination of interventions among multiple agencies.

We have described the emergence of middleware functionality to provide the shared mediating and coordinating functions and mechanisms in the first paper. We now explore the intentional aspects of mediation and coordination as a set of infrastructural service roles. This is achieved by developing the concept of brokerage.

2.2 Curation and brokerage in information service environments

In the following model we will represent a single information broker. In reality the architectural principle that we are not alone must apply and that in the case of any significant component we must recognise that there may be similar, independent, peer components in the environment and we must ask questions about the need and contexts in which they communicate with each other and provision them accordingly. Thus, in a real, scalable information economy there will be many brokers and that there will, indeed be brokers of brokerage services.

The first stage in the conversation between a publishing enterprise and an information broking enterprise is the submission or acquisition of published material for registration:

Registering agency exercises the following responsibilities:

- Assessment of the admissibility of the submitted information. Each broking domain will have a set of criteria of eligibility and relevance of information for the client/user groups which it serves, alternatively, legitimate providers, according to the criteria of the domain, may have a right of inclusion and visibility.
- Registration (i.e. acquisition and reliable storage) of data required to support identification, access and delivery transactions on any registered entity including information items. This includes the record of publication responsibility and conditions of use. This is an aspect of provenance.

In the strict definition, a register provides the information resources, such as identifiers and authentication criteria, required for transaction management but does not contain information to support searching or discovery. The organisation of selections of register entries and the

provision of supporting resources to create catalogues is the responsibility of the *classifying agent* and there may be multiple schemas implemented over the same register of information offers, and of content, to meet the needs of different user groups and segments of use.

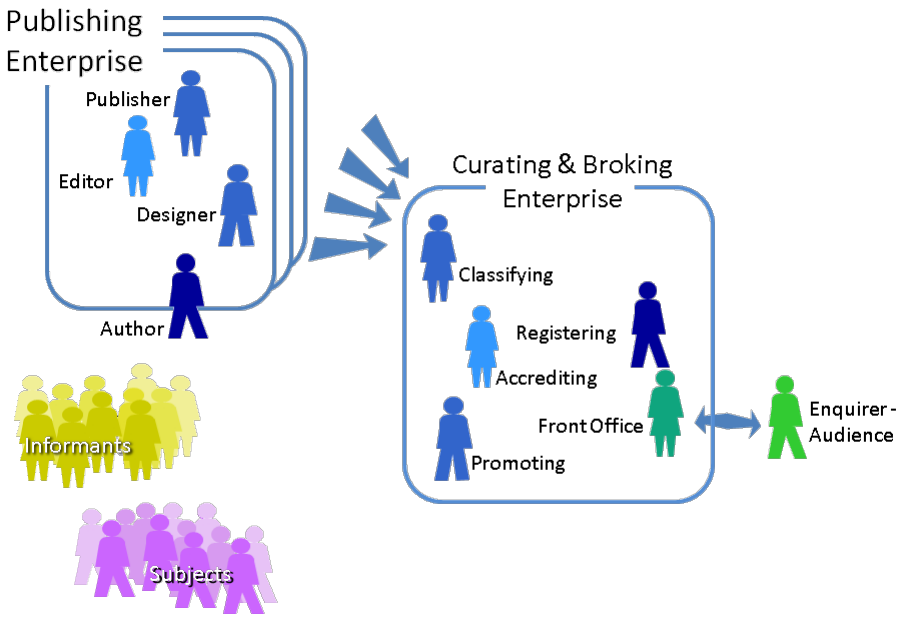

Fig. 3: Curating and Broking

The advertising agent is responsible for publicising information services to make their purposes and utility visible to enquirers/potential users. In the general case, this role may be acting on behalf of the publisher/providers (push), it may claim to be disinterested (neutral), or to be acting in the interests of users (pull). The reliable signalling of these intentions is significant in the contexts we are considering: it is important to know whether information about a drug, for example, has come from the supplying company or from independent research sources. This information about the source of information is distinct from the actual content and from independent evaluations of the provenance, relevance and value of information. This is the responsibility of *accrediting agents*.

There is a fourth class of broker under the classification of intention which is the parasitic broker who is using the information it can glean from the interactions it mediates between communication parties in its own interest. The outcome of pervasive parasitism in the social media, search engines and service ecologies such as Amazon and Apple, all of whom are engaged in brokering relationships between users, has been the emergence of what we now experience as surveillance capitalism.

The interactions between the publishing agent and the registering, classifying, advertising and accrediting agents result in an update of a catalogue which here takes on a very wide meaning. We consider it to correspond to any resources provided in an information service environment to assist the user to satisfy an information need by searching for, discovering and selecting an appropriate source.

When an enquiring agent has located a source and an item of information within an accessible catalogue environment, a transition takes place from what we term the rendezvous or search and discovery phase to the transaction phase of information service value adding.

The enquiring agent becomes a user and the corresponding agent in the information broking environment is the *transaction management agent*. The responsibilities of this agent are:

1. To check that all the preconditions for the information transaction are met.
2. To record the instance of usage. This may include charging for information or the facilitation of payments mechanisms and will certainly include the capture of information required for management purposes and to resolve any post-transaction enquiry (e.g. a complaint or evaluation).
3. To provide or mediate access capability between the user and the information distributing enterprise.

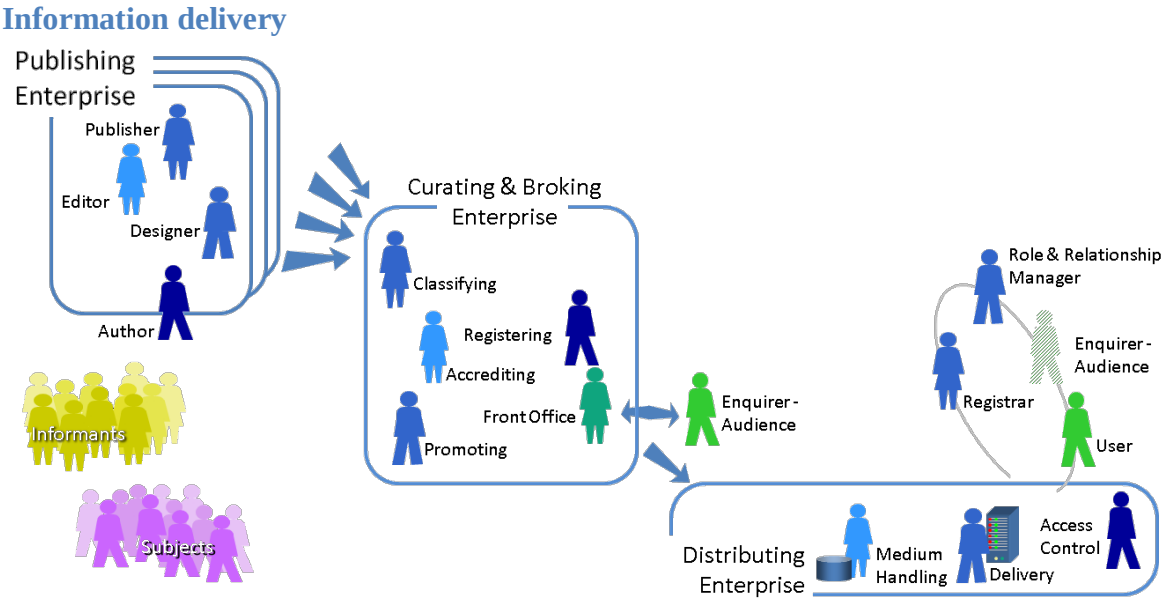

Fig. 4: Access and Delivery

The access controlling agent is responsible for ensuring that only users with the appropriate rights and permissions access information appropriate to them. In cases of "push" information services, the responsibility may involve ensuring that all who need, or are intended, to receive the information are notified to do so.

The medium handling agent is responsible for the organisation and holding of information for the purposes of delivery to the user. This includes the configuration and management of information servers in the case of network based services and would correspond to stock holding of copies in the case of physical media.

The delivery agent is responsible for the timely and appropriate delivery of requested content (and media) to the designated user. In the case of electronic information services, this agency is usually split into communications access provision and data transport provision.

We can note here that the absence of mechanisms to support and implement publication responsibilities in the World Wide Web have resulted in attempts to hold ISPs, who are the medium handling and delivery agents, responsible for inappropriate content that is accessed by their users or to police piracy. When the open and dependable operating principles of Big Science are transferred to society in general then the results are unpredictable despite any call for rationality and the respect for the greater good: people in general cannot be expected to "play nicely together" and any concept of policing, even self-policing has implications within

the sort of intentional model we are constructing because its purpose is to identify and locate the different modes of success and failure that are possible.

The concept of a service implies that there are responsibilities associated with ongoing performance as well as with instances of use. This results in a set of post transaction conversations in which evaluation takes place.

In Fig 5, the role of evaluator is depicted in conversation with the post-transaction role associated with the broking enterprise. We indicate in the model that the evaluation conversation could include all the interested parties and it should be noted that this conversation usually results in a new publication into the information space which takes the form of reviews and ratings: this is a consequence of the principle of recourse which implies that those affected by information in the system have the right to complain and, if upheld, to remedy. Again, we must take care to compose this post transaction activity with the publication roles and responsibilities and ask the questions about how they are distributed between the original publishing source, the broker and the user.

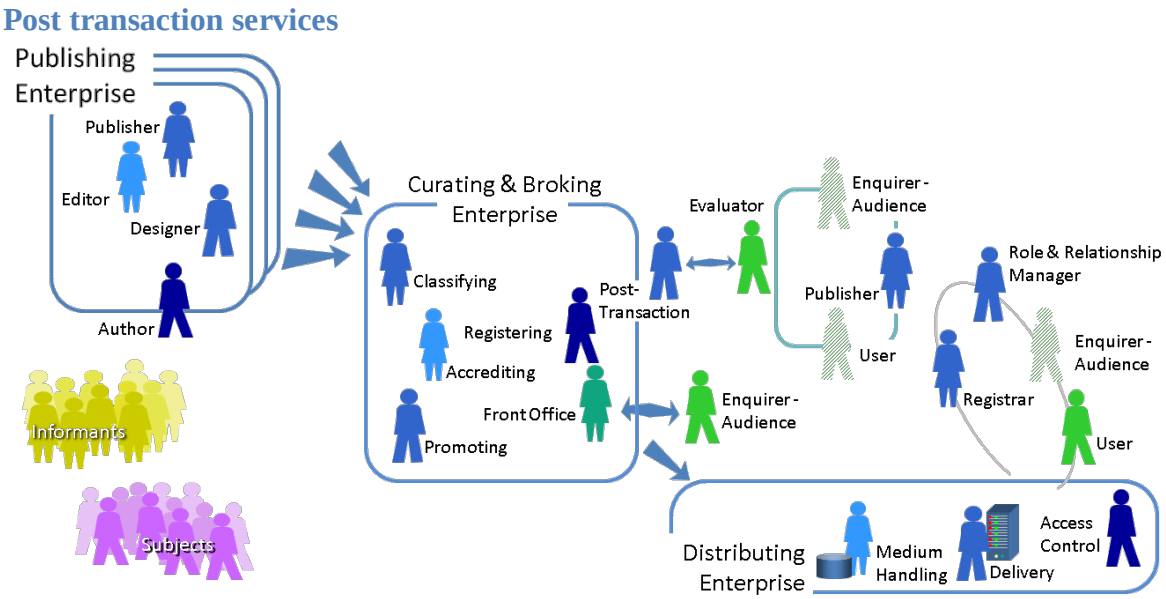

Fig 5: Post transaction conversations

2.3 Value-adding services in the information economy

So far we have interpreted the conversational processes of a brokered information service in terms of instances of its use. There will be many instances and this leads to the possibility of aggregation at the individual, cohort or sector and general population levels as well as with respect of different divisions of content and publication sources. This produces the final and complete version of our model which includes the observatory and Governance support services.

A common reaction to the finalized model presented in Fig 6 is that it is all too complicated and should be simplified. This is to misinterpret it as a design rather than as the outcome of an analysis. Each of the responsibilities is, as we have observed, a unit of success or failure. These may be composed together and mapped onto a single entity or left implicit but, in the design and evaluation of any such distribution of roles and responsibilities, we must take requisite diversity, choice and the distribution of risk into account as well as operational efficiency. Ignoring any of roles implies a loss of the ability to distinguish and respond to a corresponding failure mode.

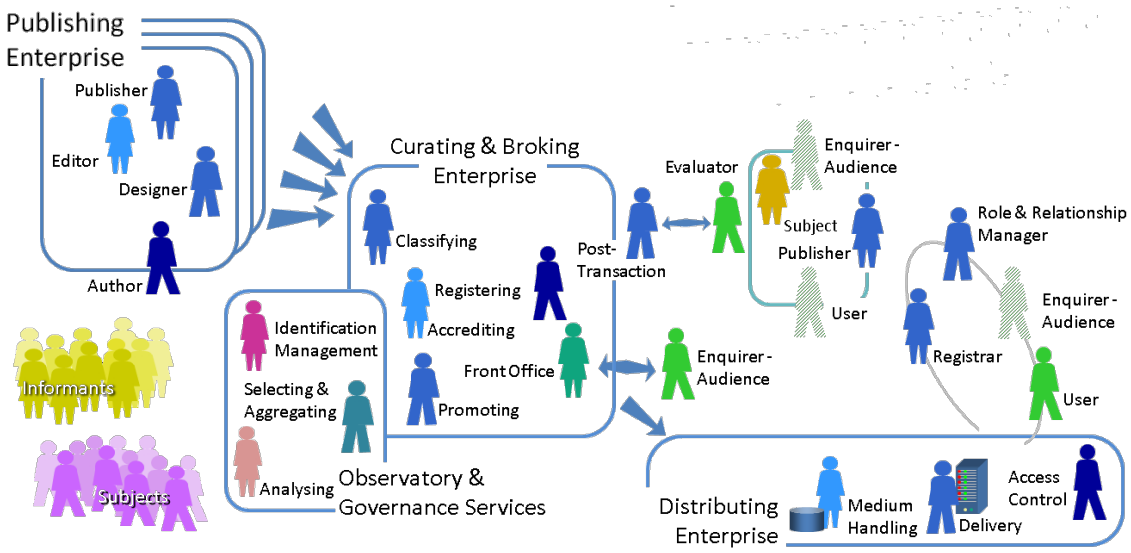

Fig 6: The complete Information service model

3.0 Conclusion

This paper has attempted to record a set of interpretations of a history which was observed and participated in form the vantage point of UK and European industrial research programs from the 1980s to the present. The first 15 years of these programs brought together researchers and developers from the computer, telecommunications and mass-communications/media industries at a time prior to and during the process of their disruptive restructuring which was the result of many political, economic and technological factors.

The opportunity to be exposed to the inner workings of the architectures of these different information oriented sectors before they were kludged and bowdlerized was a rare privilege shared by few individuals.

In more recent years, struggles to understand the challenges of supporting multi-organisational, partnership working in areas such as health and social care, particularly where these are community based, have resulted in the conclusion that some of the architectural concepts that were sacrificed to make the present global information infrastructure possible now need to be re-examined and re-applied if we are to make safe and governable systems in the face of complexity and ambiguity.

Finally, in the first paper we introduced the concept of a “conversational” layer in the development of a neo-socio-technical approach to communications, as opposed to data processing and distribution systems. The model presented in the latter sections of this paper is an example of such a “conversational” model. It represents an analysis of the distinguishable roles and responsibilities associated with an information service infrastructure and identifies the “conversational instruments” by which these relationships are enacted.

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