Overview

• (Quick) overview of D-RATS
• Winlink 2000
  • Architecture
  • Messages
  • Challenges
• AX.25
  • Reasons for learning to speak it
  • Intended support
  • Challenges
D-RATS Overview

• Designed around simplex operation for EmComm
• Requires no, nor benefits from, D-STAR network
• Email-like messaging interface
  • XML-encoded rich message formats
  • Manual or automatic routing
  • Email gateway provided
• No central server (obviously)
<table>
<thead>
<tr>
<th>Sender</th>
<th>Recipient</th>
<th>Subject</th>
<th>Type</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>KK7DS</td>
<td>N3PUG</td>
<td>RE: GPS</td>
<td>memo</td>
<td>11:4…</td>
</tr>
<tr>
<td>KK7DS</td>
<td>N70GM-3</td>
<td>RE: RE: Winlink</td>
<td>email</td>
<td>13:3…</td>
</tr>
<tr>
<td>N70GM-3</td>
<td>WL2K:k7eaj@…</td>
<td>Second test of winlink on DRATS</td>
<td>email</td>
<td>13:3…</td>
</tr>
<tr>
<td>KK7DS</td>
<td>N70GM-3</td>
<td>Winlink</td>
<td>email</td>
<td>12:5…</td>
</tr>
<tr>
<td>KK7DS</td>
<td>K7HI0</td>
<td>RE: No error on GPS send.</td>
<td>memo</td>
<td>11:3…</td>
</tr>
<tr>
<td>KK7DS</td>
<td>K7HI0</td>
<td>EMAIL: Re: EMAIL: Re: EMAIL: ...</td>
<td>email</td>
<td>16:3…</td>
</tr>
<tr>
<td>KK7DS</td>
<td>K7HI0</td>
<td>EMAIL: Re: EMAIL: test</td>
<td>email</td>
<td>16:3…</td>
</tr>
<tr>
<td>KK7DS</td>
<td>K7HI0</td>
<td>EMAIL: test</td>
<td>email</td>
<td>16:1…</td>
</tr>
<tr>
<td>KK7DS</td>
<td>VE7FKY</td>
<td>RE: RE: RE: RE: stuck email again</td>
<td>email</td>
<td>14:1…</td>
</tr>
<tr>
<td>KK7DS</td>
<td>VE7FKY</td>
<td>RE: stuck email again</td>
<td>email</td>
<td>14:1…</td>
</tr>
<tr>
<td>KK7DS</td>
<td>dsmith@danpl…</td>
<td>email test</td>
<td>email</td>
<td>13:4…</td>
</tr>
<tr>
<td>KK7DS</td>
<td>dsmith@danpl…</td>
<td>KK7DS#Unknown</td>
<td>hics260</td>
<td>13:4…</td>
</tr>
<tr>
<td>KK7DS</td>
<td>dsmith@danpl…</td>
<td>KK7DS#1</td>
<td>radio</td>
<td>13:4…</td>
</tr>
<tr>
<td>KK7DS</td>
<td>wi2k:dsmit…</td>
<td>One more</td>
<td>email</td>
<td>16:4…</td>
</tr>
<tr>
<td>KK7DS</td>
<td>wi2k:dsmit…</td>
<td>RMS</td>
<td>email</td>
<td>16:4…</td>
</tr>
</tbody>
</table>
D-RATS Messaging

• Standard Inbox, Outbox, Drafts, Sent folders
• Messages destined for local hit the Inbox
• Anything for another station goes to the Outbox
  – Outbox becomes a queue
  – Newly heard stations trigger message send
  – Internet (SMTP, WL2K) messages go immediately
• D-RATS provides SMTP/POP3 gateway
  – Easy masquerading function
  – More transparent POP3 gateway option
  – Winlink function is more transparent, both ways
Winlink 2000

• Worldwide radio email system
• Server software: CMS, RMS Packet, RMS Pactor
• Client software: Paclink, Airmail, D-RATS (!)
• Depends on the internet
  • Expects self-healing nature to work properly
  • Bypass local outages with HF to unaffected areas
Winlink 2000 (cont’d)

- Four (or so) globally-synchronized CMS servers
  - Handle incoming and outgoing mail
  - Synchronize the “picked up” flag on each
- RMS stations around the world
  - Interface RF (Packet, Pactor) to internet (CMS)
  - Can have “relay” option for queuing messages
- Everything speaks “B2F” protocol
  - Serves a similar purpose as SMTP (kinda)
  - B2F uses LZHUF compression
Winlink 2000 Messages

Mid: 12345_K4CJX
Date: 1999/09/22 14:33
Type: Private
From: SMTP:someone@isp.com
To: KK7DS
Cc: W1AW
Subject: Test message
Body: 14

This is a test

<?xml version="1.0"?>
<form id="email">
    <title>Email Message</title>
    <field id="subject">
        <caption>Subject</caption>
        <entry type="text">
            Test message
        </entry>
    </field>
    <field id="message">
        <caption>Message</caption>
        <entry type="multiline">
            This is a test
        </entry>
    </field>
</form>
Winlink 2000 – B2

<- Callsign :
  -> KK7DS
<- Password :
  -> CMSTELNET
<- [WL2K-2.4.0.4-B2FIHJM$]
  -> [DRATS-0.3.3b4-B2FHIM$]
<- SanDiego CMS >
  -> FF
<- FC EM BKQRTVNLZYMH 197 160 0
<- F> 14
  -> FS Y
*** Message Transfer ***
  -> FQ
Winlink 2000 Challenges

• What to do with cc: header?
  • D-RATS can’t really handle this properly
• Message ID – 12 alpha digits, no namespace
• LZHUF compression:
  • Ancient 16-bit DOS code, original breaks in 32-bit land without modification
  • Slow, obscure, inefficient, limited input size
  • Questionable origin and copyright grant
• How to handle D-RATS rich forms on WL2K?
D-RATS Support for WL2K

- Easily check your Winlink mail:
  - Local internet connection
  - Through a remote station with a connection
- With AGWPE, via AX.25 to a local RMS
- Address D-RATS messages to route via WL2K: WL2K:W1AW, WL2K:foo@bar.com, etc
- Issues may arise with CC’d messages, etc
- Provides a reasonable gateway for D-RATS users
AX.25 Support – Why?

• D-RATS already supports bare TNCs for users without D-STAR
  • No AX.25, thus no digipeating
  • Raw D-RATS frame stuffed into a KISS frame
  • Ability to use higher-speed (9600+) modems
• Easy to wrap D-RATS frames in AX.25 UI frames
• Existing digipeater resources could be used
• Integrate APRS, DPRS, and the D-RATS map
Intended support in D-RATS

• KISS TNC mode, D-RATS frames
• KISS TNC mode, AX.25 UI frames
• Rough AGWPE support
• APRS TX/RX (?)
• No support for:
  • AX.25 Layer 3 (this means no nodes)
  • Message forwarding to existing BBSes
  • Non-KISS TNCs
KISS Framing

- Frame delimited on either side with FEND
- FESC indicates an escaped value in next byte:
  - TFEND: FEND in the original stream
  - TFESC: FESC in the original stream
- No flow control, no checksumming, 8-bit clean
- Values:
  - FEND: 0xC0   FEND: 0xDB
  - TFEND: 0xDC   TFESC: 0xDD
- D-RATS does something similar on D-STAR radios
AX.25 Encapsulation

<table>
<thead>
<tr>
<th>Flag</th>
<th>Address</th>
<th>Control</th>
<th>PID</th>
<th>Data</th>
<th>FCS</th>
<th>Flag</th>
</tr>
</thead>
</table>

**AX.25 Information Frame**

<table>
<thead>
<tr>
<th>S Flag</th>
<th>Magic</th>
<th>Seq</th>
<th>Session</th>
<th>Type</th>
<th>ChkSum</th>
<th>Len</th>
<th>SRC</th>
<th>DST</th>
<th>Data</th>
<th>E Flag</th>
</tr>
</thead>
</table>

**D-RATS Frame**
AX.25 Encapsulation (beta)

- Currently the entire D-RATS frame in AX.25 UI
- Duplicates:
  - Source and Destination address
  - Flags and checksum
- Planned improvements:
  - Alternate packet format when using AX.25
  - Use native AX.25 addressing, FCS fields
  - “Ratflector” could translate between the two
Challenges

• TNC buffers are small
  • D-RATS designed for D-STAR “stream”
  • Generic block fragmentation scheme needed
  • Tuning required to avoid “slow start” from increasing block size too much

• Digipeaters change timing

• Lessons learned:
  • The TNC does the HDLC (bitstuffing, flag bytes)
  • Debugging is easier with a PK-96!