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# Using Actor Network Theory to Interpret the Introduction of Information Systems within the London Ambulance Service

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## ABSTRACT

This paper presents a comparative analysis of two attempts to computerize the dispatch system (known as CAD) for the London Ambulance Service (LAS). These two cases are relatively well known and the first attempt has been characterized as a ‘failure’ and the second as a ‘success’. However, this analysis focuses on the human elements and uses Actor Network Theory (ANT) as the comparative interpretive framework to draw insights from the two cases. The ANT analyses focus on the role of the chief executive (CE) in each case, and how well they were able to mobilize the relevant groups involved in the CAD development and implementation. Both cases involved conflict between management and workforce aimed at changing peoples’ working practices and processes, organizational politics, industrial relationships and the CAD development. The concepts of the successful and unsuccessful problem solving actor networks are developed as a means of appreciating the complexities, comparability and differences of these scenarios. Lessons learned from the comparative experience of the LAS cases provide insights into organizational turnaround, with success attributed to actively integrating IS and business development based on effective problem solving.

## Keywords

London Ambulance Service, Actor Network Theory, ANT, Information Systems, Failure, Success.

## INTRODUCTION

In 1992 the London Ambulance Service’s (LAS) attempted to introduce a new Computer Aided Dispatch (CAD) system. Most of those involved in the process, and a number of commentaries, identified it as an archetypal information systems (IS) failure (for example (Beynon-Davies 1995). Many Londoners remember the events with horror (Finkelstein et al. 1996), some recall phoning the emergency ambulance service to be greeted with only a recorded message (Collins et al. 1997). The implications of this ‘failure’ include a feeling of vulnerability by the people of London, a lack of confidence within the emergency service itself, and the resignation of the (LAS) Chief Executive and the worsening of the ongoing conflict between management and workforce, still without resolution. The case has now become a byword and exemplar for large scale and potentially life threatening IS failure and analysis (Dobson 2007; Sutcliffe 1998).

Although the incident had elements that were identified at the time as IS and technology failure it is clear that it was not just about the failure of the computer based information systems (CBIS) but was also about the failure of the approaches to business process development that were used, the effect of organizational change, including issues of human behavior, diverging cultures within the Ambulance service, conflict among the workforce, the union and the management and the political tensions. The latter, both in the widest sense of Governmental plans and aspirations for the Service and in the specific sense of the conflicts being played out between the LAS management, the workforce and the union.

This was not the first attempt by the LAS to introduce a dispatch CBIS. In 1990 an earlier system had failed and been scrapped prior to implementation due to problems of ‘load test performance’ (according to the report of the public inquiry, (Page et al. 1993)), at a cost of £7.5 million. It would therefore seem highly ambitious to tempt fate and attempt for a third time to introduce such a system into the service. Nevertheless, this is what happened and in 1996, a new CAD system was introduced. As Fitzgerald (2000), Fitzgerald and Russo (2005) have revealed, this time it was considered by both the

workforce and management as more successful. This outcome however depended not only in the implementation of a new CAD system, but also on the reconfiguring of the whole service, of which the CAD was one component. As well as the new CAD, this reconfiguration encompassed changes to culture, managerial style, organizational structure, lines of responsibility, working practices and processes, management/workforce conflict and struggles and the power and politics by which more friendly relationships were eventually achieved.

These two later attempts at introducing a CAD were both significantly more than just examples of technical success or failure, being far more socio-technical in nature. This prompted the authors to consider an analysis of the case using a broader framework than that used in most considerations of IT success and failure (eg. Hochstrasser et al. 1991; Lytinen et al. 1987; Willcocks et al. 1993), in order to provide a different perspective and additional insights. This paper proposes that Actor Network Theory (ANT) provides such a framework. It involves an analysis of data relating to complex organizational situations in which human and technical elements are seen as being inseparably intertwined. ANT enables a theoretical analysis that adopts neither a technological nor a social determinist perspective (Tatnall et al. 1999; Walsham 1997). Instead, it is based on an integrated symmetry of humans and machines that can be beneficial in understanding complex organizational situations, such as LAS.

The paper first introduces the theoretical framework, then it uses that framework to interpret the 1992 and 1996 cases separately before using the ANT framework to compare the two cases.

### ACTOR NETWORK THEORY AS THE FRAMEWORK OF INTERPRETATION

This paper uses Actor Network Theory (ANT) (Callon 1986; Callon 1991; Callon et al. 1981; Latour 1996; Latour 1999; Latour 2005) and its moments of translation to analyse both the 1992 and the 1996 situations, with the objective of identifying the factors that led to the first being seen nationally as a failure and the latter a much more localized success. Given requirements of publication it will be assumed that the reader is familiar with ANT and its focal actor driven moments of translation. Table 1 summarizes the key ideas in ANT moments of translation (note that this does not imply simple temporal order in the process, but is an artificial split for analytical purposes).

Phase	Explanation
Problematisation	one focal set of actors seeks to define problems of other actors in their own (focal actors) terms, and suggests that the solution to those problems is an 'obligatory passage point' (a path from problem via single solution to goal) of the focal actors' proposed programme of activities.
Intéressement	the focal actors seek to act to lock others into their place in the network proposed within their (focal actors') programme of activities; such action may include the attempt to break competing relations that other actors may have.
Enrolment	the focal actors seek through physical actions and negotiations to define and coordinate the roles of other actors.
Mobilisation	the focal actors seek to ensure that the specific representatives of the other actors come to be accepted as representative of those actors; and that they (the focal actors) come to be accepted as the main voice that speaks on behalf of all actors in the network.

**Table 1 ANT Moments of Translation (Heeks et al. 2007, p166)**

According to Callon and Latour the focal actor is "...any element which bends space around itself, makes other elements dependent upon itself and translates their will into the language of its own" (Callon et al. 1981, p286). Non-human actors, such as IT, can play an equally important role in a network to a human actor. For example a non-human actor might play a powerful role in establishing irreversibility, but as will be shown here they can also lead to the almost catastrophic deconstruction of a network as well. The successful inscription of a focal actors' interest in a technology, particularly that of information which links many other actors together, can be a major contributor to that network's consolidation (Latour 1992). It can, though exacerbate struggles between networks over which competing forces conduct their struggles. Examples of the use of ANT within the IS arena can be found in Heeks and Stanforth (2007), Lee and Oh (2007), Hanseth et al., journal special issue on this topic (2004), Whitley and Pouloudi (2001), Sidorova and Sarker (2000) Hanseth and Montiero (1998).

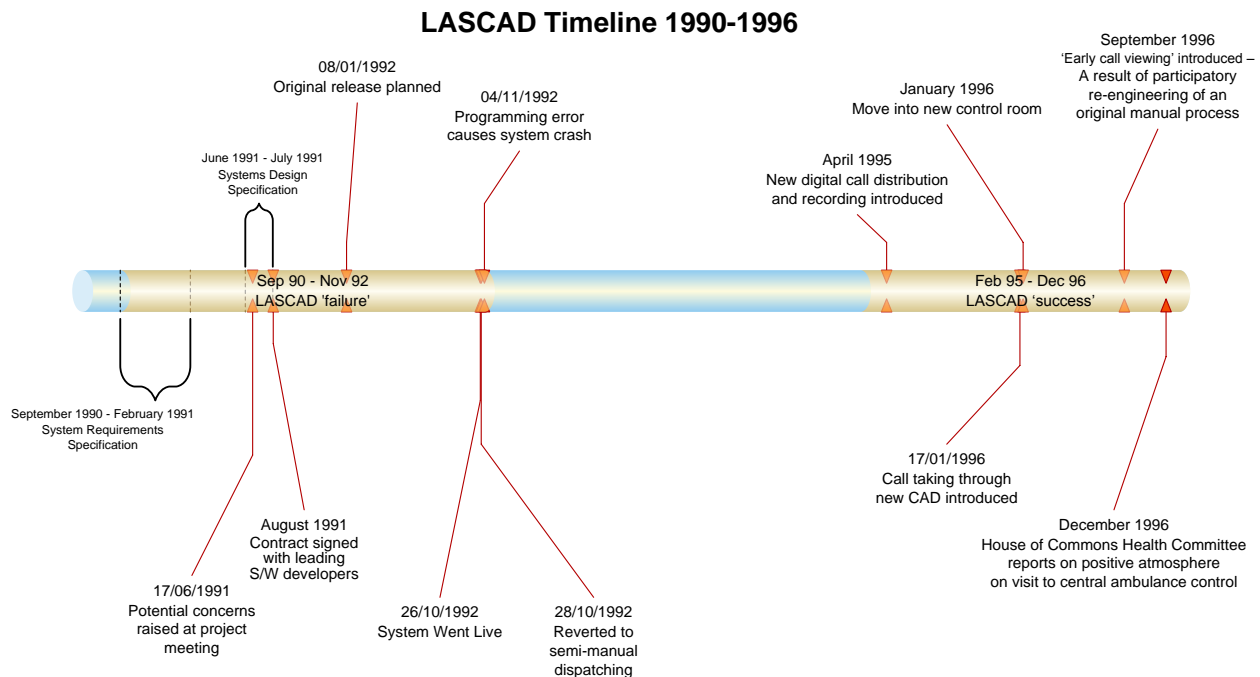
Within ANT there is a tendency to focus on the processes of translation caused by a single focal actor; whether human or, occasionally non-human. This focal actor is often the actor with the most power; ie. in LASCAD, institutionally it was the Chief Executive. However in this instance, there was also another actor directly active within the cases, namely the workforce. Their collective power was manifest through the Trade Union, which was in conflict with the management over

working terms and conditions that they saw as being imposed upon them by the Government (via its local proxy, the current Chief Executive). The Trade Union was seeking to mobilize the LAS workforce into taking action following a bitter national dispute (in 1989/90) with the NHS/Department of Health and the ambulance service over pay and working conditions. They were also aiming to translate the LAS management in line with their demands about working practices terms and conditions.

Ultimately it was with the then Conservative government that the Union had the real argument. The arena into which the introduction of the new CAD system, that initially failed and subsequently succeeded, was therefore one of translatory contestation. However, it is the two Chief Executives (CE) of the LAS who are generally taken to be the focal actors in these explorations. Each of them, in turn, initiated and pursued the organizational human and non-human translations associated with the introduction of a new CAD and its resulting impact on the London Ambulance Service’s performance in meeting patient needs. It was the CE, under conflict conditions, who also used the CAD as a, not always successful technological means for translating the staff in their professional roles and in their use of new information systems, in line with what the CE saw as the Service’s and their own interests.

**THE LONDON AMBULANCE SERVICE AND ITS COMPUTER AIDED DISPATCH SYSTEM**

This section briefly reviews the London Ambulance Service (LAS) and its history. Detailed analysis of the 1992 ‘failure’ to introduce a CAD can be found in previous literature (Beynon-Davies 1995; Collins et al. 1997; Finkelstein et al. 1996; Introna 1997) and the Public Inquiry Report (Page et al. 1993), known as the ‘Page Report’. Analysis of the 1996 ‘success’ can be found in newer interview data collected by one of the authors during a study for the British Computer Society (Fitzgerald 2000) and reported in Fitzgerald and Russo (2005). For ease of description we refer to these as ‘the 1992 failure’ and the ‘1996 success’ cases (note that although we suggest that these can be characterized as IS ‘failure’ and ‘success’ there are some who have suggested that the 1992 failure was not strictly a failure, because it was not a complete ‘termination’ (Beynon-Davies 1995), and that the 1996 success was perhaps not an ongoing success (McGrath 2001)). Figure 1 provides a timeline of the major milestones in both cases.



**Figure 1 LASCAD Timeline**

The LAS became a National Health Service (NHS) Trust in 1996. Prior to that, in 1974 the service had been transferred from local government to the responsibility of the South West Thames Regional Health Authority (RHA) as part of NHS reorganization of that time. The current LAS is the largest free ambulance service in the world serving over 7 million people and covering 620 square miles. The LAS has two main functions, the Accident and Emergency Service (A&E) and the Patient Transport Service (PTS), a completely separate service with its own computer system. The LAS comprises 70 ambulance stations, 950 vehicles (around 400 ambulances, plus fast response cars, helicopters, motorcycles, and other patient

transfer vehicles) and over 4,200 staff (including 839 paramedics, 328 control staff). In 2006/7 the A&E Service handled over 1.2 million emergency calls and staff attended over 865,000 emergencies, with PTS making around 320,000 journeys (London Ambulance Service 2007).

In the late 1980s and early 1990s the demand for emergency services had been steadily increasing and the Government had set target response rates for an ambulance to be with a patient within 14 minutes and the LAS was nowhere near achieving this. In 1990 a newly appointed top management team, motivated by the NHS reforms felt it was necessary to address these problems and improve its services through the use of new technology in the shape of a CAD system.

### **USING ANT TO INTERPRET LAS FAILURE AND SUCCESS**

Having outlined the background to LAS we next provide an analysis and interpretation of the 1992 'failure' and the 1996 'success' scenarios, using ANT. When using ANT to analyze a real-world situation it is imperative that those undertaking the analysis identify the focal actor whose problematisation of the situation is being addressed (Sidorova et al. 2000). In both LAS cases we identify the Chief Executive (CE) as the focal actor. The different CEs were instrumental, in response to a problematisation they had identified, in seeking to mobilize other actors to address the LAS's predicaments.

Other ANT analyses of the LAS have chosen differently, for example it appears that Introna (1997) has selected the Dispatchers' Trade Union as the focal actor, and McGrath (2001) uses Wells (the Chair of the Government's inquiry into the LAS failure). Other alternatives could have been the government's NHS reforms or Systems Options (SO), the software supplier. We argue that identifying the CEs as the focal actor, in both cases, offers the most cogent analysis, as it was only they who had the immediate necessity and responsibility, the assumed competencies, and the resources, to align the interests of a multiplicity of actors into a network, translating and mobilizing them into a solution that each had envisaged and defined within a problematisation. Identifying the CEs in both cases as the focal actors also produces a well-founded comparison of the nature of successful and unsuccessful problem-solving actor networks. The next section provides an ANT analysis of the 1992 Failure.

### **ANT Interpretation of the 1992 'Failure'**

*Problematisation:* As mentioned above the identified focal actor was the then LAS Chief Executive (CE) and his problematisation related to improving the performance of the LAS in response to the government's NHS reforms and the target response rates. The initial set of actors whose interests had to be aligned to form the 'problem solving actor network' with the CE's interests were the management team, the Government's NHS reforms, IS related staff, the dispatch staff (with their tacit rules and practices), the in-house paper-based dispatch procedures, the ambulances and their crews, the unions, the NHS procurement procedures and the public. Subsequent to the tendering process other actors involved were: the PRINCE methodology, the SO software company and their design, development and testing practices, and eventually, the CAD itself. From the perspective of the Focal Actor there had to be an irreversible alignment of the interests of all these human and non-human actors through the traversing of the designated OPP; which was the CAD implementation and deployment within LAS. After this, all the actors were to be mobilized to function together, which would lead to a more effective and efficient LAS service in line with the NHS reforms, and which included a more accommodating workforce, i.e., addressing the CE's problematisation.

*Intéressement of Actors:* Intéressement is the process whereby the Focal Actor corrals actors into an emergent actor network in order for it to traverse an OPP. The outcome would be a network that addresses the identified problematisation – or in this case the failure to do so. It is a process in which the Focal Actor uses a multiplicity of strategies, from politics to the mobilization of power relationships to persuade and coerce.

Where the Focal Actor's interests and the self or inscribed interest of those of the other actor(s) are commensurate intéressement is relatively easy. For example the interests of the Senior Management Team and the Government's NHS reforms were in line with the interests of the CE. Where they do not easily align, as was the case between the ambulance staff/dispatchers and the CE, then intéressement is incomplete and obstacles to the actor-network traversing the OPP occur and need to be overcome by the Focal Actor. Achieving intéressement can manifest itself in power struggles, as was seen between the LAS staff, their working practices and the unions in their relationship with the CE as he attempted to align their interests with his own. The dispatchers in particular resented this attempt at intéressement by the CE. They especially resisted attempts to change the way they worked, through centralization, replacing tacit rules and paper based procedures with those rules overtly inscribed into the CAD by the systems developers (on behalf of the CE). This would reengineer working practices in line with the CE's interests. In other words, there was failure to inscribe his interests in their working practices via the medium of another actor, namely the CAD. The CAD failed as a mechanism of intéressement.

Another *intéressement* obstacle was the emergence of alternative (sub) Actor Networks (see Table 2). The actors involved in developing the CAD, the LAS workforce and the Senior Management Team, all appear to have formed separate sub-actor network local *intéressements*. Only one, the Senior Management team, seems to be fully in tune with the CE's interests. As a result local *intéressements* arose in competition with that being created and driven by the CE and his interests. This led to a failure by the CE to achieve full *intéressement* of all the actors into a wider actor network, which then led to a failure to fully and effectively mobilize all the actors to address the problematisation.

The perceived attitude of some already mobilized actors towards other actors translated into the network by the focal actor, also inhibited the actor network in achieving *intéressement*, traversing its designated OPP and so mobilization to address the problematisation. This was the case with the project management team and SO, the CAD developers, and the PRINCE methodology, whose non-mobilization contributed to the inadequacies of the CAD, its production schedule failings, testing, functionality and reliability problems. The result was a CAD whose functioning was not quality assured or delivered on time.

*Enrolment and Mobilization*: The inability to bring about the complete *intéressement* of all the designated actors by the CE and the subsequent failure in ensuring they traversed his designated OPP resulted in the non, or only partial, mobilization of these actors to address his identified problematisation, i.e. to improve the LAS performance. In the case of SO and project management their technical or functional competencies also inhibited the network. Its poor design and inadequate performance 'betrayed' the CE, as well as its developers, playing right into the hands of the workforce which had different interests, enabling them to subvert the systems' operational implementation and mobilisation. They were able to prevent, as they saw it, the forced alignment of their interests with those of senior management, who controlled the development of the CAD which indirectly reflects their worldview (see Introna 1997).

This failure of actor enrolment and mobilization manifested itself in the failure that occurred in the LAS on the 26th October 1992, and the subsequent return to the old ways of working six weeks later. The price for this failure was the resignation of the CE and subsequently others of the managerial team. The problem solving actor network clearly failed to establish its irreversibility to transform itself into the solution that addressed the original problematisation of the CE. It appears that it was the old demarcated actor networks of the management and staff, along with their working practices and the Union, that reasserted themselves within the LAS.

To aid the ANT analysis of the two LAS cases, the authors have developed a framework (see Table 2), based on Sidorova and Sarker (2000). It focuses on the degree to which the various actors are translated into the network and how effectively they are mobilized by the focal actor to address the problematisation, or alternatively that they betray the focal actor and are not effectively mobilized.

In Table 2, 'Actors' (Column 1) were nominated by the focal actor to address the problematisation. Each actor is then analyzed according to various ANT dimensions. Column 2 shows 'Interests Ascribed to an actor by the CE'. The focal actor ascribes to the actors interests they will have as a result of their effective translation into the network. Column 3, 'Actor's own Interests', identifies each actors interests prior to the translation (including the non-human actors in which interests are inscribed). Column 4 'Obstacles to traversing OPP', sets out the obstacles to translating each actor into the problem solving actor network. Column 5, '*Intéressement and Mobilisation Mechanism and Actor Response*' reflects the mechanism employed by the focal actor to achieve *intéressement* and mobilisation (shown in italics) of each actor and the actor's response to this attempt.

For example, where the actor (Column 1) is the CAD application developer SO company (Row 6), they were translated, through the NHS procurement rules (another actor, Row 5) and contracted to produce a cost saving, safety-critical CAD system, tested, to specification, on time and within budget. The actual interests of this actor (Column 2) were apparently commensurate with those ascribed to it by the CE (Column 3) and therefore already well aligned and would potentially deliver the CAD. Indeed the company hoped to get repeat business with the NHS as a result. However, there were *intéressement* obstacles (Column 4) to effective enrolment and mobilization. The NHS procurement rules (Row 5) required the lowest bidder to be selected. This was in spite of the company having little experience with this size of application or its safety-critical nature and that it had poor project management competencies.

The *intéressement* mechanisms that the CE had with the supplier (Column 5), i.e. the mechanisms for controlling and interacting with the actor, were the written contract, the attempts to project manage the company and the formal testing quality assurance procedures. However, these actors were not powerful enough to prevent poor performance by the company and the poor solution it developed (Column 5, italics). The company, the contract and the NHS procurement procedures (ie. the lack of PRINCE project management tools) betrayed the CE in achieving successful *intéressement* translation and mobilization of the SO actor in producing an effective IS solution.

Sub Networks	Actor (1)	Interests Ascribed to an Actor by the CE (2)	Actor's Own Interests (3)	Obstacles to Traversing OPP (4)	Intéressement and Mobilisation Mechanism Actor Response (5)
Management actor network	<i>Senior executive management team</i>	To improve performance LAS – operationally in line with NHS reforms	Same as (2) and career advancement and avoiding failure is the bottom line	Failure to manage effectively CAD development Staff and public resistance	Self directed interests that drive project forward <i>Fail to overcome CAD inadequacies plus staff resistance and public issues</i>
	<i>The Government's NHS reforms</i>	To improve LAS performance and reduce costs	To improve LAS performance and reduce costs Manifest policy of Government	Pressure LAS to improve performance with reduced budget in short timescales	Build in to project Negotiations with staff and union <i>Drive project forward</i>
CAD procurement ,design and delivery sub actor network	<i>LAS systems manager (CE) and contract analysts, other IS related staff</i>	To produce good CAD information requirements analysis To effectively procure and deliver the CAD	Career advancement To produce good performance and ensure good personal income	Lack of morale, overwork and ability	Monetary rewards and continued contracts of employment <i>Carried out roles ineffectively with respect to CAD procurement and implementation</i>
	<i>The NHS procurement rules subsequent to the tendering processes</i>	To minimize cost and ensure delivery	Maximize supplier performance minimize costs, and avoid litigation by contractor	Lowest NHS bidder rules Time required to procurement and delivery	Underpin CAD procurement process and subsequent improved performance. <i>Lowest bidder, weak choice poor CAD application, betrayal of the other actors</i>
	<i>IT project management</i>	To orchestrate project effectively & ensure deliverable quality	To orchestrate project effectively & ensure deliverable quality	Lack of knowledge and desire by SO and project staff to use PRINCE	Include in tendering process <i>PRINCE not mobilized</i>
	<i>'Systems Options' company (SO), their design, development and testing practices</i>	To produce cost saving, safety - critical CAD system to specification on time within budget	To produce cost saving, safety - critical CAD to specification on time within budget Repeat business	Lack of experience in designing CAD and safety critical systems, poor project management skills, low fees	Contract with supplier Project management Testing of system functionality <i>Poor performance of company and the CAD solution betrayed</i>
	<i>The CAD (Computer Aided Dispatch) system</i>	To replace and enhance current manual system leading to improved LAS performance	To replace and enhance current manual system leading to improved LAS performance	Poor performance of the CAD	Contract, project management Implementation <i>Poor performance &amp; betrayal of the other actors CE and staff</i>
Public & staff sub actor network	<i>Dispatch and ambulance staff within LAS, the union, the tacit rules of dispatch practice and in-house paper- modus operandii</i>	To improve their individual and overall LAS performance	To preserve their current working practices and status To pursue their dispute with management	Conflict with management Current working practice and working environment	Struggle & negotiation CAD training, too little too early. <i>Staff resistance, current working practices, lack of faith in the CAD, refusal to be translated and mobilized</i>
	<i>Public (using service)</i>	To use the service in line with the rules in the CAD	To get the best service for themselves	Providing better access	Launch CAD <i>Public panic, anger and complaints rejection of translation</i>

Table 2. An ANT Analysis of the Interests and the Intéressement of Actors translation or betrayal (1992)

### **ANT Interpretation of the 1996 'Success'**

In this interpretation of the second LAS case, i.e. the 'successful' 1996 translation of the LAS into a more effective service (Masters 1997), we again use an ANT analysis and examine the problematisation, intéressement, enrolment and mobilization of the emergent problem and its solution actor network. Tables 2 and 3 provide examples of the tool used and summarize the focal actors' interests.

*Problematisation:* The overall problematisation and OPP was much the same as in the 1992 case, i.e. to improve the performance of the LAS in the face of the government's NHS reforms and the internal market. This time, however, there was the added element that the LAS needed to meet the requirements of another powerful non-human actor; the Page Report (Page et al. 1993). In addition, a new CE had been appointed whom we again identify as the Focal Actor. There was also a number of other problematisations that the CE saw as vital to address before launching into the major development of improving the business performance of the LAS, which he decided (adopting the recommendation of the Public Inquiry) should again encompass the development of a CAD system.

As can be imagined this was not a popular decision with the staff and the Unions because it had been perceived as such a major part of the 1992 failure. However, the CE felt that the degree of improvement required could not be achieved without technology. These other problematisations came under the overall heading of 'Infrastructure Development' and were a necessary condition for the latter success of the translation and mobilization of the CAD. These included the unstable electrical supply, the 'dying on its feet' switchboard, and the existing Control Room that needed to be replaced. In addition, the ambulance fleet was ageing and becoming difficult to maintain, the service was over-centralized and the ambulance crews needed better communications and security. The management also identified that staff scheduling required reform, which was not popular with staff as it was again seen as an attack on their working conditions. There was a significant issue with uniforms, which annoyed and irritated the staff because the previous CE had introduced them under duress. It was this complex 'mess' of interlocking problematisations that the CE addressed first.

The new CE had been recruited for his experience and good track record of achieving change in health organizations. However, the Director of operations/support services remained the same. The CE valued his experience of the past failure as well as his detailed knowledge of the way the organization functioned and he was felt to be a vital resource to draw upon in addressing the problematisation.

A new IT director, as well as Training, Personnel and Finance Directors, plus four Divisional Directors, were all appointed. The workforce, ambulance teams and dispatchers were still much the same, and initially still in dispute with management. In addition an in-house full-time systems developer was employed with experience and expertise of working with command and control systems in the public sector. In terms of project management, PRINCE was to be hopefully actually used in the CAD development. An in-house prototyping development approach was decided upon. It too was an actor artifact to be translated and mobilized by the problem solving actor network.

*Intéressement, enrolment and mobilization of Actors for Addressing the Preliminary Problematisations:* The management team addressed the preliminary problematisations effectively traversing a series of OPPs, consolidating their capacity as a problem solving actor network, as follows:

- A new digital PABX/Automatic Call Distribution System, together with DAT (Digital Audio Tape) was installed.
- A new control room (CAC, Central Ambulance Control) was built with a secure power supply.
- Four service divisions were formed.
- A program of ambulance vehicle replacement was introduced, bringing the average age of the fleet down to 18 months.
- The crews were provided with hand-held portable radios (these could be used away from the vehicles when necessary).
- A compromise solution regarding uniforms emerged.
- New schedules were introduced against strong, but not fatal, staff opposition.



	<b>Actor (1)</b>	<b>Interests Ascribed to an Actor by the CE (2)</b>	<b>Actor's Own Interests (3)</b>	<b>Obstacles to Traversing OPP (4)</b>	<b>Intéressement Mechanism Actor Response (5)</b>
<b>A Single CAD development and Design and Delivery Actor Network</b>	<i>Senior executive team</i>	To improve performance LAS – operationally in line with NHS reforms	Same & career advancement avoiding failure in bottom line, gain satisfaction in achieving	Establishing credibility in LAS Past experience of CAD development by the LAS	Self directed <i>Lead, support, encourage, treat staff as valued individuals Take pride in the work</i>
	<i>The Page Report on the LAS (Page, et al. 1993)</i>	Would lend support and legitimacy to the intended LAS changes	Government's desire to ensure LAS does not fail again and that it achieves trust status in so doing	Pre-empts the changes that needed to be undertaken within the LAS and used by the unions	Use Page Report as a means of leverage to carry the reforms forward <i>Page Report supported and legitimised change</i>
	<i>The Government's NHS reforms</i>	To improve LAS performance and reduce costs	To improve LAS performance and reduce costs Manifest policy of government	Pressure LAS to improve performance with enhanced budget	Build in to project Negotiations with staff and union <i>Drive project forwards</i>
	<i>The CAD in-house development team</i>	To improve LAS dispatch performance To develop an effective CAD with staff on-board	To improve LAS dispatch performance To develop an effective CAD with staff on-board	Handling the amount of work Getting staff on board	Support and encouragement, rewards <i>Enthusiastic, professional work with effective LAS delivered</i>
	<i>IT project management</i>	To orchestrate project effectively & ensure deliverable quality	To orchestrate project effectively & ensure deliverable quality	How to establish PRINCE as project modus operandii and ensure use	Project management based on PRINCE <i>PRINCE assures quality &amp; participation</i>
	<i>Prototyping methodology, tools, techniques, forums and teams</i>	To produce an effective CAD To facilitate participation in development	To produce an effective design for the CAD	Acceptance by the staff of its use and participation	Employ prototyping developers from public sector experienced in participation Foster a culture of respect for individual <i>Prototyping delivers</i>
	<i>The CAD system</i>	To replace and enhance current manual system leading to improved LAS performance	To replace and enhance current manual system leading to improved LAS performance	Poor Performance of the CAD and rejection by staff	Project management, developer and participative approach Implementation <i>Excellent progressive performance by the CAD</i>
	<i>Dispatch staff within LAS, the union, current tacit rules of dispatch practice and in-house paper-modus operandii,</i>	To improve their individual and overall LAS performance	To preserve their current working practices and status To pursue their conflict with management	Ongoing distrust of management Wariness from previous CAD project Current working practice and work environment issues	Engagement, participation involvement in CAD development Stimulate staff desire to improve performance Improve environment <i>Eventual staff direct involvement in the CAD project and its effective deployment</i>

**Table 3. An ANT Analysis of the Interests and the Intéressement of Actors in the CAD 'Success' (1996)**

Addressing these preliminary problematisations had the affect of establishing credibility across a wide constituency of actor stakeholders within and outside the LAS. By successfully implementing and achieving the above, in consultation with the

staff, the management team demonstrated its commitment and capabilities. Also, the traversing of a series of OPPs had the effect of consolidating and strengthening the problem solving network initially made up of managers, but would in the future have to translate staff and technologies, if it were to be successful. In response to the Government's reforms and the 'Page Report' it was time for the CE to address the major problematisation of overall business performance through the use of IT to enhance current working practices. This required the CE, along with the Senior Management, the IT team and the CAD technological actors to become effectively mobilised within the problem-solving network, and it would require the translation and mobilisation of the staff, a challenge the previous regime had singularly failed to meet (Masters 1997). The CE nominated a further two OPPs, firstly getting the majority of the staff involved in the CAD development and mobilising them, and secondly getting them and the system to produce an improved service.

*Intéressement:* The previous attempt by a problem solving actor network at addressing the business performance of the LAS had failed due to management attitudes, staff resistance and dispute, short time-frames, weak project management, a lack of system development capability, inadequate testing, poor functionality, and a disastrous failure to add value to the ambulance service in the eyes of the community. It was vital in this next attempt that these be successfully addressed through the effective intéressement of actors into the problem solving and subsequently solution actor network, and that the earlier mistakes and entrenched opposition did not occur again. An additional element was the openness of the CE and his personal commitment to participation.

Also the IT development professionals and the tools and techniques used (i.e. the prototyping approach, the project management, the PRINCE methodology, etc.) were rigorously mobilized and effective in achieving an integrated technical and business solution. To be successful it was essential that they normatively (Pouloudi 1999) engaged the staff directly and actively in the process of developing and deploying the CAD system. This OPP was achieved by the prior intéressement of the participative prototyping design approach and in-house IT design and development professionals that were both competent in their approach and had a different attitude toward the staff's involvement, within a wider culture of respect. These human and non-human actors and their effective mobilization acted as the mechanisms by which the intéressement of staff was achieved.

*Enrolment and Mobilization:* Having effectively achieved the intéressement of a heterogeneous group of actors these people were enrolled by the CE and mobilized into becoming an effective problem solving actor network through traversing the OPP which was jointly designing, developing and implementing the new CAD and then mobilizing it to the benefit of LAS dispatch business processes and subsequently the government and the public. There was no betrayal this time by the CAD technology or the other actor stakeholders in the network, for it had their now commensurate interests effectively inscribed within it. The dispatch staff had been active participants in the IS development. It now incorporated the tacit rules and general approach of the staff's working practices, i.e. the CAD system now articulated their wishes. Not until later, when both the staff and the CAD had become essentially translated and mobilized via the OPPs, was any attempt made to re-engineer the dispatch processes away from the staff's originally desired working practices.

All the actors within the problem solving actor network, in traversing the OPPs, were translated and mobilized into an effective problem solution network whose improved performance and internal environment addressed the CE's original problematisation and the displacement of the manual CAD system. This forging of the irreversible integration of the human and non-human actors into an effectively mobilized actor-network was exemplified by the Focal Actor, the CE, who said: "IT was an absolutely essential function and it was vital that we integrated our approach to IT with our whole approach to people management in general, it couldn't be anything else. If it had been we would have failed".

In this section we have, using ANT, analyzed the 1996 success of the London Ambulance Service in its attempt to address the problematisation of meeting the public's demands for a better service within the context of the Government's NHS reforms. As in the discussion of the 1992 'failure' case we use a tool (Table 2) to present and summarize the Focal Actor's interests attributed to each actor, the actors' own interests, the obstacles to, and mechanisms for, intéressement for the 1996 'success' case (Table 3). In the next section we compare the two analyses to reveal common and diverging themes.

## **AN ANT COMPARISON OF LONDON AMBULANCE SERVICE CAD SUCCESS AND FAILURE**

Using ANT to look at the 'failure' and 'successful' CAD initiatives, it is clear that in both cases the problematisation was essentially the same i.e. to improve the performance of the LAS driven by the government's NHS reforms of the internal market and to meet the public's need for a better service and to do this using IT to enhance or even replace existing manual working practices. The incumbent CEs were the Focal Actors who identified the problematisation. In the 1996 'success' case there were also preliminary problematisations relating to the replacement of associated infrastructure, such as the telephone system and the ambulance fleet. Addressing these issues significantly contributed to the outcome and helped overcome the

consequences of the history of CAD failure in the LAS and the legacy of mistrust and antagonism between staff and management.

The actors in both cases were of a similar structure, with similar roles and relationships at the start of each intervention. The major exception was that the CE in the 'failure' case also played the role of IT director. In the 'success' case the management team was strengthened and clearly more effective, with a culture of respect for the staff and their importance and contribution to the LAS. The CAD development actors and processes were also markedly different. Table 4 provides a comparison of the 'successful' and 'unsuccessful' LAS problem solving actor networks and their capacity or not to become the solution that addressed the problematisation, utilizing ANT concepts.

In the 'success' case development was in-house, it was highly participatory and inclusive, it adopted a prototyping approach, and it was implemented stage by stage (Masters 1997). Rigorous testing and training of staff was undertaken and it was managed effectively, incorporating PRINCE and quality assured deliverables. These factors played a major role in translating the staff into the problem solving actor network. In the 'failure' case the opposite occurred. It was driven from the top downwards, the requirements were defined by the analysts and the CE, it did not include the views and needs of the staff, and it was constrained by the NHS procurement rules in that the least-cost supplier was chosen. Overall the CAD system was poorly developed and tested by inexperienced people, it was poorly managed, with only lip-service paid to the PRINCE methodology and quality issues, (the staff were inadequately trained, an over-tight deadline was enforced and a big bang implementation undertaken).

In the 'failure' case the actor intéressement was weak, appropriate relationships between actors within the network were not formed and the actors did not identify themselves fully with the intent of the focal actor and were therefore not mobilised to address the problematisation effectively, whereas the 'successful' case was the opposite. The non-human facilitating actors, such as the formal procedures, methodologies, tools and techniques and project management approaches, and their enactment by human actors, were instrumental in enabling or inhibiting the enrolment of other actors, the traversing of an OPP and the subsequent mobilization to address the problematisation. In the failure case they betrayed the other actors in the network, in that they contributed strongly to an ineffective solution. Again, the opposite was seen in the 'success' case.

In terms of the 'successful' intervention, an intéressement of the actors by the Focal Actor relevant to addressing the problematisation was achieved. In the 'failure' case competing intéressements, particularly between those of the dispatch staff and management, but also the application developers and management, resulted in a failure to traverse the OPP, which in this case was the implementation of the CAD. In the successful case there was a series of OPPs, initially addressing the infrastructure issues, then achieving the active involvement of the dispatch staff in the development of the CAD, followed by the successful implementation of the CAD to achieve the desired improvement of the service. Instead of one big bang, the series of OPPs represented a staged approach to technical, human and organisational development.

In the 'failure' case there was no traversing of the designated OPP and this resulted in the CAD being abandoned and reverting to manual practices. Neither staff nor technology were mobilized to address the problematisation. The non-human technologies, the CAD functionality and also the development techniques and tools betrayed the other actors, including the public, in not delivering what was intended. That the staff saw the CAD as having the CE's interests inscribed in it, such that he could use it to monitor and control staff performance and as a means of reducing staff, and staff influence (the panopticon, see Introna (1997)) contributed significantly to the failure of the actor-network to traverse the OPP. So both staff and the CAD failed to be mobilized to address the problematisation.

In contrast, the 'success' case shows how achieving an intéressement and subsequently traversing a series of OPPs, the problem solving actor network was then mobilised into a solution to the problematisation. This was enhanced by the fidelity of the various non-human actors in the network and their lack of betrayal through poorly enacted functionality either within the process of development or in what resulted from it, i.e. the new infrastructure and the CAD. This resulted in successful inscription and articulation and the alignment of dispatch staff and management interests in the technology. The actor network was then mobilized to enhance services to the public and in doing so the problem solution actor network had irreversibly enhanced the LAS service. Of course this does not mean that other problematisations will not arise, nor that the service could not go downhill (there are some who suggest that this has subsequently happened), but it can never return to where it was before. The ANT interpretation reveals it was a successful human/non-human problem solving actor network.

ANT Concepts	LAS Failure to implement	LAS Successful implementation
Actors	<ul style="list-style-type: none"> <li>• Chief Executive (The Focal Actor)</li> <li>• The senior management team</li> <li>• LAS systems manager (CE) &amp; contracted analysts</li> <li>• Other IS related staff</li> <li>• Dispatch staff their working practice</li> <li>• Ambulances and their crews</li> <li>• Unions</li> <li>• NHS procurement procedures</li> <li>• PRINCE (little used)</li> <li>• Systems Options (SO) their design, development and testing practices</li> <li>• CAD (1)</li> <li>• Government's NHS reforms</li> <li>• Public</li> </ul>	<ul style="list-style-type: none"> <li>• New Chief Executive (The Focal Actor)</li> <li>• New training, personnel and finance &amp; four divisional directors</li> <li>• Page Report</li> <li>• Director of operations/support</li> <li>• New IT director</li> <li>• Dispatch staff, their working practice</li> <li>• Ambulances and their crews</li> <li>• Unions</li> <li>• In-house full-time LAS developer</li> <li>• PRINCE (effectively deployed)</li> <li>• Prototyping ISD methodology inc.</li> <li>• Participatory practices</li> <li>• CAD (2)</li> <li>• Existing/new infrastructure</li> <li>• Government's NHS reforms</li> <li>• Public</li> </ul>
Actor-networks	<p>An overarching plus multiple sub-actor networks, that failed to traverse its OPP, achieve irreversibility or mobilisation of actors to address the problematisation</p> <p>Only partially became problem solving network and failing to translate into a solution that improved LAS service performance</p>	<p>Single actor network that traversed the designated OPP to effectively develop and implement the CAD and improve services</p> <p>In so doing it became an effective problem addressing and, via translation, an effective problem-solving actor network.</p>
Problematisation	To improve the performance of the LAS in the face of the government's NHS reforms on the internal market and to meet the public's need for a better service	<p>To improve the performance of the LAS in the face of the government's NHS reforms on the internal market and to meet the public's need for a better service</p> <p>To address infrastructure problems</p> <p>Overcome history of CAD failures</p>
Intéressement of Actors	Failed to achieve all actors, only partial and limited in effect	Achieved, through participation and use of prototyping tools and techniques
Obligatory Passage Points	The implementation of the CAD and its effective deployment by the staff and service – not traversed	<p>The series of Infrastructure developments</p> <p>Engaging staff in the CAD development</p> <p>The implementation of the CAD and its effective deployment by the staff and service – traversed</p>
Speaker/Representatives	The In-house project management team	The in-house development team, the workforce and CE
Betrayal	Betrayal by CAD and development approaches, tools and techniques of the focal actor, the staff and public	No betrayal by CAD and development approaches tools and techniques of other actors in the network including public
Mobilization	Failed to achieve; disastrous outcome	Achieved by human and non-human actors
Inscription	The inscription and articulation of the CE, the development team and the SO's interest's in the CAD	The inscription of the aligned interests of all the network's human/non human actors in the CAD and their articulation by it
Enrollment	Failed to achieve all actors	Achieved, for all the intended actors
Irreversibility	Not achieved, CAD failure, poor services	Achieved, enhanced services

**Table 4 ANT Central Concepts in a Comparison of LAS's Failure and Success**

## CONCLUSION

This paper has set out to demonstrate the utility of Actor Network Theory as a means of interpreting the socio-technical complexities of successful and unsuccessful attempts at organizational change and transformation, using two instances of the London Ambulance Service. Instead of giving primacy to either the social or technical component we have used ANT to explore the interweaving of the human and non-human actors as they constitute, or fail to constitute, solutions to address complex organizational problem situations.

ANT differs from other frameworks for analyzing information systems. It does not apply a 'technological determinism' in which the machine alone drives the change in an organizational setting (Markus et al. 1988), or the technocentric notion of the computer and its human 'user'. Equally it does not follow 'social determinism' in which technologies play a passive symbolic role in supporting human agency. ANT implies that being translated into an actor network changes an actor, both human or otherwise (Tatnall et al. 1999). The focus in ANT is on the duality of the human and non-human rather than the approach used in other frameworks in which the computer-based information system (CBIS) and the organization (a synonym for the human dimension) exist in both a contiguous and unequal relationship. It is the manner in which artifacts of all kinds (whether a CBIS, a report, or a prototyping methodology) do or do not meld with human beings (whether a CE or a dispatcher). Such processes are about technical effectiveness and about the social interplays of power and the legitimacy of discourses between the various actors with differing interests. The interactions between the human and the machine constitute what Jones (1998) calls a 'double mangle'. In this process 'material agency', the behavior of technologies, and 'social agency', the intentional behaviors of human beings, conjoin through processes of negotiation and accommodation to create a solution, a new order of things. What emerges in the bringing together of humans and technologies is conditioned by the situation in which it happens.

From this perspective it is not the failure of the designers of the CBIS alone to take into account all the organizational human requirements that is of interest in evaluating a problem-situation. Nor is it the manner in which 'organizational factors', such as the union dispute with management, impedes the successful implementation and use of the application. Rather it is both, with ANT's explanatory power showing in its capacity to appreciate how entanglements of humans and artifacts are brought together to form a problem-solving actor network that is successful (or unsuccessful) in traversing the OPPs and translating themselves into an integrated solution that addresses the original problematisation(s) of the focal actor.

The use of ANT as a framework of analysis reveals that in the 'successful' case the developers connected with the prototyping approach were reinforced by the successful addressing of the preliminary problematisations, and facilitated by a process of negotiation and accommodation between the human and non-human actors. Successful change and development occurred when interventions actively integrated CBIS and business development based on effective problem solving competencies. Failure occurred when this did not happen and these competencies were not present. Using ANT as a normative framework to underpin practice these competencies are revealed from the LAS cases as:

- Appropriate and germane problematisation of an organizational situation, ie. how to identify the specific problem for that case.
- Identification of one or a number of obligatory passage point(s) (OPP) that will lead to problematisation's solution, ie. what needs to be done to achieve success, in that case.
- Identification of human and non-human actors necessary to address the problematisation, and their power to facilitate or inhibit their own translation and mobilization, ie. identify who and what needs to be involved in the case and how they might tackle it.
- Achieving the intéressement of relevant actors, aligning their interests into a problem solving actor network. Breaking down existing or preventing alternative intéressements from arising that will seduce actors away, ie. setting the right people involved, working together and focused on the problem and how to solve it.
- Facilitating the actors in their traversing of designated OPP(s), ie. supporting people in moving forwards to tackle the problem.
- Mobilization of actors (including their creation and development) into becoming the in-situ actor-network solution that addresses the original problematisation, ie. getting people and technology to work together to address the problem together.
- Facilitation of organizational learning based upon the successes and failures of such problematisations and their resulting integrated interventions, ie. working out what lessons can be learned and used again, once the problem has been tackled.

In addition developing the following competencies are seen to be critical:

- Psychological, cultural, social, political and power competencies for dealing with the messy relationships between the actors (human and non-human).
- Management competencies, including managing appropriate resources, processes of change and political acumen.
- Information technology competencies.
- Information systems competencies including process and systems design, development and implementation together with the mobilisation of appropriate methodologies, approaches, tools and techniques.
- Integrative competencies in bringing all the above together.

In summary this paper has shown that the two instances of LAS demonstrate ‘success’ and ‘failure’ in the same organization, and provide a rich environment for comparative study. The use of an ANT based analysis has enhanced understanding of the cases and the issues of ‘success’ and ‘failure’. In the course of the analysis, the paper has sought to highlight the particular benefits of using ANT as compared to other theoretical frameworks. In addition the paper has illuminated and illustrated the use of ANT as a conceptual basis for interpretation. Finally, within this research we have evolved tools and frameworks that facilitate this type of ANT analysis, for example in Tables 2 and 3, columns 2 and 3 show the relative interests as seen by the focal actor (CE) and the actors themselves, and how this contrasts between the ‘failure’ and ‘success’ cases.

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