

APRS and the Internet

Is APRS-IS Amateur Radio?



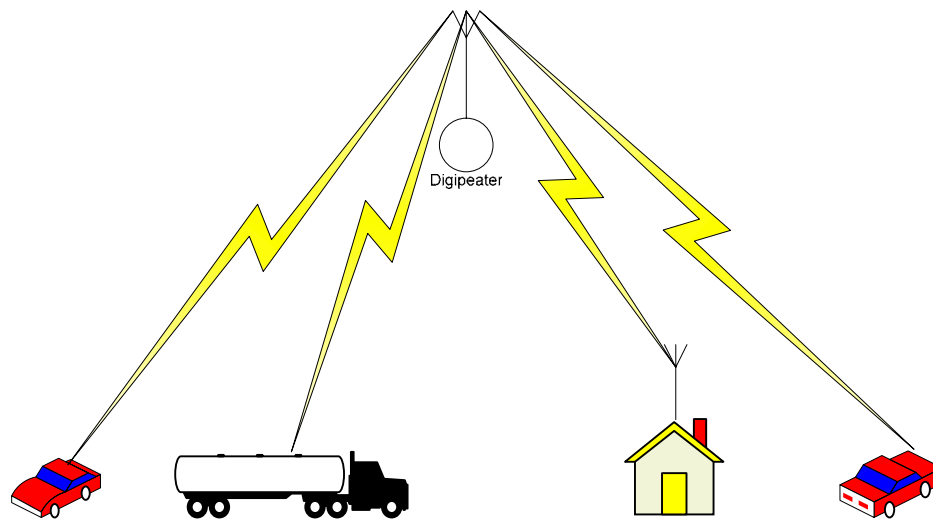
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Automatic Position Reporting System

- Original Name – Automatic Packet Reporting System
- Developed in 1990 based on 2 meter AX.25
- Designed for one-to-many communication of automated information
- Support for SMS (Short Messaging Service)



One-to-Many Communication



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One-to-Many Communication

- Not Broadcast (according to FCC).
- Everyone sees all packets from everyone else.
- Information of value to amateur radio communicated.
- Two-way communication possible (most APRS is two-way).
- Unnumbered Information (UI) subset of AX.25

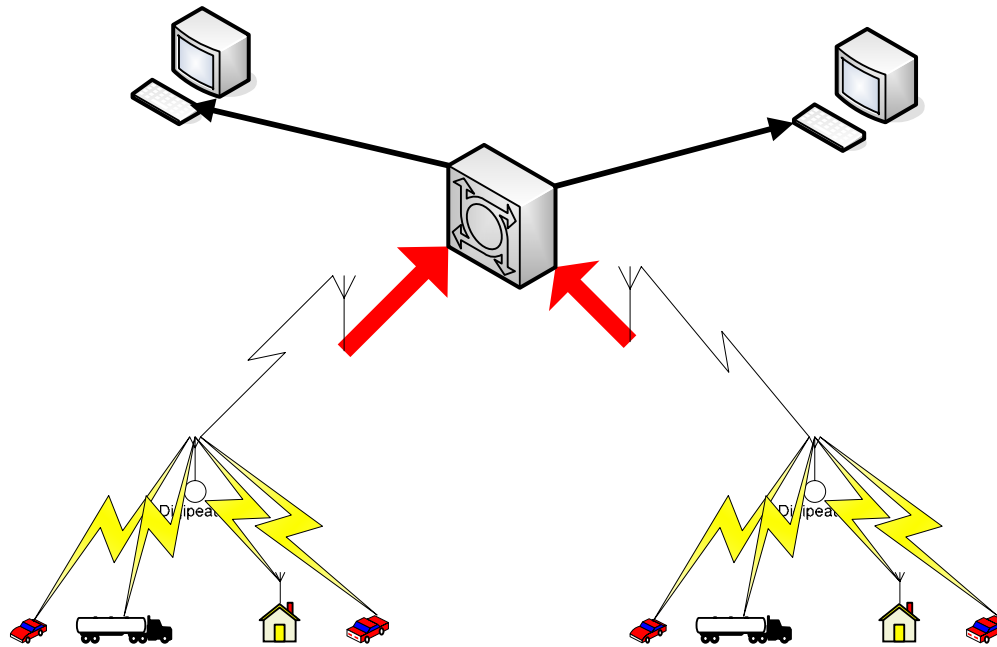


Enter the IGate (Internet Gateway)

- Dale Heatherington WA4DSY created first IGate
 - Provided a TCP/IP port passing TNC monitor-mode text
 - Unidirectional – RF->IP
- Steve Dimse K4HG created first server to collect data from Dale's IGate
 - Connected to the IGate port
 - Provided port for client connection
 - Unidirectional – TNC->Server->Client



APRS-IS The Early Days



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The Birth of APRS-IS

- Unidirectional – RF->IP
- Restricted access – List maintained by K4HG
- Low volume – 20-30 stations on RF, 2 IGates
- Single server – APRServe (Macintosh)
- javAPRS – Java applet for station display



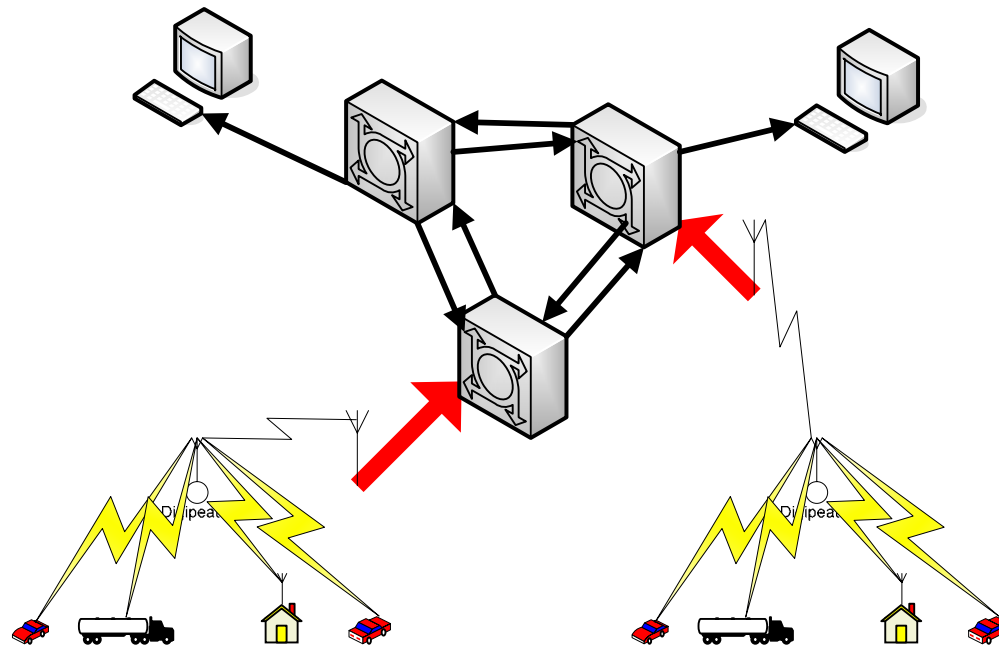
Core Servers

- Dale Heatherington WA4DSY develops aprsD
- Steve Dimse K4HG develops inter-server communications schema
- Steve Dimse K4HG creates first.aprs.net, second.aprs.net, and third.aprs.net as core server DNS names
- first.aprs.net, third.aprs.net use aprsD
- second.aprs.net use APRServe



APRS-IS

The Core Architecture



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APRS-IS Grows

- Still unidirectional – RF->IP
- Restricted inbound access
 - List maintained by K4HG
- Low volume – <100 stations on RF, 2 servers
- Two servers
 - APRServe (Macintosh)
 - aprsD (Linux, Unix)
- javAPRS – Java applet for station display
- MacAPRS/WinAPRS provide access



Bidirectional Connections

- Login Validation Algorithm
 - Non-validated stations marked to prevent gating to RF
 - Validated stations may pass packets from other stations
- Software authors issue validation code
- Global messaging-enabled IGates



Bidirectional Results

- Proliferation of IGates and Servers
- Duplication of gating to RF
- Server interconnects ad-hoc
- Exponential growth in bandwidth
- Instability in network
- Instability in servers and IGates
- Ad-hoc development of RF-IP interface



State of APRS-IS at Beginning of 2002

- 3 server types
 - APRServe (Macintosh; second.aprs.net)
 - aprsD (Linux, Unix; first.aprs.net, third.aprs.net)
 - AHub (Windows)
- Many IGates
 - WinAPRS/MacAPRS
 - APRS+SA
 - Xastir
 - aprsD
 - Others



State of APRS-IS at Beginning of 2002

- **CHAOS**
- Looping Packets
- Crashing Servers
 - Average Core server uptime < 1 day
- Crashing IGates
- Mangled Data
- Packet Translation



javAPRSSrvr

Third-Generation Server

- Operates on any OS with Java support
- Designed solely as a packet switch
- Loop prevention built in
- Stable
- In use on all core servers by end of 2002
 - Chuck Byam KG4IJB would switch first between aprsD and javAPRSSrvr



State of APRS-IS at End of 2002

- Core Servers were stable
 - Average uptime > 2 weeks
- Looped packets significantly reduced
 - 95%+ eliminated
- Mangled packets reduced
 - ~ 75% eliminated
- Bandwidth had increased by more than 2 times



q Algorithm

- Introduced by Dale Heatherington WA4DSY on aprsD
- Refined by Peter Loveall AE5PL and Dale WA4DSY
- Identifies point of entry
- Provides trace capability
- Provides propagation prevention mechanism
- Limited looped packet detection/prevention



What is a Loop Packet?

- A packet which traverses any single point in the network more than once.
- Duplicate checking prevents digipeater loops.
- Current q algorithm prevents server loops and multiple client loops.
- Since APRS-IS is now a backbone between RF networks, all clients which insert data (on RF and/or on the Internet) **MUST** use **UNIQUE** identifiers.



APRS-IS in 2003

- javAPRSFilter developed by Roger Bille SM5NRK
 - IGate loads reduced, therefore stabilized
 - Clients able to connect without large bandwidth
- Proliferation of javAPRSSrvr/javAPRSFilter
 - Cleaner data stream
 - Reduced loops
 - More stable APRS-IS
- Growth to over 15,000 stations world-wide



APRS-IS in 2003

- APRS finally became a stable, bidirectional backbone between local RF networks
- RF long distance networking requirements reduced or eliminated
- Dissemination of amateur related information
 - NWS
 - Citizens Weather
 - FireNet
 - IRLP
 - EchoLink
 - WinLink



APRS-IS in 2004

- Further refinement of loop detection/elimination
- Further refinement of IGate software
- Full backbone capabilities, world-wide
- Further stabilization of servers and data streams
- Removal of Mic-E translation
- Growth to over 25,000 stations

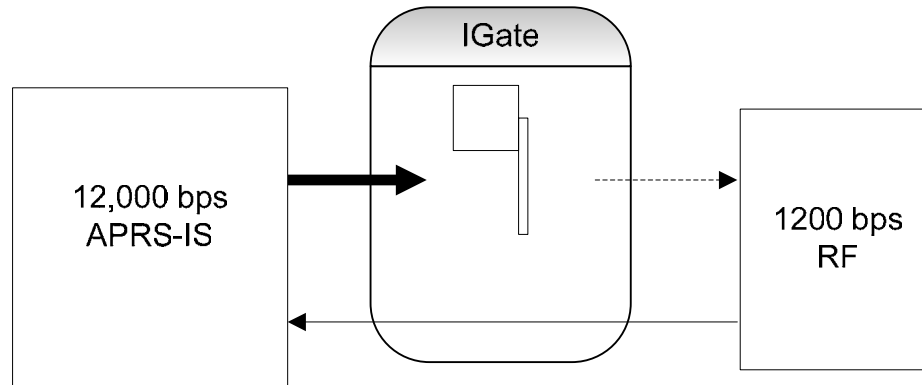


APRS-IS into the Future

- Elimination of digipeater networking on APRS frequency
- Further refinement of IGate gating algorithms
 - Hop management
 - Selective gating
- Further refinement of APRS servers
 - Continued improvements in stability
 - Continued improvements in data integrity
- Continued growth in capacity and utilization



What is the Key to Growth?



- Fully Functional IGates
 - Comprehensive Hop Counting
 - Unidirectional Proliferation
 - Bidirectional Coordination



Comprehensive Hop Counting

- Fully implemented in APRS+SA, javAPRSIGate
- Limits “local” stations to X number of digipeater hops away
 - X is set by the sysop
- WinAPRS/MacAPRS implement 3 hops
 - Excessive for metropolitan areas
- Xastir and UI-View implement distance restrictions
 - Requires accurate posit from receiving station before messages will be gated



Unidirectional Proliferation (RF->IP)

- APRS-IS servers duplicate checking prevent bandwidth overload
- Coverage holes filled without adding QRM to RF
- Anyone with a 9600 bps line or above can do this
- Most IGate software supports unidirectional gating



Bidirectional Coordination

- IGates are like wide area, linked repeaters, on the same frequency
- IGates receive packets from the Internet within milliseconds
- Multiple bidirectional IGates in one area collide causing complete loss of gated packets
- Excessive paths cause further loss of packets
- Established 24/7 IGate should be considered higher priority than new IGate or less than 24/7 IGate



I Want to Participate

- Viewing
 - <http://www.findu.com> (Most used database)
 - <http://www.jfindu.net> (javAPRS live mapping)
 - <http://www.aprsworld.net> (Well used map server)



I Want to Participate

- Clients
 - MacAPRS/WinAPRS (The original)
 - APRS+SA (Uses StreetAtlas 9.0 or earlier)
 - APRSPoint (Uses Microsoft MapPoint)
 - UI-View (Versatile Windows Application)⁽¹⁾
 - Xastir (X-Windows Application)
 - APRScE (Windows CE Application)
 - javAPRS (Java applet for web pages)

(1) The author, Roger Barker G4IDE, died in 2004. No more development on the core application. However, addins are continually be added and supported.



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- IGates
 - MacAPRS/WinAPRS (The original)
 - APRS+SA (Uses StreetAtlas 9.0 or earlier)
 - UI-View (Versatile Windows Application)⁽¹⁾
 - Xastir (X-Windows Application)
 - aprsD (Linux/Unix Application/Server)
 - javAPRSIGate (Adjunct to javAPRSSrvr)

(1) The author, Roger Barker G4IDE, died in 2004. No more development on the core application. However, addins are continually be added and supported.



I Want to Participate

- Servers
 - AHub (Windows Application)
 - aprsD (Linux/Unix Application)
 - javAPRSSrvr (Java Application – Multi-OS)
 - Many adjuncts written for this
 - javAPRSFilter, javAPRSDB, javAPRSIGate, javAPRSDigi



Where do I Connect To?

- It depends...
 - Client or IGate with filtered feed (most common)
 - Any core server, port 14580
 - Any javAPRSSrvr tier 2 server, port 14580
 - Server with full feed
 - Any core server, port 23 or 10152
- <http://www.aprs-is.net/aprsservers.htm>
- Check javAPRSSrvr server status page (<http://server.ip:14501>) for regional ports



What's FireNet?

- Originally a “subnet” of APRS-IS providing fire sighting information
- Now supports METAR, buoy, earthquake, river, and ship information
- WinLink objects
- As well as the entire APRS-IS feed
- They are using javAPRSSrvr so filtered ports are available
- <http://www.dwrracesupport.com/fire/>



Summary

- APRS-IS is a high speed backbone interconnecting the local RF APRS networks world-wide.
- Global messaging without routing.
- Window for non-amateurs and RF challenged amateurs to participate in APRS.
- Used by government agencies for emergency preparedness (NWS, for instance).
- Mechanism for dissemination of relevant amateur related information world-wide.



Q&A

- <http://www.aprs-is.net>
- Peter Loveall AE5PL – pete@ae5pl.net

