A Shadow Ad-Hoc TEMPn-N network

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http://aprs.org/rovers.html

APRS is ideal for ad-hoc coordination communications among portable VHF and UHF stations and roving vehicles such as the packet Mountain-Topper shown to the right.

Of course stations and rovers have nearly perfect connectivity using the existing national APRS network on the established national channel of 144.39. But the problem is, it is hard to see who is involved in the event among the other thousands of permanent users there. Or at other times, a temporary digipeater may be needed because certain key digipeaters might be down during an emergency and a station needs to use other surrounding stations to get out. For these reasons, it is nice to have a backup, shadow ad-hoc networking capability built into every packet station that is always on and ready to be used.

The Shadow TEMPn-N Network: TEMPn-N is the name for such an AD-HOC APRS emergency network that can use existing packet assets at any time. In particular, all of the thousands of D700/710 mobiles and portables are capable of the muilti-hop generic type digipeating used by APRS and these radios can be permanently configured for temporary digipeater operations. The objective across all of amateur radio is for *ALL* of these radios (and any other packet station) to be permanently enabled as TEMPn-N digipeaters for emergency or temporary use at any time. However, at the same time, these radios do not do any normal digipeating on the national APRS channel or anywhere else they are used which would cause excessive QRM because the TEMPn-N path is only used in these special cases. Since the shadow TEMPn-N capability is always enabled, however, they will respond at any time, and they serve as a silent reserve emergency backup or ad-hoc digipeater system independent of existing infrastructure[1].

Emergency APRS digipeating: One use of the TEMPn-N capability is when an APRS station is out of range of the existing APRS national network. In this case, he can try changing his path to TEMP1-1,WIDE2-2. Using this path, his packet will attempt to digipeat one hop through any surrounding TEMPn-N mobiles. From there, the remaining WIDE2-2 in his path will propagate further along the existing APRS WIDEn-N network. This capability is also useful when giving live demos or working from temporary indoor locations and needing to digipeat out through a mobile in the parking lot.

AD Hoc Network: Another application of the TEMPn-N network is special events where a temporary frequency is needed. One possible frequency is the national HamIM frequency of 147.585. This frequency is chosen to be as far as possible from the weak signal end of the band so that it can be used for instant messaging (HamIM) during VHF and other weak signal work.

There is no permanent APRS network on 147.585 MHz, only stations that show up there for any given event. But APRS is perfect for establishing an AD-HOC network since every D700 and D710 APRS radio should already be configured to serve as an automatic digipeater and the D72 HT is already configured and just needs to be enabled from the front panel menu; just set UITRACE to TEMP and make sure it is enabled (ON).

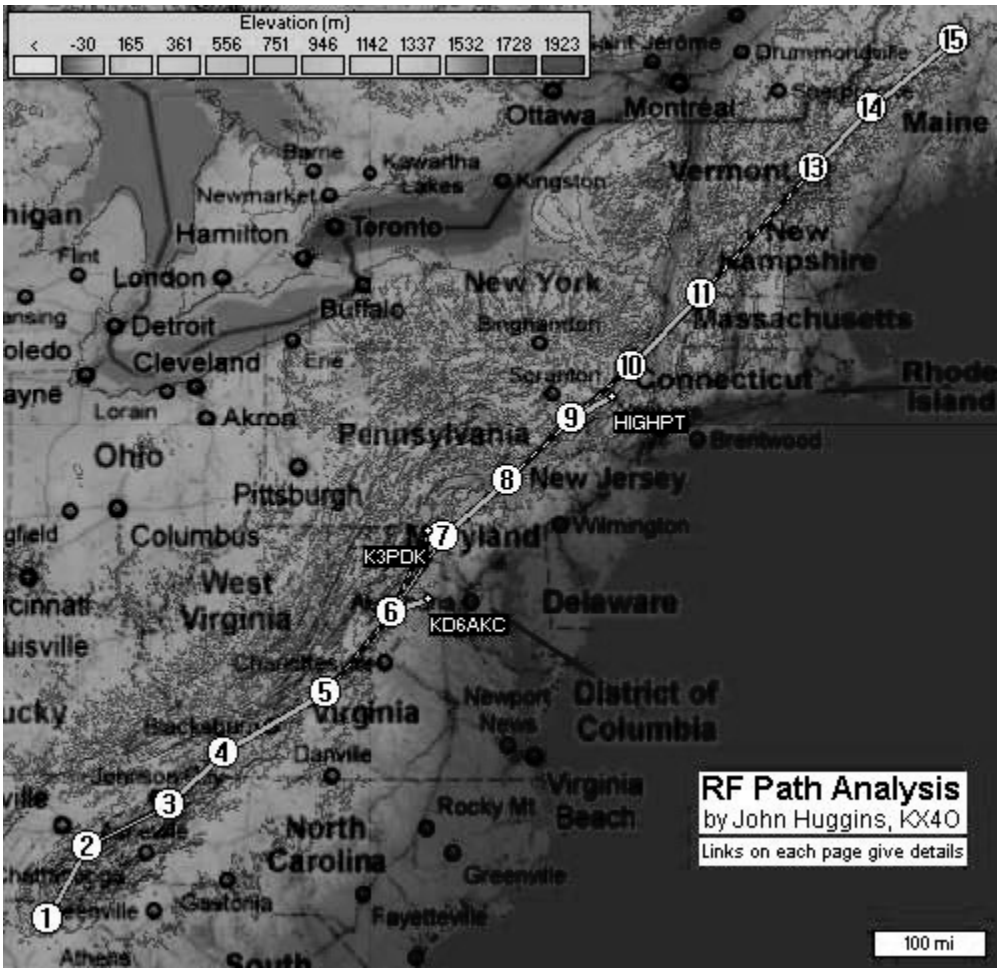

Figure 2. Fifteen mountain tops from Georgia to Maine can support an ad-hoc APRS communications network along the 2000 miles of the Appalachian Trail. The annual event is usually held the third weekend or so in July.

The Annual Golden Packet Event: A perfect example of an ad-hoc packet digipeating event with instant messaging is the annual Golden Packet Event shown in figure 2. This event attempts to communicate over very long distances using APRS packets along temporary mountain top digipeaters. There are 15 mountain tops from Georgia to Maine where operators

should be able to link the entire 2000 mile length of the Appalachian Trial. For the last three years (and annually forever after) dozens of APRS hams go to the hills to test their ad-hoc networking skills [2]. A similar event is attempted on the Pacific Crest Trail [3] on the west coast and any other location where enough hams can get out doors along any of the 50,000 miles of long linear national trails.

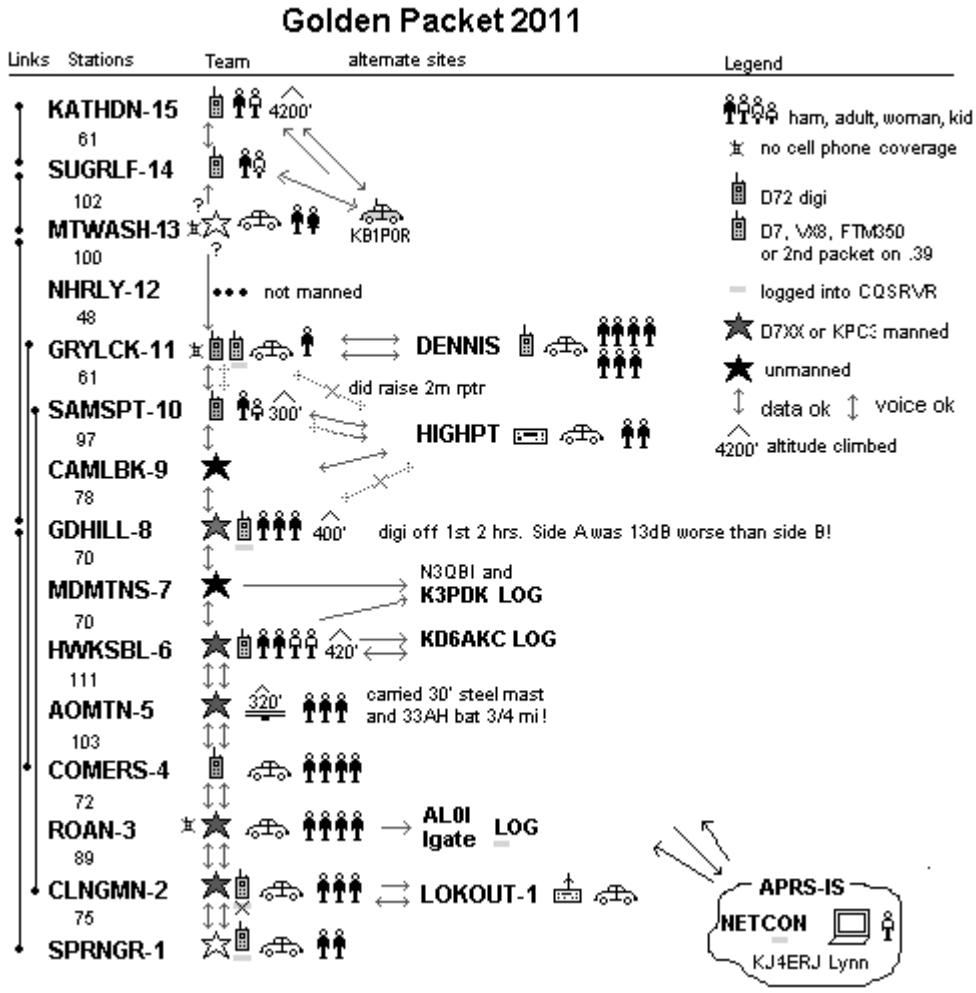

Figure 3. This graphic attempts to catalog the details of the various sites in the 24 July 2011 event. The 15 mountain tops are shown as well as the designated Shack-Potato (KJ4ERJ) who stayed home to serve as net control on the APRS-IS, cell phone and any other means.

Although hams practically anywhere in the entire US can easily communicate locally or over thousands of miles using the existing national APRS channel of 144.39, the difference is that the national network is worm-holed together by internet IGates that tunnel the long haul packets over long distances. Every packet is absorbed into the APRS Internet System (APRS-IS) but nothing goes back out to RF, unless it is a message addressed to a particular callsign. In that case, the nearest IGate that has heard the station recently will automatically pass the message from the APRS-IS back to RF in his local area. In the case of the Golden Packet Event, however, we wanted to conduct the experiment and seek the longest packet record entirely on RF only. Figure 3 above attempts to catalog all the information about the 15 stations during the 2011 event.

Another advantage of using a dedicated frequency is that the map is not cluttered by non participants as it would be on the national channel. To see only the other stations in the event, stations can use APRS on the national HamIM channel of 147.585 as a temporary ad-hoc APRS channel. The only stations on that frequency will be other real-time participants. Setting up a digipeater requires nothing more than a radio and antenna as shown in figure 4.

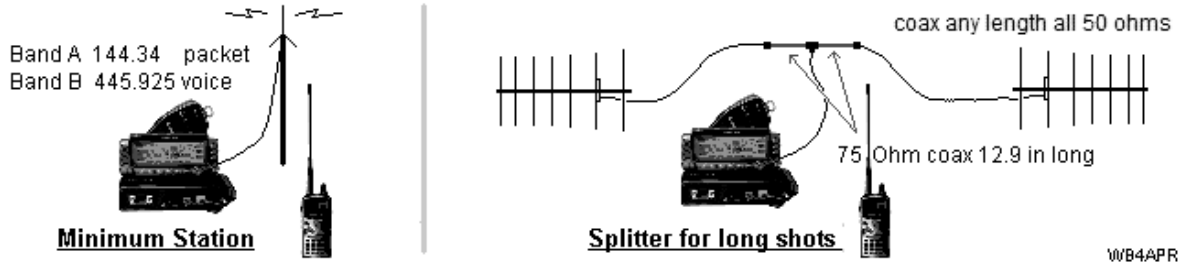

Figure 4. All that is needed for a portable or emergency ad-hoc digipeater is a D700/D710 or the new hand held TH-D72. The D710 is factory configured and enabled for TEMPn-N digipeating support.

Setting UP for the TEMPn-N network: On the D710, TEMPn-N is enabled by factory default. This is with the UITRACE Menu set to TEMP and UITRACE set to ON. For the D700, the owner needs to set UITRACE TEMP using a PC over the serial port. Do this once for the life of the radio and then it is always available to support an ad-hoc TEMPn-N network wherever it is used. The radio will remember these settings:

UITRACE TEMP	<== enables TEMPn-N digipeating
HID OFF	<== turns off the useless 10 minute ID packet
DIGI ON	<== enables MYCALL digipeating (should be on always anyway)

TEMPn-N Network Usage: So, if everyone follows the guidance on this page, then the shadow TEMPn-N emergency network is always in place. To use this network, any USER simply changes his normal path from WIDEn-N to TEMPn-N and if one of these radios is in range, he will get out. Typically on the national channel, a user in this case would use the path of TEMP1-1,WIDE2-2 so that after hitting the first nearyby TEMPn-N digipeater, he then gets into the normal network with WIDE2-2 hops to go. But for special events on another frequency, then the path of TEMP3-3 or more might be used in an all TEMPn-N network. The owners of the TEMPn-N mobiles do not have to do anything but have the radio ON to support these links.

Contesting Events and Rules: We hope to also use the 147.585 HamIM channel for ad-hoc communications during other VHF events where there are lots of roving or portable participants. For example we hope to re-man the 15 golden packet mountains during the 10-11 September 2011 VHF QSO Party!

This ad-hoc TEMPn-N network can be used by all VHF multi-op stations and rovers, but the single-op stations and Rovers cannnot use the digipeating portion. The ARRL disallows digipeating by single-op rovers and stations. During an event, multiop stations simply switch their APRS mobile or station to the HamIM frequency of 147.585 and switch their outgoing

PATH to TEMP7-7. Single-Op rovers should use the direct path of RFONLY. All stations will see all the other rovers and VHF stations in range. The TEMPn-N digipeating by high placed multi-op rovers or VHF stations will allow everyone on the channel to be seen. NOTE: If this gets too popular, we may have to cut that back to TEMP3-3.

Non Scoring Participants: Single Op stations and rovers that are not submitting scores may of course use the digipeaters and enable their own stations for digipeating because they are not in competition. But they can still make contacts with as many other stations in the event and see everyone on the APRS map! This approach also works within the Field Day rules[5].

Portable Digipeaters: Since every D700, or D710 (and any needed D72 HT) can be used as a temporary TEMPn-N digipeater, it is relatively simple to carry up a portable digipeater to any high location to form the ad-hoc network. The image to the right shows all that is needed for one of these sites. Long term power is usually the driving factor in the station design. For the D700/710, typically about 1.5 AH per hour are needed for the station as shown in figure 5. We used these techniques exclusively during the annual Golden Packet Event.

Figure 5. Typically about 1.5 Amp Hours per hour is the average power drawn for such a portable diggipeater. Figuring out the long term power for such an ad-hoc station is part of the challenge. Several other creative power techniques were used at the 2009 event[4].

Lets get the word out. See you on the mountain top!
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[1] http://aprs.org/TEMPn-N.html
[2] http://aprs.org/at-golden-packet.html
[3] http://aprs.org/pct-golden-packet.html
[4] http://aprs.org/aprs-swer.html
[5] http://aprs.org/fd2005.html