

# Understanding IT Governance within the San Mateo County Emergency Medical Service Agency

**Michael J. Marich**  
Michael.Marich@cgu.edu

**Thomas A. Horan**  
Tom.Horan@cgu.edu

**Benjamin L. Schooley**  
Ben.Schooley@cgu.edu

Claremont Graduate University

## ABSTRACT

This paper examines inter-organizational governance within the context of a County wide Emergency Medical Services (EMS) system. Through a case study approach that included an action research methodology, this paper reports research findings on how one multi-organizational EMS system in California designed a process to establish an inter-organizational IT governance structure. The process resulted in EMS stakeholders defining architectural qualities that could be used to drive the EMS enterprise to a higher level of architecture maturity. That is, away from inherent business silos and towards greater levels of standardization and integration of information and technology across all stakeholder groups.

The San Mateo County, CA Emergency Medical Services (EMS) system provided the case study context to better understand characteristics of a high performing emergency response system. The unique governance structure of this case allowed researchers to formulate a preliminary understanding of what IT governance is within this context and how it plays a role within private and not-for-profit sector large-scale, inter-organizational, emergency response systems.

We applied the time critical information services (TCIS) framework to the specific setting of the San Mateo EMS strategic redesign initiative. The TCIS framework was used to drive roundtable discussions and in addition to obtaining a better understanding of the governance dimension, much was also learned about the operational and organizational dimensions of a high performing emergency response system. From these discussions, a set of 11 key findings were developed in order to guide the county's procurement strategy and future strategic direction. The impact of these findings is that they will be used to formulate public and private sector service contracts that will remain in effect for the next 10 years.

## Keywords

Architecture, emergency medical services, emergency response systems, governance, time critical information services.

## INTRODUCTION

Much of the inter-organizational systems (IOS) literature has focused on the relationship between information technology (IT) and business operations in the private sector. A more recent subset of IOS literature has addressed the relationship between IT and service chain performance across public sector organizations, emphasizing the increasingly important role of aligning IT systems, organizational relationships, and governance across an array of multi-organizational arrangements [Dawes, 1996; Landsbergen and Wolken, 2001; Layne and Lee, 2001]. While some recent research has noted that a well founded enterprise architecture enables effective IT governance and provides an organization with a strategic advantage [Ross and Weill, 2006], this paper extends the notion that enterprise architecture is also critical for governing multi-organizational service chain systems comprised of an array of public, private, and not-for-profit sector firms.

More specifically, the domain of this research is multi-organizational institutions that are charged with delivering emergency medical services (EMS) to the public. For this study, these organizations include the County EMS Agency, first responders (e.g., fire agencies), ambulance companies, 9-1-1 communication dispatch centers, and hospital and trauma centers. The patient-focused service chain for these EMS systems begins at the time that a 9-1-1 call is made, continues through dispatch, response, field care, and patient delivery to a care facility, and ends with patient treatment and discharge. Although many patient hand-offs occur between the private and public firms that constitute this service chain, the services rendered by these firms are extremely time-critical in nature and require coordination and information hand-off between and across each of them [Schooley and Horan, 2007]. In this sense, inter-organizational IT governance to guide and enable efficient and effective information exchanges is an essential and, at times, life critical endeavor. This focus has historically gained little attention in the United States, but has been identified as an important area for wide scale EMS system improvement [Institute of Medicine, 2006; Mayer-Schonberger, 2003].

An interesting challenge faced by these multi-organizational EMS enterprises is that the public EMS Agency that has the responsibility to provide oversight and performance improvement does not always have direct control over any of the organizations that provide emergency medical services to citizens. Therefore, the EMS Agency must find ways to align multiple independent stakeholders with the objective to improve the timeliness and quality of emergency services. As such, the EMS agency must essentially provide a high level of IT governance to design and enforce an enterprise architecture across disparate organizations. Enterprise architecture is defined as the organizing logic for an organization's IT infrastructure and business process capabilities to address a firm's need for IT and business process integration and standardization [Ross and Weill, 2006]. These researchers describe four general stages of architecture maturity, where the greater the maturity level, the better that information is shared and integrated across processes, and the greater the likelihood that strategic advantage can be realized. This paper addresses how one multi-organizational EMS system in California designed a process to establish an inter-organizational IT governance structure. The process resulted in EMS stakeholders defining architectural qualities that could be used to drive the EMS enterprise to a higher level of architecture maturity. That is, away from inherent business silos and towards greater levels of standardization and integration of information and technology across all stakeholder groups.

## RESEARCH FOR PRACTICE IN SAN MATEO COUNTY

An important goal of applied research is toward an ideal that "research and its findings will be used in some way to make a difference to the lives and situations of those involved in the study" [Robson, 2002]. A type of applied research known as "action research" is aimed at increasing the relevancy of research by bringing the researcher and practitioner together [Baskerville and Wood-Harper, 2002]. The action research approach was adopted for the study presented here in order to translate IT research concepts into practical advice for a County EMS Agency that would guide the development of long-term relationships (i.e., 10 years) with County hospitals as well as service contracts entered into with public and private EMS providers in San Mateo County, California.

## Research Process

Various governmental entities at a municipal, county, or state level within the United States will periodically evaluate the contracts they maintain with the providers of civil services. EMS within the United States is often governed at a state level; however, in California much of the governance responsibility is at the county level. County officials, when going through the process of contract development in order to re-design, or upgrade an EMS system, will oftentimes compare their county to a similar size county or state. Although the comparison method is expedient and provides a means of justification, this method has limited usefulness since it cannot adequately account for the entire range of differences that may exist between counties. Nor can it account for the full range of potential innovative solutions that exist but are not included in the few cases selected for comparison. While the comparison method tends to focus on discrete properties such as population and budget, a more robust framework is needed to provide the ability to more closely examine the unique characteristics of a county from several key dimensions over the entire spectrum of patient care. Through observation, interviews, group discussions, and participation, researchers were able to influence the development of such an IT alignment framework for San Mateo County.

## Case Setting

San Mateo County is located just south of San Francisco and north of San Jose. Although most of the county's residents of approximately 700,000 live in a narrow urban corridor, the majority of the land mass is located in rural and remote, mountain and coastal areas. Roughly 10 years ago, the San Mateo County EMS Agency formed an innovative public/private partnership to provide more efficient and effective emergency medical services to its citizens throughout the county. The County EMS Agency has a unique governance aspect that is exhibited in an agency-based oversight responsibility governed largely with performance-based contracts with the private sector Ambulance providers and the Fire Joint Powers Authority (JPA), which includes all 18 fire departments in the County. Also unique to the County is a single Consolidated Communications Center for all health related emergencies. The EMS Agency is responsible for end-to-end performance across all county EMS organizations including the 9-1-1 EMS communications center, fire services, paramedics, and 11 hospitals. Within this role the Agency strives to find ways to use IT for strategic advantage, which in this case means using IT to ensure and improve end-to-end performance for and in behalf of the County citizens.

Similar to many other counties, San Mateo has for-profit contractors that supply a number of services, such as the air and ground ambulance services. The county EMS system has in most instances a typical IT implementation, but has been innovative in some key areas distinguishing itself as an early adopter of wireless, web-based, Electronic Patient Care Records (PCR) that emergency responders use in the field to capture patient and care provision information, and then populate a centralized database for other stakeholders (e.g., Agency, hospitals) to utilize. The County was also an early adopter of Hospital Availability Systems (HAV), or systems that allow hospitals to "divert" ambulances to other hospitals based on their capability to immediately accept new patients or not. Finally, the County was also an early system integrator, automatically pushing data about an emergency incident (e.g., location, call type, medical issue, patient demographics, etc...) from the 9-1-1 call center computer aided dispatch (CAD) system to emergency responders in the field, or to their PCR systems and pagers. The County's propensity towards IT innovation and organizational integration provides a useful case to examine how such systems, or those migrating towards greater levels of integration, design and maintain effective governance structures.

The central challenge that the EMS Agency faces is that even though they have oversight, they do not have direct control over any of the aforementioned service organizations. The chief mechanism of indirect control that the Agency employs is through their enforcement of a county-wide performance contract. In essence, the contract mandates certain levels of training for personnel, compliance with designated emergency response times, compliance with generally accepted health care provision protocols, and allows the Agency to fine ambulance providers if/when violations occur. This mechanism essentially aligns county EMS organizations with the large-scale EMS system vision and goals. In other words, the contract for this inter-organizational system functions much like an enterprise architecture would for a single enterprise. Agency officials were determined to find more effective ways to use IT in their next generation of contracts to better manage performance and its relationships with the various organizations that provide emergency services. In particular, the county's pursuit of IT-driven solutions and innovation led to their request for Claremont Graduate University's research team to participate in the strategic redesign process.

### **Data Collection**

In 2007, researchers conducted numerous on-site interviews in San Mateo County with a cross-section of personnel that represented the end-to-end coverage from pre-hospital (i.e., those services rendered to a patient by dispatch, police, fire, EMS agency, and paramedics prior to treatment at a hospital or care facility) to hospital (i.e., those services rendered at a patient care facility by nurses, doctors, and administrative staff). In March of 2007, the San Mateo County EMS Agency invited the research team to participate in the strategic planning of the next-generation EMS system. As part of this planning effort, the research team led roundtable discussions with three committees, whose members were focused on IT matters related to the county's EMS system. One committee was focused on IT usage relevant to the hospital sector, a second committee was focused on IT usage as it related to the pre-hospital sector, while the third was focused on IT implementation associated with performance measurement and management across the continuum of patient care.

During the roundtable discussions, the researchers posed a series of questions to 28 committee members in order to elicit responses related to the activities of EMS personnel and to gain insight into the information upon which these personnel gauge their performance relative to operational, organizational, and governance dimensions. The group dynamics of these interactive roundtable sessions not only provided a glimpse into the current workflow and the information needs of the pre-hospital and hospital personnel, it served to facilitate discussion regarding the inefficiencies at the boundaries of each organization. Through identification of the potential disconnects that occur in the patient hand-offs between organizations, the research team was able to gain valuable insight as to how information technology could potentially facilitate more effective system performance and progress the county inter-organizational EMS enterprise to a more mature architecture as described by Ross and colleagues [Ross and Weill, 2006].

### **Organizing Framework**

The Time-Critical Information Services (TCIS) framework was used to guide our discussions. This framework provides a multi-dimensional view of "end-to-end" system performance, and information sharing therein, for services such as EMS [Horan and Schooley, 2007]. Over the course of several years, the TCIS framework has been validated through a series of expert workshops sponsored by the National Science Foundation [Horan, Marich, and Schooley, 2006; Schooley, Marich, and Horan, 2007]. The TCIS framework was employed in San Mateo as a means to drive the roundtable discussions regarding the EMS process as well as understand the role of IT with respect to the three key dimensions: operational, organizational, and governance.

Figure 1 shows that there are four levels to consider: the service, the inter-organizational system, end-to-end performance, and peak versus normal conditions. At the top level, the service is depicted as an end-to-end process that occurs from the time a 9-1-1 call is placed until definitive care is provided. At the second level, various organizations exchange information and are linked together through governance, organizational, and operational structures. At the third level, performance metrics related to the overall process (such as timeliness and quality of service) are considered. The lowest level depicts the notion that there are varying service demands, peaks and valleys, that occur in delivering time-critical emergency services.

Roundtable discussions held with the various subcommittee members yielded a total of 11 significant findings. These findings, as discussed below, were grouped according to the three key dimensions of the TCIS framework (i.e., operational, organizational, and governance).

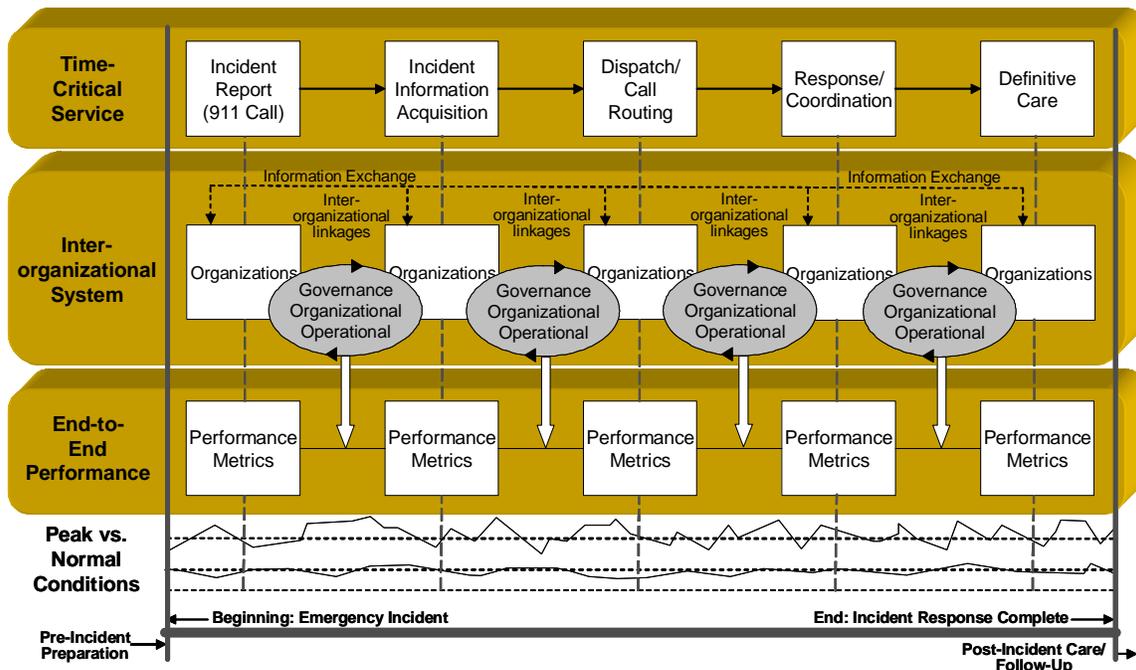


Figure 1. Time-Critical Information Services Framework

## Operational Findings

At the operational level, there was an attempt to gain an understanding of how information flows throughout the EMS system process. The discussion was focused to address performance implications and the information needs of emergency professionals across the inter-organizational service process.

**End-to-End Unified Patient Record:** While San Mateo County has systems in place to track patients within the EMS process, the county has not yet achieved an integrated patient record. Having an end-to-end patient record would allow those persons responsible for overall system performance to have better access to information about what is happening as the patient moves throughout the EMS system. For instance, with regards to basic information on the health care facility receiving a patient, the Clinical Coordinator stated:

“We have no way to be sure which patient went to which facility... That’s a huge confounder during a major casualty incident, MCI. That’s very problematic because people can’t find their loved ones...”

One of the managers from a hospital emergency department stated:

“We get [many] people asking ‘My mom was going to you, where did she go?’ We don’t know what to tell them.”

**Pre-Hospital to Hospital Gap:** Although the county currently uses performance measurement tools, the capability to data mine the full range of pre-hospital and hospital data, in terms of system performance and health outcomes is not yet fully realized. This is due to the information silos that exist in each environment. While the pre-hospital system has made enormous strides to integrate and share information between dispatch, ambulance provider, fire, and EMS Agency organizations, each of the 11 county hospitals continues to maintain its own information systems silo. At the roundtable meetings, it was stressed by a number of committee members that there was a need to close this gap. What happens on the pre-hospital side is often not well known to those who operate within the hospital side and vice versa.

One Performance Measurement/Management Committee member summed up the session by noting that it was important to see patient outcomes over the entire end-to-end process, stating:

“[We need to] get results of patient outcomes [from] dispatch to discharge.”

Tying patient outcomes to all of the activities that occur within the pre-hospital environment would provide a wealth of information for improving patient survival and quality of service. Another Performance Measurement/Management Committee member felt that if they were allowed to change only one thing to improve the overall system, they would recommend:

“Obtain hospital outcome data for EMS patients.”

**System Usability:** Over the years, the EMS personnel have strived to improve system usability. While much has been done, there still remains a challenge for designing a better user interface to more easily collect and present information within the emergency context. Although many responses are not time-critical, those that are require additional thought and perspective. In the end, the emergency context, where a person’s life is at stake, is much different than retail and on-line banking activities. In this regard, the Fire Battalion Chief/JPA Coordinator commented directly on ease of use:

“As we look forward to information systems and performance measurement, people need to pretty much have a very easy system to use.”

Similarly the Medical Director/Emergency Physician stated:

“It takes too much time and effort to go to a computer terminal and log on to get that [emergency medical] information.”

End-to-End Data Standards: While there are data sharing standards for storing data, data sharing, and inter-personal communication in place, the county has not yet addressed the end-to-end perspective of these standards. The Medical Director/Emergency Physician commented that standards were long overdue, especially when the paramedics communicate with the care facilities:

“Unfortunately it was 20 years ago when somebody decided what medics should say on the radio to emergency departments.”

The Fire Battalion Chief/JPA Coordinator stressed the importance of standards for interoperability between information systems:

“When it comes to the information sharing piece, one thing that we have always been bogged down for a long time is how does one system communicate with another system.”

### Organizational Findings

At the organizational level, the discussion was used to gain an understanding of the organizational and inter-organizational actions that support the collection and use of EMS information. The focus was on organizational information sharing to support timely and high quality end-to-end performance.

End-to-End Awareness: Currently, each of the EMS organizations track their own resources using information technology. However, the county has not yet realized an end-to-end operational and resource awareness, including resource tracking and tools for improved communication. This would lead to a better understanding of what occurs throughout the whole process in a near real-time way in terms of the resources that are available, dispatchers, ambulances, EMTs, and hospital availability status. Information related to current situation analysis would be greatly improved, especially regarding such questions as: Where are ambulances? Where are fire units? What are they doing? Information from the system would also allow for retrospective analysis and more thorough quality control. The Medical Director/Emergency Physician reconfirmed this by saying:

“... there is a lack of communication on both sides [i.e., pre-hospital to hospital] that could really be improved upon.”

One member of the Pre-Hospital/Hospital Technology committee indicated that the single most important issue facing the county is to:

“Improve geographical accuracy of dispatch through installation of vehicle locators/GPS and accompanying CAD software.”

Although there is much high-tech gadgetry available on the commercial market the EMS Agency Administrator explained that basic radio communications needed to be enhanced to allow the fire department to communicate directly with the hospital. She stated:

“... the fire first responder’s radio does not have the capability of talking to the hospital.”

End-to-End Performance Feedback: Within each of the EMS organizations, there are ways that performance feedback is gathered and reported. However, the capability to attain an “Organizational” Performance Feedback System to report various types of performance outcome information to a wider range of practitioners is needed. When paramedics and others that help people in emergencies discussed the human side of the emergency process during the roundtable sessions, they indicated that they rarely know what happens to the people that they treated during the course of the day. Providing feedback for the events that occurred during a previous quarter would fulfill the human side of the whole service. During one roundtable meeting, the Fire Battalion Chief/JPA Coordinator noted:

“Paramedics really want to know what happened to a patient. They want to know past the ED. Did they go home? Did they go to ICU for 4 days and then PCU for 2 and then somewhere else?”

Another Fire Chief noted:

“Until whatever system is designed ... we are going to be faced with these problems. We are going to be faced with inefficiencies and the inability to get good, accurate performance indicators ... including feedback to providers...”

**End-to-End Team Interaction:** While there are many formal opportunities for discussion across service silos, there does not appear to be adequate informal opportunities for interaction across service silos, where practitioners across organizations meet and talk among themselves. Participants in the roundtable sessions believed that informal communication was important to get through some of the issues that people were more tentative to discuss in the formal environments. During one of these sessions, the Hospital Emergency Department Manager looked toward the Public Safety Communications Manager and said:

“Talking in groups like this I have really been able to see all the things [dispatch] has to deal with. I had no idea how difficult your task was down there.”

The Clinical Coordinator was proud of the ability to share the information they gathered and reported to our group:

“One of the things we have done very well and somewhat uniquely is share clinical information ... with the quality leadership council and the medical advisory committee.”

**End-to-End Stakeholder Involvement:** While EMS stakeholders currently participate in system design, more innovative and full participation across the stakeholder groups, including payer representation (i.e., the health insurance providers) has not been fully accomplished. One Hospital IT person stated:

“The issue is really that we just don’t think of them [payers] as a stakeholder, we don’t bring them to the table to help us design our system or to recognize the value of it and they are actually the ones that are paying for it.”

A Hospital Committee Member also felt concerned on this topic and noted:

“... the payers... are a major stakeholder and we never talk about them. We aren’t able to show our value to them either. They look at this [EMS] as a taxi ride.”

## **Governance Findings**

The discussion related to governance was used to gain an understanding of the structures, in terms of policies, regulations, and funding decisions that guide the EMS system. The focus was on the policy and political factors that facilitate or inhibit the deployment of a timely and high quality EMS system.

**End-to-End Contract Relationships:** An opportunity exists to further utilize the County contract to encourage information sharing and include information sharing elements in the new contract. It was pointed out that because of the nature of contracts there are a number of issues and challenges that are encountered. One of the Fire Chiefs captured the sentiments quite clearly:

“As far as sharing information, we have to remember that it is a contractor versus subcontractor relationship still and a public versus private relationship. A lot of great strides have been made and a lot of people are really trying, but some of it is just what it is.”

A Fire Battalion Chief/JPA Coordinator noted that no one is paid to share information:

“Well the one big thing that I see is that it all comes back down to the finance piece and the money and who’s going to pay for what and if you want the data, you pay for it. Who comes up with the software? Who comes up with the data points? Who cross links them? It’s a whole piece that we have been struggling with for 7 or 8 years on.”

End-to-End Non-Contractual Relationships: Non-contractual relationships for a portion of the system are in place and are working well. Continued work is necessary to further encourage and provide greater incentives for information sharing through pre-hospital and hospital relationships. The Clinical Coordinator alluded to the difference in contracts and the result that occurs in terms of shared data:

“...we have relationships with trauma centers and stroke centers, contractual relationships with them; we have nothing specific with base hospitals.”

In discussing the consistency of information sharing, the Fire Battalion Chief/JPA Coordinator concluded that:

“...it [i.e., information sharing] is inconsistent. It’s basically who you know at the facility that will give you that information.”

Policy Opportunities: While policy opportunities have largely been pursued by the county over the years, there is still a challenge to further explore policy opportunities that have not been realized (e.g., concurrent interests in Healthcare and Homeland Security). In some cases these policies may align, but currently they have not yet done so. The EMS Agency Administrator stated:

“The EMS program can only fund a part of what could be a wide range of solutions.”

Thus the need to find parallel and overlapping policy initiatives to help drive enthusiasm from a range of local, state, and national agencies on the issue of improved information technology for EMS.

Resources: This finding is concerned with the provision of sufficient resources, such as personnel and funding to get the job done. The Operations Manager stated:

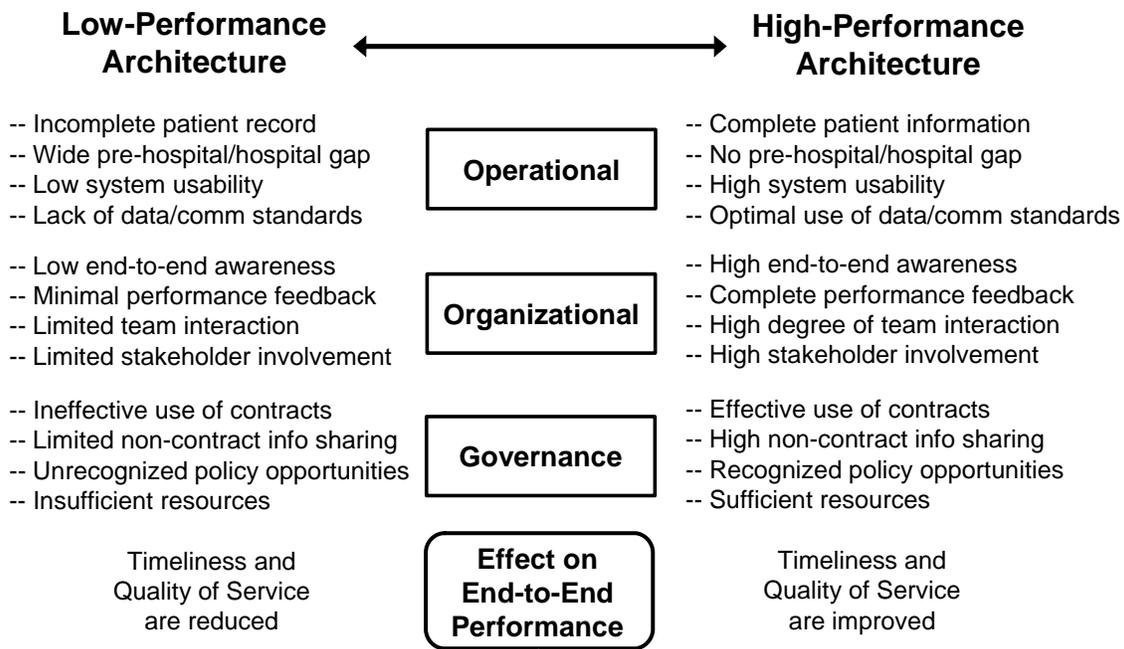
“We are woefully understaffed for trying to analyze the data... I can look at the data [that we collect] and say ‘We are not performing very well on compliance.’ But who is going to take the time to go and find out why? Who is going to drill down into all of that and find the answer? I just don’t have anyone to do that right now.”

## **STRATEGIC DIRECTION**

Examination of the findings led to a set of architecture qualities that would enable a high-performance architecture to achieve the desired level of timeliness and service quality necessary for delivering the county’s time-critical emergency medical services. The illustration in Figure 2 depicts the continuum between the features that characterize a low-performance and high-performance architecture.

**Alignment of the TCIS Framework with the Architecture Qualities**

The architecture qualities shown in Figure 2 align with the three key dimensions (operational, organizational, and governance) of the TCIS framework. For example, the first quality listed is: an incomplete patient record for a low-performance architecture and complete patient information for a high-performance architecture. This quality is related to the operational dimension of the TCIS framework. Other dimensions, as illustrated in the findings section above include: 2) the degree of information sharing that occurs between the “pre-hospital” and “hospital” environments, 3) the level of operational awareness that organizations exhibit in regards to the value and importance of “end-to-end” information sharing, 4) the degree that users find IT systems to “work” within their end-to-end medical care processes, protocols, and the time-critical nature of EMS care, 5) the degree that data, communications, and process standards have been utilized and implemented within IT systems, 6) the amount of free and open information sharing that takes place in and between stakeholders, 7) the amount of formal and informal discussion and interaction that takes place between stakeholder groups for the purposes of discussing performance improvement, 8) the level of involvement by each stakeholder group in governance decision making, 9) how well contracts have been utilized to create incentives to share information, 10) how well non-contractual agreements have been designed to create incentives for sharing information, 11) how well policy opportunities have been taken advantage of to fund data sharing initiatives, and to motivate, incentivize, and mandate information sharing, and 12) how adequately resources are provisioned. Taken together, the high performance architecture for inter-organizational end-to-end EMS is one that facilitates the development of the operational systems and processes, the organizational structures, and governance mechanisms for a high performing end-to-end EMS IT-driven system.



**Figure 2. Architecture Qualities that Affect End-to-End System Performance**

**CONCLUSION**

The TCIS Framework was used to guide the strategic direction of the multi-organizational EMS system for the county. The research team presented the set of findings to the San Mateo Redesign Steering Committee within the context of the TCIS framework. The Steering Committee, which was comprised of key members from the various committees, used this information to guide their long-range procurement strategy. The high performance architecture qualities outlined above were included in the Request for Proposal (RFP) that was written by the EMS

Agency. The intention was to gain agreement across stakeholder groups about the performance features desired in the next generation EMS system. In this way, the TCIS framework served as a tool to help define the multi-organizational enterprise architecture desired by all EMS stakeholder groups. Each of the architecture qualities were further defined and described in order to relate the level of IT integration and standardization expected of the organizations that would respond to the RFP. In sum, it provided a structure for the governing Agency to assess and guide the multi-organizational EMS system to move from a “siloed” IT system architecture to a more integrated and standardized inter-organizational IT system architecture.

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