12.3 NCF – AN INSIDE LOOK

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1. INTRODUCTION

The Advanced Weather Interactive Processing System (AWIPS) Network Control Facility (NCF) located at the National Weather Service (NWS) in Silver Spring, Maryland serves as the 911 emergency call center for AWIPS. The NCF is staffed 24 hours a day, 7 days a week. NCF engineers are constantly working on problems that range from a minor issue on a single component at a site to major outages that affect multiple sites. However, the NCF is more than just a help center, it also serves as the communications hub for the entire AWIPS communications network (ACN). More than 150 AWIPS sites depend on the NCF systems to disseminate their critical forecasts and warnings. The intent of this paper is to provide a clear description of how the NCF operates on a day-to-day basis to meet its primary functions: call center communications hub and trend analysis.

2. NCF HELP DESK OPERATIONS

From a very broad perspective, the problems handled by the NCF are identified as either reactive or proactive.

2.1 Reactive Operations

Reactively, the engineers respond to questions or problems received by a phone call from a site or other NWS operations personnel. The primary emphasis of the engineer is to restore service for the end user. This may entail sparing over to redundant equipment or placing a site on alternate communication circuits. Once service is restored, the engineer will focus on the root cause of the problem and take necessary corrective action. This will often involve using one of the more than 250 Standard Operating Procedures (SOPs) contained in the Network Monitoring and Control Facility Document, which is the blueprint for NCF operations and service restoration. Additionally, the NCF is provided workarounds addressing problems that are specific to a given software release. These workarounds are usually short-lived and made obsolete by the next maintenance release, major release, or patch release.

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If these sources fail to resolve a problem, there are a number of other sources where an NCF engineer can turn for support, such as fellow NCF engineers, the shift supervisor, the NCF's Level 3 or senior engineers (available 24x7), Northrop Grumman IT development and test engineers, government agencies (Site Support Team [SST], Forecast Systems Laboratory [FSL], Meteorological Development Laboratory [MDL], etc.), hardware vendors (Hewlett-Packard [HP] and DynCorp), and the telecommunications vendor (MCI/Worldcom).

2.2 Proactive Operations

Proactively, the NCF engineers are constantly monitoring the AWIPS enterprise via HP OpenView IT Operations (IT/O). On each monitored node, IT/O runs agents that execute general and customized monitoring scripts. These scripts monitor the health of the hardware, software, and communications links. If a fault condition is detected, the NCF receives an alarm indicating there is a possible problem. The NCF engineer will begin troubleshooting based on the alarm, and if some intrusive action is necessary at the site, the engineer will contact the site to inform them of the problem and that they are working to resolve it. On average, the NCF receives in excess of 15,000 alarms weekly.

There are more than 290 different types of alarms. They range from informational messages to critical alarms indicating that a Weather Forecast Office (WFO) or River Forecast Center (RFC) is completely isolated from the AWIPS Wide Area Network (WAN). Some alarms include an automated action and provide an indication to the NCF engineer whether or not the automated action completed successfully. Other alarms require operator-initiated action causing the NCF engineer to intervene by taking a look at the problem and then making a decision to execute or not execute the automated action. Some alarms contain instructions that are similar to SOPs in that they provide the NCF engineer a series of troubleshooting steps to resolve the problem. Also in use is event correlation software (ECS) that correlates multiple IT/O alarms and determines if a single problem is the cause. For instance, if all sites send an alarm that they are not receiving Satellite Broadcast Network (SBN) data, the root cause is likely a single, centralized problem. The NCF engineers are able to more quickly isolate and fix the problem.

The most crucial, proactive service provided by the NCF is critical weather monitoring. The NCF's meteorologists are charged with monitoring the watch and warning boxes posted across the U.S. Anytime a site falls within a watch box, the NCF immediately takes two actions. First, the IT/O alarms for the site or sites are isolated into a separate viewer. This helps to ensure that these alarms are easily recognized and not interspersed with the hundreds of other alarms the NCF may be receiving during any given hour. Second, the NCF engineers log into these critical weather sites and conduct a health check of the systems and critical processes.

2.3 Service Level Agreement

The level of service that the NCF provides is detailed in the Service Level Agreement (SLA). The Service Level Agreement specifies the roles and responsibilities of the NCF and the measurements by which the service level of the NCF is judged. Since the first priority of the NCF is to restore service to a site that is having problems, the SLA defines the following four metrics having to do with service restoration:

- Percentage of restorations by NCF alone
- Percentage of restorations by first engineer contacted
- Average time to restore service
- Average time to refer troubles

If the engineers are unable to promptly restore service, they must escalate hardware problems to the applicable vendors and escalate Government-furnished Software (GFS) problems to the SST. The NCF's ability to quickly restore or escalate problems is tracked on a monthly basis and is gauged against the metrics spelled out in the SLA. The NCF opens a trouble ticket (TT) for all site problems whether identified via IT/O or a site call. All the engineers' troubleshooting actions are recorded in the TT. The SLA requires every problem to be classified into one of four categories: critical, high, medium, or low. The NCF's performance relative to the SLA metrics is provided to the NWS on a monthly basis in the Performance and Availability Report (PAR). The NCF began officially reporting the metrics in the October 2000 PAR, and since that time they have exceeded the service restoration and escalation goals required.

In addition to the service restoration measurements, the SLA also defines goals for responsiveness, or how quickly incoming calls are answered. Once again, the NCF's performance is reported in the PAR. Since October 2000, the NCF engineers' average speed in answering incoming phone calls has consistently been 6 to 11 seconds.

3. NCF COMMUNICATIONS

In addition to serving as the help desk for AWIPS, the NCF is also the communications hub. Because of its strategic communications role, the NCF design team has systematically increased the redundancy of the major communications systems to include the SBN, the WAN, and the Message Handling System (MHS).

The AWIPS SBN provides point-to-multipoint communications between the NCF and the sites. In this capacity, the NCF receives various products from the WFOs and RFCs via the WAN, and data feeds from the NWS Telecommunications Gateway (NWSTG) and the National Environmental Satellite, Data, and Information Service (NESDIS). In order to ensure reliable service, all SBN components within the NCF are redundant. Additionally, all components at the primary master ground station (MGS) located at Ft. Meade, Maryland are redundant with the exception of the uplink antenna. To provide another level of service assurance for the SBN, the NWS has recently commissioned and certified as operational a backup MGS located in Fairmont, West Virginia. Thus, should the systems at the Ft. Meade MGS fail, the NCF's primary uplink would be switched to the Fairmont MGS.

This type of redundancy is also found on the WAN. Every site is tied to the NCF via a primary and secondary hub. Despite this dual-homed architecture, there are occasions when both hubs are unreachable due to circuit problems. When this occurs, the NCF can establish a connection to a site via a dial-up circuit. The NCF has the ability to handle more than 30 dial connections at any given time.

The MHS provides product delivery capability for the sites using the WAN. The NCF has six MHS servers supporting the WFOs and RFCs. Should one or more MHS servers fail at the NCF, the load is distributed across the remaining servers.

4. TREND ANALYSIS--THE NCF WAY

A critical, yet often unknown, service provided by the NCF comes from the Data Analysis group in the form of software and hardware TT trend and diagnostic analysis. During the original NCF buildout, AWIPS management quickly identified the need for a group, separate from operations, to take raw data received daily from the field sites and perform in-depth analysis to identify negative trends affecting single sites as well as AWIPS-wide problems. This information is distilled down into very concise reports that delineate the data by region and site, separated by software and hardware problems, and associated to the major equipment component. Additionally, given the importance of the radar data, a separate report identifies all radar failures by site. Should any site exhibit a significant radar problem, the Data Analysis group will conduct proactive, daily monitoring to further isolate the problem. Much of the aforementioned diagnostic analysis is included in the PAR.

In all cases when a repetitious software problem impedes the mission of a site or sites, the Data Analysis group documents their findings in a Discrepancy Report (DR) and submits it to the NWS for evaluation. In conjunction with identifying problems, a member of the Data Analysis group sits on the AWIPS patch board that evaluates new problems with consideration for resolution via a monthly maintenance release or an emergency patch.

This group also monitors the effects of new software and hardware installations and builds, evaluating system performance and reporting all problems to the NWS Headquarters, NWS regional focal point personnel, Engineering, and FSL.

The Data Analysis group also maintains open communication with the field sites, updating them on critical issues that would interfere with site performance or availability. They respond to site requests for guidance or corrective action for software problems, review problems reported by the sites, and write DRs against these problems after thorough evaluation. The group also provides the sites a status of all TTs escalated outside the NCF.

This group analyzes the performance of all NCF operators by reviewing all TTs to ensure the operators are creating meaningful tickets that properly document the problem and are following proper problem-resolution methods and escalation policies. IT/O alarms are periodically checked to ensure the operator opened up a TT and the proper corrective action was taken.

The Data Analysis group is the single point of contact for the configuration management of all documents used in the NCF. They create and maintain SOPs based on problem workaround provided by Government support groups, (e.g., OH, SST, MDL, FSL), and review field site input as well. These procedures go through a rigorous review and control process before dissemination to the NCF operators.

5. THE NCF TEAM AND ITS TRAINING

The NCF team of engineers is a mixture of IT professionals and meteorologists. The mixture is usually one-third meteorologists and two-thirds IT professionals with at least one meteorologist assigned to each shift. To prepare new engineers for the fast-paced environment and the complex system, the NCF trainer developed a training program that brings the engineers to the required technical level. Every new member of the NCF staff must complete a fast-paced 7 1/2-day Basic Engineering Course (BEC). During their probationary period, new engineers work closely with senior NCF engineers as a form of mentoring. Approximately 30 days after completion of the BEC, each engineer must pass an impromptu certification test to continue working. The test is comprised of three parts: a closed-book written portion, an oral examination, and an analysis of each engineer's TTs since completion of the BEC. By far the most difficult portion of the exam is the oral portion. The student is given a series of four situational problems to describe how they would isolate and resolve the problem. Each problem gets progressively more difficult to solve.

The training for an NCF engineer does not stop once they have passed the certification exam. The on-the-job training continues via mentoring, and informal and formal advanced training.

Advanced training is offered in Linux, Informix, AWIPS D2D Interface, the various AWIPS communications components (i.e., SBN, WAN, etc.), localization, and numerous others.

6. THE NCF--WHAT S NEXT

As the complexity of AWIPS continues to increase, the NCF must continue to evolve to ensure they can provide outstanding support to the sites. The previous training and problem-solving approach used by the NCF was to have a staff of well-trained generalists. All NCF engineers were expected to tackle any problem. This generalist approach has been effective in quickly solving most problems, but forces escalations outside the NCF for more complicated problems. The next step in the NCF's growth is to become more self-reliant for complex problems. This will require a transformation from generalist to specialist.

All new NCF engineers will have the same generalist starting point—the BEC; however, after completion of their probationary period, engineers will focus their skills on one of three very broad areas: communications, hydrological product support, and meteorological product support. Within their area, engineers will be required to become a subject matter expert for a subset of the area. For instance, anyone in the communications group will be responsible for resolving common WAN, MHS, SBN, and NCF-to-NWSTG communications problems. Additionally, each member of the communications group will further specialize in one or two of the components; hence, be expected to tackle more complex problems in their specialization.