QuakeAPRS

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ABSTRACT

QuakeAPRS provides the APRS network with near real-time earthquake information. It is a per1 script run as a cron job on a Linux machine. When the script is executed on the hour and half hour, it connects to the USGS to collect earthquake data. It then converts the information to the standard APRS packet format and sends it via the Internet to APRServe. This allows APRS clients to easily display and track earthquakes. QuakeAPRS has been running 24/7 for nearly a year. This paper describes quakeAPRS, the earthquake object format, and lessons learned from the development of this application.

KEYWORDS
APRS, Earthquake, Linux, Packet Radio, Perl, USGS

INTRODUCTION

The idea for quakeAPRS started with an email from Bob Bruninga to the Automatic Position Reporting System' (APRS) SIG asking for someone to volunteer to write a program that would post earthquake reports to the APRS network. Since the United States Geological Survey (USGS) supplies near real-time earthquake reports on the Internet, all that had to be done was to collect the information, put it in APRS packet format, and send it to APRServe. The original intention was to broadcast the packets to the local APRS RF network where an IGATE would receive the packet and pass it to the Internet. However, the final implementation performs all communication via the Internet, thereby increasing the reliability by removing a single point of failure, the IGATE. This design also has the benefit of allowing confirmation that the packet was received since it communicates directly with APRServe. In the event the connection fails, additional action and notification are possible.

Like most programming projects, the development seemed a simple task, one that could be implemented quickly. However, like most programming projects, once work began, it became apparent that many "what if' scenarios had to be addressed to insure a reliable reporting system. In addition, a standard format for the identification of an earthquake object had to be developed and learning how to interface to APRServe was also necessary to bring the project to fruition.

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[1] The APRS formats are provided for use in the amateur radio service. Hams are encouraged to apply the APRS formats in the transmission of position, weather, and status packets. However, APRS is a registered trademark of BobBruninga who reserves the ownership of these protocols for exclusive commercial application and for all reception and plotting applications. Other software engineers desiring to include APRS protocols in their software for sale within or outside of the amateur community will require a license from him.

SAMPLE OUTPUT

Figure 1 shows earthquake objects as plotted by WinAPRS. The objects are actual earthquakes with all other APRS objects removed for illustrative purposes. Those who are familiar with earthquake patterns will not be surprised at the distribution of the earthquakes. Japan, Australia, Alaska, California, Turkey and the West Coast of South America are places where earthquakes loccur frequently. Due to this wide distribution, users displaying the world map will have the best chance of seeing earthquakes.

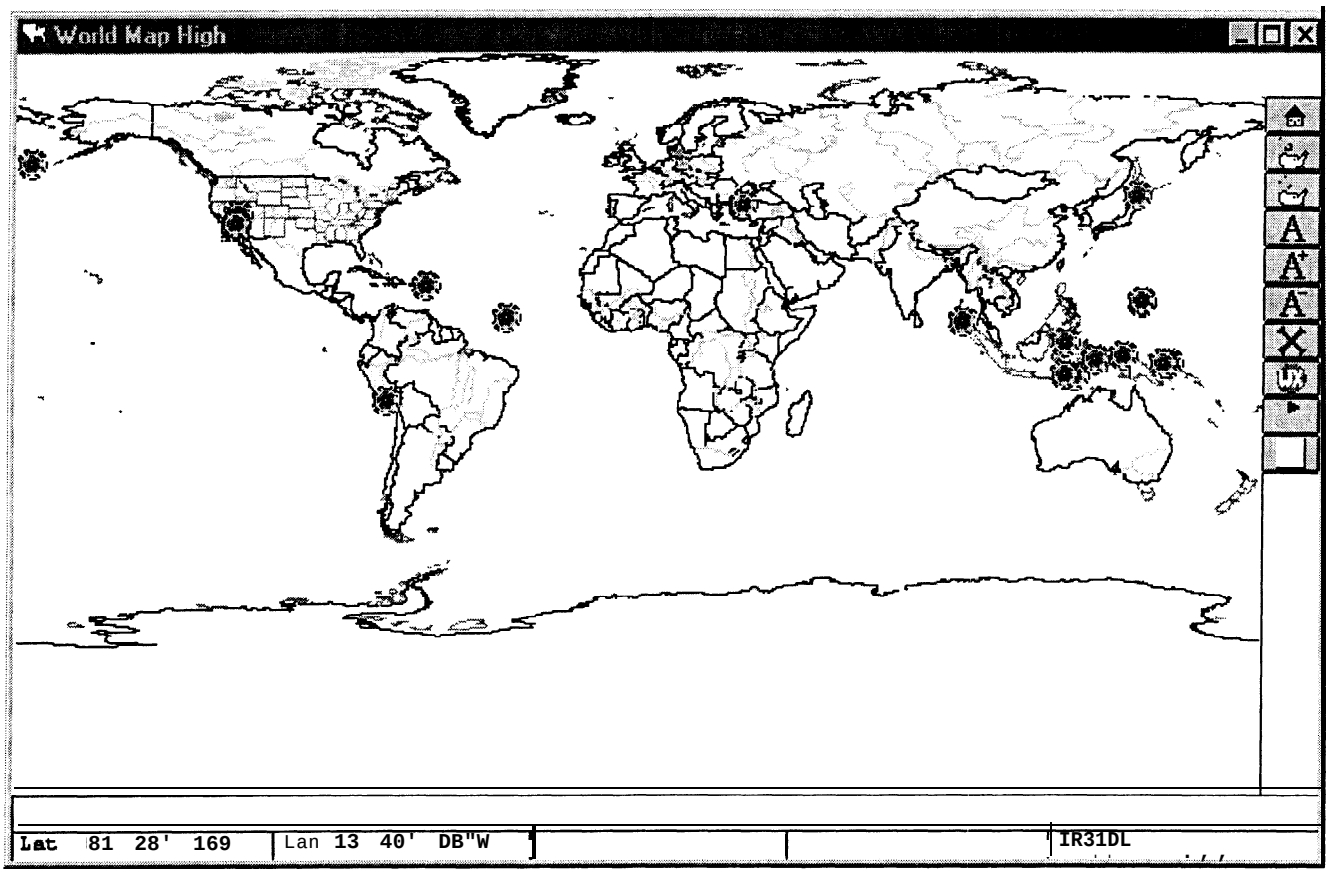

Figure 1 Earthquake Report on World Map

Many earthquakes occur each day, fortunately, most are small. To limit the number of earthquakes to those that are of most interest, two criteria are used by quakeAPRS before the earthquake is considered significant enough to be displayed. First, earthquake objects are limited to those that have a Richter magnitude greater than 3.0. In addition, quakeAPRS sends to APRServe only those earthquakes that are less than 24 hours old. The number of earthquakes reported varies greatly, however, on average, 4 to 10 earthquakes meet this criterion.

QUAKEAPRS FORMAT

Developing an earthquake format for APRS use was an evolutionary process. The first attempt at a format made every object label unique. This is an unacceptable use of APRS objects since it means every 30 minutes approximately 10 new objects are sent to APRServe. Those who leave their APRS

clients running continuously would receive several hundred objects daily. This is an unsatisfactory number of earthquake objects, especially since most are duplicates. In addition, these redundant objects represent a significant portion of stations comprising the limited resources of the “stations list”.

The final version of the format can be seen in Figure 2, which shows a WinAPRS Station List window. The label for the first object is **060515q49.** The digits to the left of the “q” represent the date and time. In this example, the earthquake occurred on the 6th of the month at 05152. To the right of the “q” is the magnitude of the quake with the decimal point removed. Therefore, the value of 49 is read as an earthquake with a magnitude of 4.9. It was not possible to include the mo:nth and year since the APRS protocol limits the size of the label to 9 characters. However, since by deftition all earthquake objects are less that 24 hours old, the year and month are obvious and need not be included. The “q” is used as a delimiter and to make it unique. This means other applications can use a similar format for objects. For example, hurricanes might use the same format by using “h” as the delimiter. The lower case “q” should not be confused with the icon character. The icon information for an earthquake is actually two characters, “Q” and ‘Y’.

This format was developed with suggestions from Brent Hildebrand, KH2Z, who uses the same format in APRS+SA.

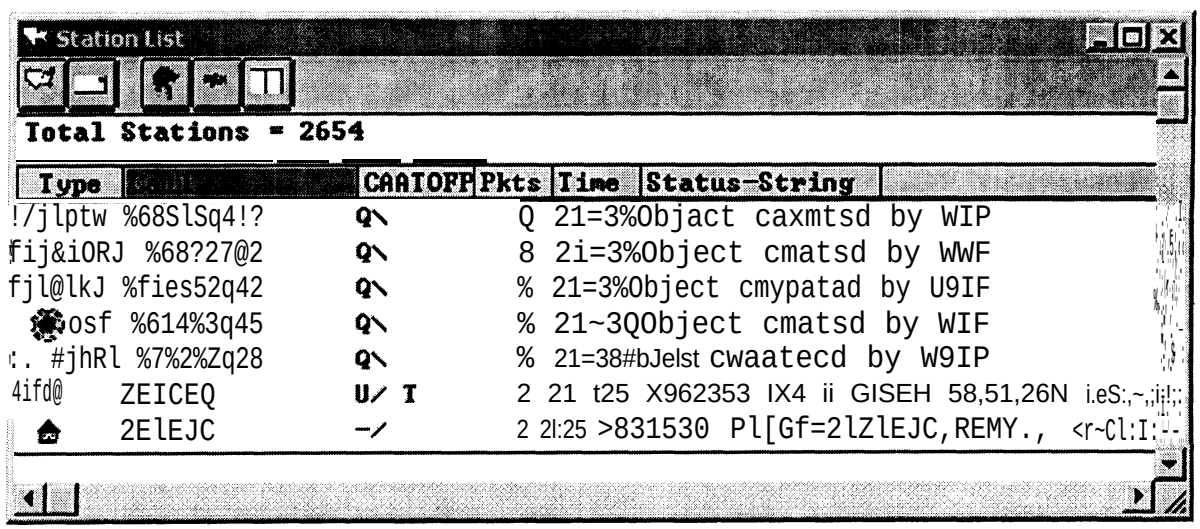

Figure 2 Earthquake Station List

GETTING THE DATA

Numerous web sites are available to obtain earthquake information; below is a small sampling. Some sites show earthquakes by geographical area, some show earthquakes worldwide, while others show only large earthquakes such as those with a Richter magnitude greater than 3.

```
http://www-socal.wr.usgs.gov/recenteqs/Quakes/quakesO.html
http://www-socal.wr.usgs.gov/recenteqs/Maps/Los   Angeles.html
http://www-socal.wr.usgs.gov/recenteqs/Quakes/q~akes=big.html
```

Web pages are an excellent method for displaying earthquake data in an easy to understand graphical format. However, the goal of quakeAPRS is to put earthquake data in APRS object format, so we are interested in getting earthquake data in a format that is easy to parse.

A more useful method for obtaining earthquake data is the UNIX "finger" command. It provides a simple and elegant means to obtain the necessary information. The output of "finger" is shown below.

```
[rparry@blue  rparry]$  finger  quake@gldfs.cr.usgs.gov
[gldfs.cr.usgs.gov]

USGS Central Region Geologic Hazards Team Finger Server.

Login name: quake                       In real life:  see Ray Buland
Never  logged  in.
New mail received Sun Aug  6 20:53:17  2000;
  unread since Sat May 27 14:05:59 2000
Plan:
The following near-real-time Earthquake Bulletin is provided by the National
Earthquake Information Service (NEIS) of the U.  S. Geological Survey as part of
a cooperative project of the Council of the National Seismic System.   For
a description of the earthquake parameters listed below, the availability of
additional  information,  and our publication criteria, please finger
qk-info@gldfs.cr.usgs.gov.

This Bulletin is updated every 5 minutes, if necessary.   The same Bulletin
is also available via the Internet at:
http://wwwneic.cr.usgs.gov/neis/bulletin/bulletin.html and that is the
preferred means of obtaining it.
Updated as of Mon Aug 7 03:30:36 GMT 2000.

 DATE-(UTC)-TIME     LAT     LON      DEP    mG   Q  COMMENTS
yy/mm/dd   hh:mm:ss    deg.    deg.      km
00/08/03  13:18:09   34.24N 139.18E   10.0 5.5Mb A  NEAR S. COAST OF HONSHU, JAPAN
00/08/03  13:34:12   39.58N 111.69W    5.8 3.2Ml     <SLC>  UTAH
00/08/03  17:01:57   11.88N 143.073   33.0 5.3Mb B  SOUTH OF MARIANA ISLANDS
00/08/03  19:22:11   17.59s   71.85W  33.0 5.5Ms B  NEAR COAST OF PERU
00/08/03  19:23:38   34.13N 138.993   10.0 5.2Mb B  NEAR S. COAST OF HONSHU, JAPAN
00/08/03  19:25:55   17.67s   71.97W  33.0 5.2Mb B  NEAR COAST OF PERU
00/08/04  07:17:56   34.27N 139.033   10.0 4.7Mb A  NEAR S. COAST OF HONSHU, JAPAN
00/08/04  07:47:40    O.OlN 126.6OE   82.3 5.6Mb A  NORTHERN MOLUCCA SE:A
00/08/04  09:18:40   17.655: 178.89w 559.9 4.5Mb B  FIJI ISLANDS REGION
00/08/04  21:13:03   48.85N 142.23E   10.0 7.0Ms A  SAKHALIN ISLAND, RUSSIA
00/08/05   02:55:07    7.28s 128.65E 160.2 5.1Mb A  BANDA SEA
00/08/05  06:13:32   24.41s 112.1OW   10.0 5.OMb B  EASTER ISLAND REGION
00/08/05  06:52:22   48.85N 142.19E   10.0 4.7Mb A  SAKHALIN ISLAND, RUSSIA
00/08/05  08:30:12    6.28s 130.29E 152.0 5.3Mb A  BANDA SEA
00/08/05  19:25:59    5.235;  77.73W  33.0 4.6Mb A  NORTHERN PERU
00/08/05  19:43:09    5.79s 130.40E 181.7 5.3Mb A  BANDA SEA
00/08/06  05:15:40    5.26s   77.58W  33.0 4.9Mb A  NORTHERN PERU
00/08/06  07:27:16   28.84N 139.523  433.9 7.2Mw A  BONIN ISLANDS, JAPAN REGION
00/08/06   08:52:22   46.23N   75.09w  18.0  4.2Lg     <OTT> SOUTHERN QUEBEC, CANADA
00/08/06  14:03:50   22.00N 142.93E  260.5 4.5Mb A  VOLCANO ISLANDS,  JAPAN REGION
00/08/07  02:02:30   40.90N  81.13W    5.0 2.8Lg C   OHIO
```

The date, time, location, magnitude, and brief description are given for each earthquake. QuakeAPRS must parse each of the lines, extract the relevant information, determine if the earthquake meets the magnitude and age criteria, and put the information into APRS packet format.

Below is the same information in APRS format. This data is sent to APRServe for distribution through the Internet. Notice that of the 21 earthquakes reported by the USGS, only 4 meet the age and magnitude criteria.

```
WgIF>APRS:; 060515q49*060515z0515.6OS\O7734.8OWQMag 4.9 Depth 33.0 km NORTHERN PERU
WgIF>APRS:; 060727q72*060727z2850.40N\13931.20EQMag 7.2 Depth 433.9 km BONIN ISLANDS, JAPAN
WgIF>APRS:; 060852q42*060852z4613.80N\07505.40WQMag 4.2 Depth 18.0 km SOUTHERN QUEBEC, CANADA
WgIF>APRS:; 061403q45*061403z2200.00N\14255.80EQMag 4.5 Depth 260.5 km VOLCANO ISLANDS, JAPAN
```

QUAKEAPRS INTERNALS

QuakeAPRS is written in perl. It runs on the hour and half hour as a cron. job on a Linux machine. It is a relatively simple task to obtain earthquake data, put it in APRS format, and send it to APRServe. However, since it is automated, some means of assuring redundancy and notification in the event of a failure is highly desirable.

Redundancy in obtaining earthquake information is provided by using two sources of data. QuakeAPRS first tries to "finger" the USGS. In the event a finger connection is not possible, quakeAPRS connects to the USGS web page **(http://earthquake.usgs.gov/neis/bulletin/bulletin.html)** and again tries to extract the necessary earthquake data. If either of these connections fail, an email notification is sent to indicate a failure. This allows intervention to determine if there is a problem. Experience shows that the USGS "finger" server is sometimes offline during weekends. However, the **USGS** web page has been very reliable. This redundancy technique results in near continuous operation.

Getting the data reliably is only half of our goal. The other half is getting the data to APRServe reliably. Since APRServe may itself be offline, a backup system of servers was developed. QuakeAPRS tries connecting to each of the servers below until a connection is made. If any connection fails, an email notification is sent to inform the administrator of a potential problem. If all connections fail, quakeAPRS exits and attempts connection on the next hour or half-hour.

- first.aprs.net
- aprs.socal.interworld.net
- second.aprs.net
- third.aprs.net

Experience thus far shows that although one server may be off line, one or more of the backup servers is typically operational.

CONCLUSION

QuakeAPRS has been running nearly continuously for a year. It started as a simple project to provide a service to the APRS community, but it also turned out to be an interesting and enjoyable learning experience. However, it was not until I received the email below that the seriousness and importance of quakeAPRS was put into perspective.

```
thanks for the quakeAPRS service.  i thought i'd let you know that it has
been of great value to us here since the earthquake(s) that hit Nicaragua
a couple of weeks ago. . . . thanks rich.

73 de rick, hr2kos
```

ACKNOWLEDGMENTS

Thanks to Bob Bruninga, WA4APR, for permission to use the APRS trademark. Also many thanks to Brent Hildebrand, KH22, for suggestions for the final version of the format used by quakeAPRS and APRS+SA.

RESOURCES

1. Bruninga, Bob, "Automatic Packet Reporting System (APRS)," 73, December 1996, pp. 1 O-1 9.
2. Dimse, Steve, "javAPRS: Implementation of the APRS Protocols in iJava," *ARRL and TAPR 15th Digital Communications Conference Proceedings,* Seattle, Washington, September 1996, pp. 9-14
3. Pa.&, Richard, "Position Reporting with APRS," *@ST,* June 1997, pp 60-63.
4. Parry, Richard, "APRS Network Guidelines," 73, October 1997, pp 19-20.
5. Parry, Richard, "Position Reporting: The Global Positioning System and Linux," *Linux Journal,* July 1998, pp 46-49.
6. **Parry,** Richard, "XNET: A Graphical Look At Amateur Radio Packet Networks," *ARRL and TAPR 15th Digital Communications Conference Proceedings,* Seattle, Washington, September 1996, pp. 64-75.
7. Parry, Richard, "perlAPRS," *ARRL and TAPR 16th Digital Communications Conference Proceedings,* Baltimore, Maryland, October 1997, pp. 14 1 - 148.
8. Parry, Richard, "APRSstat: An APRS Network Analysis Tool" *ARRL and TAPR 17th Digital Communications Conference Proceedings,* Chicago, Illinois, September 1998, pp. 7 1-76.