Abstract - Deploying, failover and redundant component setups and proactively resolving network component failures is the key to maximize the uptime of any network or service. This paper describes a low cost, notification and action framework, which can be built, using simple scripting language and open source messaging tools to help network administrators to proactively administer complex networks and thus maximize the network service uptimes. The aim is to finally transform feedback-administered services to proactively administered services. At our center, we have adopted this framework for administration of various network services and facilities and gained immensely in increasing the uptime of the related network components and services.

II. PROPOSED MULTICHANNEL NOTIFICATION AND ACTION FRAMEWORK

The Fig. 1 depicts a layer wise logical layout, various components and the interconnections of various layers of the proposed multi channel notification and action framework. The proposed framework consists of 5 layers to achieve our goal of proactively administered services to maximize network service uptime.

Following layers have been identified:

1. Feedback Administered Services layer: This layer consists of all the network services that are hosted on any organizational network and user feedback based administration approach is used to maintain the services.

2. Monitoring layer: This layer consists of various system tools which can be used to monitor status of various services which need to be proactively administered.

3. Status Analyzer and Even Dispatcher layer: This layer consists of various logics in the form of scripts supported by the host OS. The scripts mainly perform functions required for analyzing the status information passed on by the monitoring layer and dispatches related events to the next upper layer.
4. **Notification and Action layer:** This layer consists of two parts namely the notification module and the action module:
   a. **Notification Module:** This layer consists of various scripts and generates notification alerts which are passed on to various messaging plugins.
   b. **Action Module:** This layer consists of various scripts to generate the required setup configuration files, based on the received events, which are passed on to the next upper layer.

5. **Messaging plugins and setup configuration modifier layer:** This layer consists of various messaging plugins like Email, SMS, HTML and Windows Systray. The setup configuration modifier which is a part of the layer is responsible for copying the configuration files generated by the action module to the actual directories and restarting the service.

### III. OPEN SOURCE TOOLS FOR IMPLEMENTATION OF VARIOUS LAYERS

- **Feedback Administered Services layer:** HTTP service-apache, Failover Internet Links-Ultra Monkey and Iptables, DNS – DJBDNS, email - qmail / sendmail / postfix /EXIM,
- **Monitoring layer:** ping, Nagios, Dig, MRTG, Customized Status Report generators
- **Status Analyzer and Even Dispatcher layer:** PHP, Python, Perl, Shell Scripts
- **Notification and Action layer:**
  - **Notification Module:** Implement using various scripting languages like PHP, Python, Perl, Shell scripts.
  - **Action Module:** Implement using scripting language like Python, PHP, Perl, Shell scripts.
- **Messaging plugins and setup configuration modifier layer:**
  - **Email Plugin:** Implement using sendmail, SMTP functions of scripting languages and host email server.
  - **SMS Plugin:** Implement using GSM/GPRS modem and SMS server tools. Can also be implemented using Email alert notification feature of various free email to SMS Gateway provider like way2sms.com.
  - **HTML plugin:** Implement using local HTTP server and php, python, perl, shell scripting language.
  - **Windows systray plugin:** Implement using JAVA, Python GTK based szystary modules and using files for interprocess communication.

### IV. A PRACTICAL IMPLEMENTATION OF THE FRAMEWORK AT RRCA

At our center multiple links – from different service providers - have been used to provide uninterrupted Internet access to the users. A number of administrative tasks are required to be carried out when the status of any of the link changes. All the three possible events namely “both links up/down”, “BSNL link up/down” and “ERNET link up/down” require different set of configuration files to be used by the various services. This was an apt example for application of the proposed framework. The monitoring layer has been implemented using the “ping” and “dig” command line tools and for implementation of rest of the layers a number of reusable PHP scripts and functions have been written. The most challenging part was developing the SMS messaging plugin. We used the services of “way2sms.com” service provider and wrote scripts to automate the entire process of sending SMS’s thru their website. All the four forms of messaging plugins as defined in the framework have been developed for this service. Majorly we have relied on command line tools, Linux shell scripting, MRTG log files and PHP scripting for implementing the proposed framework for this application.

### V. CONCLUSIONS

The concepts described here have nothing in specific to the open source paradigm and the proposed framework can even be used with commercial products without much ado. At our center, we have adopted this framework for administration of various network services and facilities and gained immensely in increasing the uptime of the related network components and services. The messaging plugins really increase the visibility of problems occurring in the various networking components and give administrators the required information as soon as some status change event happens. We have converted almost all critical networking services to proactively administered services and hope that the information presented here will benefit the readers also in converting their feedback-administered networking services to proactively administered services.

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### REFERENCES