

**Figure 4-1. Progressive Point Estimates of MTBF**

Based on the fact that the MTBF (or the failure rate) of the various subsystems has not reached a steady state, the frequency of the outages will generally be reduced even without major upgrades to the system. However, this statement is not true when assessing the system's MTTR trends. For the short run, the most urgent need is to improve the maintainability, such as having an adequate and better-trained support staff. A required strategy is to amend all identified weak points in the system and infrastructure, particularly, the single points of failure identified in Section 3. This will improve the overall system availability by:

- Reducing the vulnerability to system-wide failure and consequently increase the uptime.
- Providing automatic switchover to the backup and thus effectively reduce the downtime.

The HEC incident report shows that 6 out of 15 system failures since the system went live involved human or procedural errors, and they account for 78% (32.08 hours / 35.73 hours) of the total unexpected outage downtime. The outage history indicates that, not only did the maintenance staff from Northrop Grumman and HP make mistakes; they also seemed to complicate the problems further resulting in a very slow recovery of the system. Some problems leading to human errors may have been intrinsically difficult. Nevertheless, improvements in the skill level of the maintenance staff may help to increase the MTTR and, thus, improve the availability of the system.

### **4.3 Workload and Performance Assessment**

The MITRE team observed the operations of the CAD system during several on-site visits and interviewed management staff, call takers, and call dispatchers to discuss system performance. During these discussions, concerns were raised about the performance of the system during busy time periods and when upgrades were made to the system. In order to attempt to determine whether the workload of the system impacted system and performance, call volume statistics and

data were gathered. This data identified call volume statistics handled by the various departments for the period of January 2004 to December 2004. A secondary analysis was to try to determine if the demand level pointed out a probable cause for some of the system outages that occurred at HEC.

System performance can be affected by the amount of demand using the system. There are three major types of demands that require system resources and may contribute to component wear out and cause degradation in system performance. These three types are:

- (1) 911 (including 10-digit calls) call volume statistics.
- (2) Call takers and dispatchers use of the CAD systems.
- (3) Police and Fire/EMS units and stations that have to respond to the dispatching assignments and make information queries.

Among those three types of demands, only the call volume statistics has data available for each hour during the assessment period. A more useful demand data will be the staffing level records (how many call takers and dispatchers are connecting to the system at each hour), which corresponds to the second type of demands. A series of charts of call volume data are presented in Appendix D. As an example, Figure 4-2 shows the chart for November 2003 (prior to the acceptance). The purpose of the analysis is to determine whether there is any correlation between call volume and outage occurrences. Each chart covers a one month interval within the assessment period. The call volume value includes all calls for Fire, EMS, and Police events. Each data point is the call volume for the corresponding hour. Each triangle on the chart indicates the start time of one of the seventeen outages since the system went live.

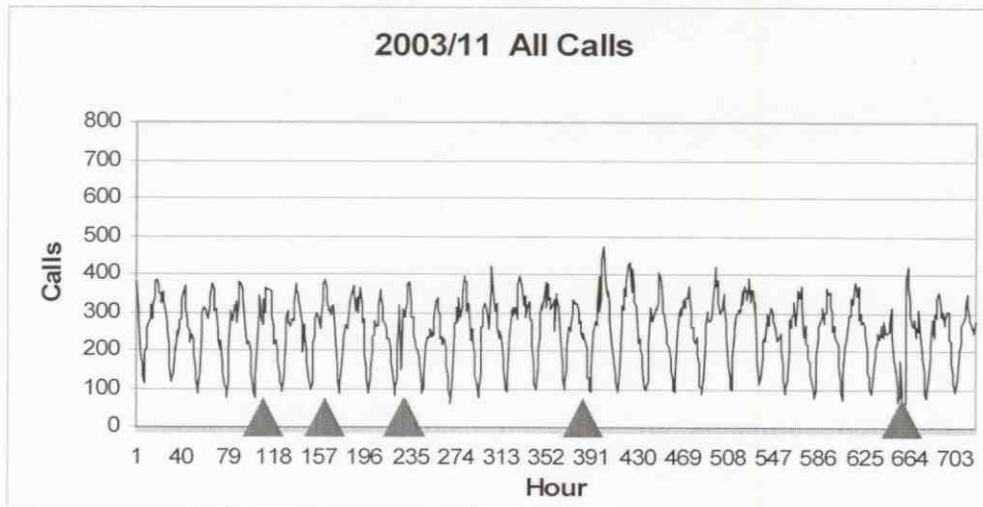


Figure 4-2. Call Volume Statistics and Outages

The analysis of the data from the charts concludes that none of the outages correlate with a spike or surge of the total 911 call volume. Using separated department-wise<sup>7</sup> call volume data, there is still no evidence of correlation between system outages and the volume of either Police calls or Fire/EMS calls. Although a careful analyst may sometimes look further into the fluctuation and variation of the raw data to extract hidden patterns, observations obtained from the plain call volume data deemed further analyses unnecessary. MITRE concludes that the call volume data by itself, does not show impact on the outages.

The MITRE team attempted to gather performance statistical data at various levels to make a clear determination or root cause analysis of system performance.

Figure 4-3 identifies our approach to the end-to-end performance analysis effort. By taking this approach, the team planned to gather performance data at each layer of the subsystems, and then correlate the data to make an accurate assessment of potential system performance issues.

The HP Systems Insight Manager was not adequate for the performance analysis because it was not completely configured. The team was able to use UNIX level command scripts to gather performance data on the CAD and RMS servers in order to conduct a performance analysis for these two subsystems. Figure 4-4 summarizes CPU utilization for a specific snapshot period.

---

<sup>7</sup>Individual charts for Police calls and Fire/EMS calls are not included in this report, but they have been inspected and led to the same conclusion.

Performance Analysis Scope	Performance Analysis Toolkit	Results
Application Layer (CAD, RMS)	<ul style="list-style-type: none"> <li>Transaction Response Tool</li> </ul>	Tool turned off; Monthly data from Altaris Command Stats
Database Layer	<ul style="list-style-type: none"> <li>Oracle Enterprise Manager</li> </ul>	Tool not available; Data from DB Data Status Reports
Hardware / Operating System Layer	<ul style="list-style-type: none"> <li>Unix Perf; Tools</li> <li>HP System Insight Manager</li> </ul>	New intall of Insight Mgr; Used Unix tools to snapshot perf.
Network Management Layer	<ul style="list-style-type: none"> <li>OPNET NetDoctor</li> </ul>	Perf. Data captured and analyzed
Telecom Infrastructure	<ul style="list-style-type: none"> <li>Network Sniffer</li> </ul>	Perf. Data captured and analyzed

**Figure 4-3. Performance Analysis Layers**

### System Utilization - Snapshot

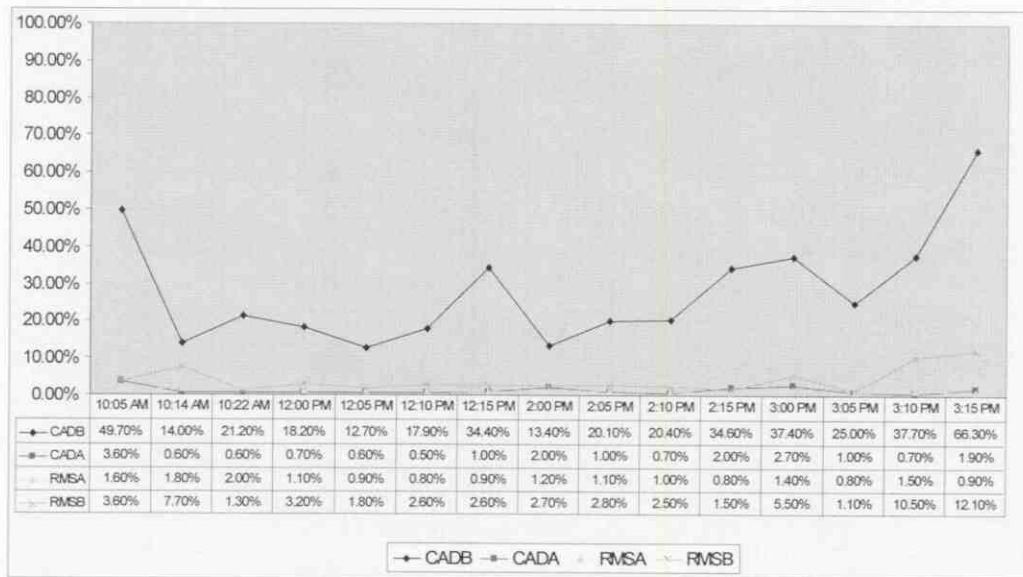


Figure 4-4. System Utilization – Snapshot

As evidenced in the above Figure, for this specific snapshot, the CADB systems' (primary production environment) CPU utilization increased to over 48% in the early morning (approximately 10:00 am), returned to an average range between 13%-34% for the mid-day period, then increased to over 66% utilization towards the latter part of the day (approximately 3:15 pm). Unfortunately, because no other performance data is available for either the Application Layer or the Database Layer during this period, we are unable to perform any root cause of the increases in the CPU utilization.

Northrop Grumman provided summarized data corresponding to the command response time statistics in task category "Check response time of CAD commands," see Section 4.6. For each of the 464 commands, the data shows the total number of invocations in each month and the number of elapsed seconds averaged over each month. Many commands were not used in every month. About 80% of commands were infrequently used. (Less than 7200 invocations per month. If there were averagely 10 CAD users per hour, this would imply that such a command was used averagely less than 1 time per user.) Table 4-9 compares the January 2005 measurement results with the CAD response time requirements for the acceptance test defined in Attachment 27 Section J (Acceptance Test Plan for Altaris CAD Implementation). Northrop Grumman provided measurement results for 18 out of 27 command types. For each of these 18 command types, the response time averaged over the entire month compared very well with the corresponding threshold value. However, the two sets of numbers do not represent the same time scale. The requirements defined for the acceptance testing were meant for evaluating a peak load hour of at

least 433 events (Page B-6 of Test Plan), while the Jan 2005 results were averaged out over the entire month of January 2005 and did not correspond to a particular hour with peak load condition. The comparison results are shown here only for indicating that, on a monthly average basis, the CAD response time average performance fared very well in January 2005.

MITRE recommends the entire performance analysis toolkit referenced above be activated and an extended performance data capturing period be established in order for the appropriate level of performance data correlation and root cause analysis be conducted.

The process for the creation, delivery, verification of the Geofile has a major impact on the performance of the public safety system. During interviews with HEC, Northrop Grumman, call takers and dispatchers, the Geofile accuracy was a major discussion item. The team was unable to determine if the concerns were technical or training issues. For example, it was noted during the interviews with call taker and dispatcher personnel that location information sometimes has to be keyed in different ways before the system recognized the street address and provided the proper system and agency recommendation. These concerns were also discussed with the Graphical Information System (GEO) Team lead. Based on the discussions, the MITRE team believes that these issues could be caused by a number of reasons, many of which cannot be solved through technology solutions. Many of the issues require improvements in processes and communications to be assessed. The process improvements include the use of written documentation to record and forward the problems to the Graphical Information System Team. Next, the recommendations in Section 5 for improved processes should also help to identify and resolve these issues.

#### **4.4 Scope of Services and Performance**

MITRE analyzed the performance of the system to determine where performance may not meet requirements in the Northrop Grumman scope of services. Three areas of noncompliance and possible noncompliance with the scope of services were identified.

First, the CAD and RMS did not meet the required monthly 99.9% availability. The Scope of Service requirement number 14.1.2 requires Northrop Grumman to maintain the required system availability of 99.9% for the CAD upgrade and RMS systems. The requirement states that the City shall record the system downtime on a monthly basis. If the system availability is not met, Northrop Grumman is required to submit a report that documents the event and to detail a plan of action to prevent a recurrence in the future. As identified in Section 4.2, the CAD system has not met the monthly requirements of 99.9% availability.

Second, the system performance and monitoring is not being provided. The Scope of Service requirement number 3.3.17 requests CAD reporting statistics, including transaction response times, be provided for any time/data range required. Northrop Grumman has several tools that are

