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SUBJECT	Common Standards for APRS™ within IARU Region 1		
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Common Standards for APRS™ within IARU, Region 1.

Introduction

This paper proposes "Common Standards for use of Automatic Position Reporting System (APRS™) within IARU, Region 1" to improve today's APRS communications reliability and network performance, as well as providing a common baseline for future development and improvements, and user education and training.

Background

APRS™ was developed by WB4APR/Bob Bruninga in the mid 80's; modifying the original Packet Radio AX.25 protocol to enable APRS one-to-all (broadcast) network functionality. Over the years the APRS protocol has been further developed, allowing for more functionality, more reliable communications, as well as vastly improving network performance. The latest effort is the "New n-N Paradigm", which has been implemented throughout the US to finally break with a number of inefficient legacy settings which impacts overall network reliability.

APRS today is used on HF, direct point-point, via Digital APRS Repeaters (Digipeaters) on VHF and UHF, even via Amateur Radio satellites, all with access to a World-wide APRS Internet Server network (APRS-IS) via Internet Gateways (IGATEs).

In Europe however, where APRS came about some years later, the APRS network is generally unreliable due to lack of consistent user- and network settings, both nationally and regionally. Some nations have converted their setup to comply with the "New n-N Paradigm" (WIDEn-N), others still use the old setup, and some use a mix of the two - known today as the "New EU Paradigm" (TRACEn-N) as some are reluctant to fully adopt a so called "US system".

A quick Path check on the APRS map reveals:

WIDEn-N: Azores, Belgium (and old), Finland, Ireland, Italy (and old), Norway, Poland and Portugal

TRACEn-N: Denmark, United Kingdown

Mixed Wn and Tn: Austria, France, Germany, Greece, The Netherlands, Spain, Sweden, Switzerland and Turkey

It should be noted that APRS is also an important supplement to the Amateur Radio Emergency Service (ARES) in some of the member countries.

Key points and proposal

Differences between "New EU Paradigm" and "New n-N Paradigm":

Technically, they are the same, as both are attempting to get rid of all legacy paths, and concentrate users and operations to a single recommendation which will work everywhere. Further, they are identical in that "RELAY,TRACEn-N" works exactly like the "WIDE1-1,WIDEn-N".

In "New n-N Paradigm" the "WIDE1-1" is a one-for-one syntax replacement for "RELAY", and "WIDEn-N" is a one-for-one syntax replacement for "TRACEn-N".

Both also focus on simplifying the network, and simplifying user settings, to make training easier.

But, if we take apart the last sentence:

1. If "RELAY,TRACEn-N" and "WIDE1-1,WIDEn-N" are identical, then it violates the simplicity object to have both.
2. Further, "WIDE1-1" does have a slight advantage in duplicate elimination in systems which use Kantronics TNCs (this was a major problem in the USA).
3. Further, Space-based (AMSAT) APRS systems should not be required to support "WIDEn-N" over the rest of the world, and have to support "TRACEn-N" over Europe.
4. And finally, since they are identical, there is no known advantage in using "RELAY,TRACEn-N" in view of the previous three arguments.

Improvements from implementing the "New n-N Paradigm":

- "WIDEn-N" is the new common single parameter for relay of APRS packets
- "N" max number of Digipeater hops is limited to lessen QRM and improve reliability
- Former parameters "RELAY", "WIDE", "TRACE", "TRACEn-N" and "SS" are obsolete
- "SSn-N" (Single State or Section nets) is added for selected non-routine nets (e.g. National, District or Commune nets, etc.)
- Syntax "DIGI1,DIGI2,DIGI3" may still be used for dedicated point-to-point communications

Outcome following implementation of "New n-N Paradigm":

- Traceability of packet is maintained 100% (ref new contents of Digipeater parameter UITRACE)
- Extended control with distribution and relay of data (number of hops, Nation wide or local distribution ("SSn-N") versus World-wide)
- No "ping-pong" of packets between Digipeaters (improved filtering, less QRM)
- Automatic removal of duplicates between Digipeaters (packet ID relay-count)
- Number of Digipeater hops kept to a minimum (max 3) will drastically reduce packet collisions, congestion of frequencies, thereby improving network reliability without loss of data
- Users have one unique parameter for their packet path, namely "WIDEn-N"

A very important modification is the actual contents of the Digipeater parameter UITRACE, where it should now read "WIDE" versus former "TRACE". This ensures continued 100% traceability when relaying packets via Digipeaters. To enable "SSn-N" (Single State, equiv), the Digipeater parameter UIFLOOD is used (no traceability, as before).

“New n-N Paradigm” further recommends the following settings of packet path for individual APRS stations:

1) Fixed: WIDE2-2 or WIDE3-3 (2 or 3 hops via Wide area Digipeaters)
2) Mobile:WIDE1-1,WIDE2-2 (using a Fill-in Digipeater as gap filler, then 2 hops via Wide area), or WIDE2-2 or WIDE3-3 (depending on required coverage)

With this, the individual APRS user only have to focus on “WIDEn-N” for their packet path, as it replaces all former Digipeater parameters (“RELAY”, “TRACE” and “WIDE”).

For Digipeater System Operators (Sysop), equal adherence to the new parameters is vital, as a few modifications may be required to existing Digipeaters. This includes replacing obsolete parameters, updating new parameters, correct beacon and path setup, filtering excessive number of hops, and properly set packet timing, etc. A properly set up Digipeater (both Wide Area and Fill-in’s) is imperative for the success of the local APRS network, as well as providing full compatibility with the World-wide APRS Internet Server system.

Additional considerations

IGATEs

Strict and proper configuration and setting of filters (callsign groups, geographical areas, range, etc) is required not to flood the local RF frequencies with unwanted APRS traffic. Make sure your local community is properly served, allowing reliable two-way message communications (e.g. UI-View’s “Max digis for local”).

Digipeaters

Trap packets using more than max allowed number of hops, by implementing call substitution for WIDE7-7, WIDE6-6, WIDEn-n, etc, which will allow a single hop and stop excessive routing. This requirement will diminish as individual APRS users get more acquainted with proper setup.

Set up of Digipeater beacons. Every Digipeater should fully inform its nearby users of its proper settings. Consider local information requirements and proper path and time setting for each beacon. A beacon is normally transmitted every 30 mins from a fixed station. Include PHG (Position, Height and Gain) information as part of the beacon, to enable calculation of a relative ALOHA circle. Further, include type of Digipeater (W3, W2, W1 etc) and any SSn-N indicator as part of the beacon text.

Fill-in Digipeaters

A fixed station or a mobile station (during Emergency operations) may establish a one-hop (WIDE1-1) Digipeater (Fill-in) to cover the radio gap between a Wide Area Digipeater and the local operations. This is only relevant where the area is not otherwise covered by a Wide Area Digipeater. Note that the syntax “WIDE1-1” is a one-for-one replacement of the old obsolete “RELAY” parameter.

Mobile and/or Trackers

As for beacons, a mobile (moving) station will normally transmit a beacon every 1 or 5 mins, depending on speed and requirement for continuous real time position updates. Some trackers have a built-in “Smart beaconing” where the beacon interval is automatically set based on speed, but this is the exception rather than the norm. Note that all APRS network participants should be

two-way systems. APRS is a network sharing local information, and this includes annotating ones voice operating frequency to facilitate human-to-human communications. In this regard, tracking devices which only transmit APRS packet data should include a listening or operating frequency in their beacons, so that the operator (like all other APRS operators) can be considered a participant in the network, and can be contacted.

Use of Symbols and SSID

Choice of proper symbol is required to easily identify individual installations on an APRS map (remember to use an updated version of the symbol table). Use of “correct” symbols is a must, especially when using APRS as part of ARES (Amateur Radio Emergency Services), as this will immediately display the station’s function on available maps in the HQ (operations rooms, etc). This document is therefore also a recommendation on using correct symbols, for proper map displays.

Use of SSID

Although in the early 1990’s there were some specific SSID definitions for raw NMEA GPS data, those SSID’s are no long needed. However, the APRS community has found it useful to encourage users to consider a few simple SSID’s as it makes rapid callsign recognition possible. The most commonly used are:

SSID	Function
-6	Satellite or special applications
-7	TH-D7 or other handheld applications
-8	Boats (Maritime Mobile)
-9	Stations primarily mobile
-10	Internet only applications
-11	Balloons
-14	Large multi-wheel trucks

Remarks:
- SSID -1 to -4 are normally used when having more ports/frequencies on the same Digipeater or home callsign.
- A standalone Digipeater does not require a SSID, as the assigned callsign would normally clearly indicate what kind of installation we are talking about

Recommendation:

Adopt the APRS “New n-N Paradigm”, as published by WB4APR, for use within IARU Region 1, to ensure World-wide consistency regarding parameter settings, improving the overall APRS network flow, as well as providing a common baseline for future improvements. This also ensures simple user training, and compatibility with all APRS platforms.

By simplifying the network to only accept “WIDEn-N”, and telling users to limit their “N's” to the minimum needed for their own area, a vast improvement in reliability and throughput will be achieved in a common IARU, Region 1 APRS System, and beyond.

Source and background information:

a. Bob Bruninga / WB4APR http://www.ew.usna.edu/~bruninga/aprs.html

b. New n-N Paradigm http://www.ew.usna.edu/~bruninga/aprs/fix14439.html
c. APRS Spec Addendum 1.2 http://www.ew.usna.edu/~bruninga/aprs/aprs12.html
d. Stephen H. Smith / WA8LMF http://wa8lmf.net/DigiPaths/index.htm
e. Andy Pritchard / M0CYP http://www.apritch.myby.co.uk/uiview_neweu.htm