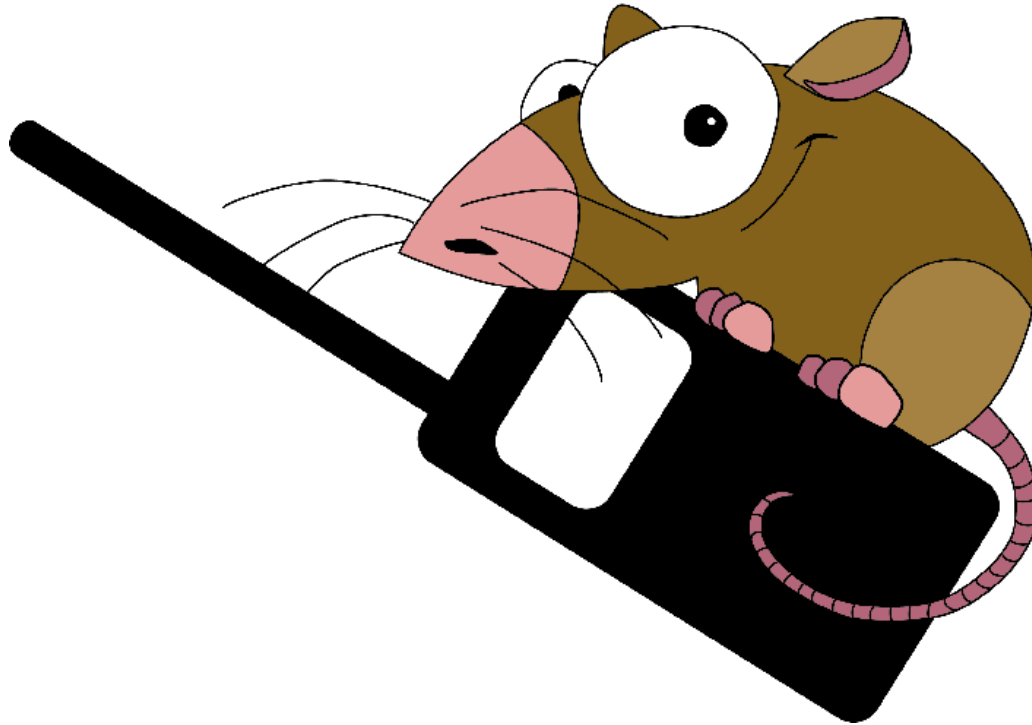# D-RATS:
Speaking Winlink and AX.25

ARRL/TAPR DCC 2010

Dan Smith - KK7DS

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)

D-RATS

File   View   Help

Messages | Chat | Files | Event Log | **Stations (0)**

	Sender	Recipient	Subject	Type	Date ▲
✉	**KK7DS**	**N3PUG**	**RE: GPS**	memo	**11:4···**
✉	KK7DS	N7OGM-3	RE: RE: Winlink	email	13:3···
✉	**N7OGM-3**	**WL2K:k7eaj@···**	**Second test of winlink on DRATS**	email	**13:3···**
✉	KK7DS	N7OGM-3	Winlink	email	12:5···
✉	**KK7DS**	**N7OGM-3**	**RE: No error on GPS send.**	memo	**11:3···**
✉	**KK7DS**	**K7HIO**		memo	**17:0···**
✉	**KK7DS**	**K7HIO**	**EMAIL: Re: EMAIL: Re: EMAIL: ···**	email	**16:3···**
✉	**KK7DS**	**K7HIO**	**EMAIL: Re: EMAIL: test**	email	**16:3···**
✉	**KK7DS**	**K7HIO**	**EMAIL: test**	email	**16:3···**
✉	**KK7DS**	**K7HIO**	**EMAIL: test**	email	**16:1···**
✉	**KK7DS**	**VE7FKY**	**RE: RE: RE: RE: RE: RE: RE: stu···**	email	**14:2···**
✉	**KK7DS**	**VE7FKY**	**RE: RE: RE: RE: RE: stuck email···**	email	**14:1···**
✉	**KK7DS**	**VE7FKY**	**RE: RE: RE: stuck email again**	email	**14:1···**
✉	**KK7DS**	**VE7FKY**	**RE: stuck email again**	email	**14:1···**
✉	**KK7DS**	**dsmith@danpl···**	**email test**	email	**13:4···**
✉	**KK7DS**	**dsmith@danpl···**	**KK7DS#Unknown**	hics260	**13:4···**
✉	**KK7DS**	**dsmith@danpl···**	**KK7DS#1**	radio···	**13:4···**
✉	**KK7DS**	**wl2k:dsmith···**	**One more**	email	**16:4···**
✉	**KK7DS**	**wl2k:dsmith···**	**RMS**	email	**16:4···**

Folders:
- Drafts
- Inbox
  - Archive
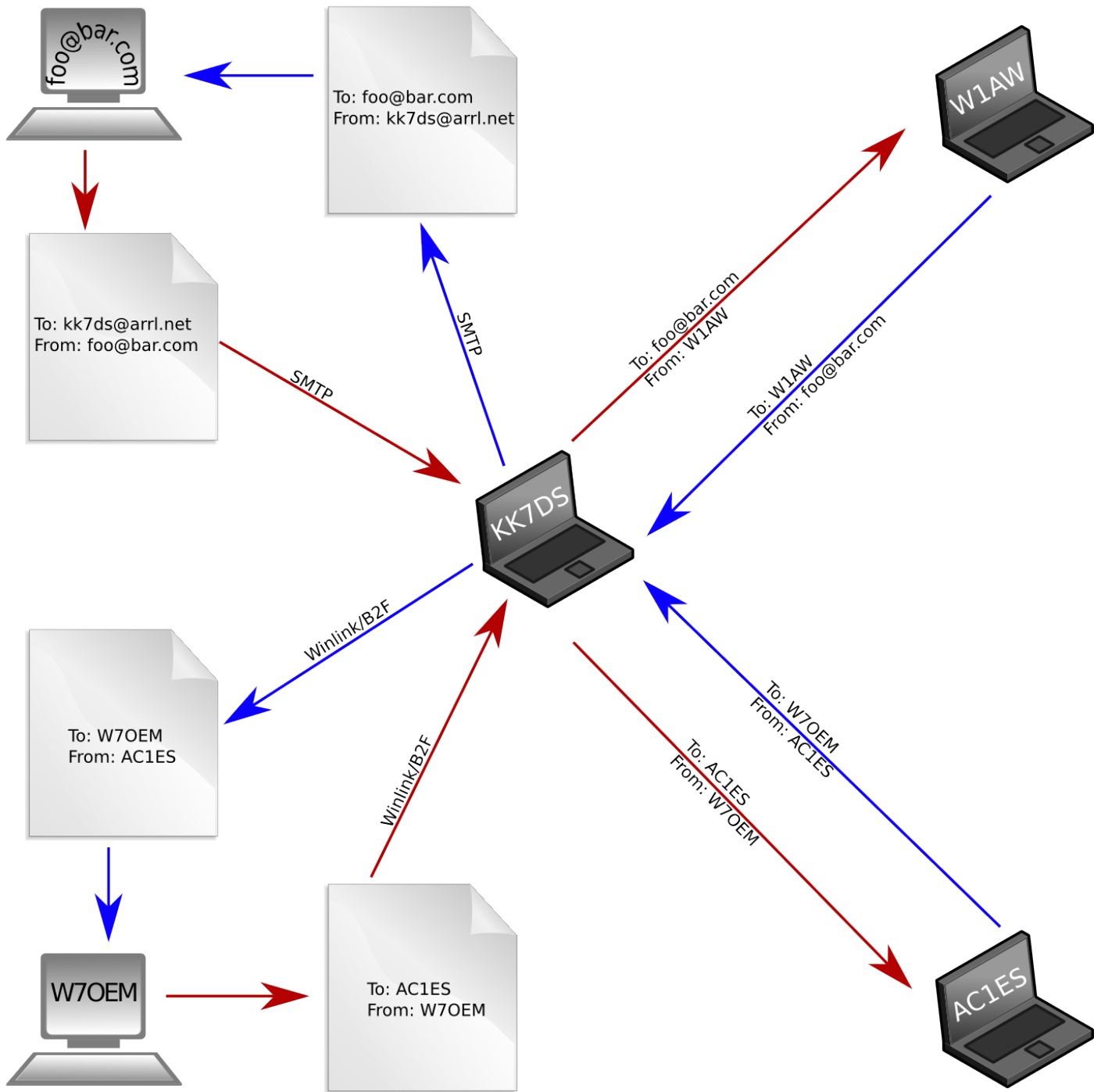- Outbox
- Sent
- Trash

My Status

Unattended ▼

Not around

KK7DS

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

D-RATS

foo@bar.com

To: foo@bar.com
From: kk7ds@arrl.net

W1AW

To: kk7ds@arrl.net
From: foo@bar.com

SMTP

SMTP

To: foo@bar.com
From: W1AW

To: W1AW
From: foo@bar.com

KK7DS

Winlink/B2F

Winlink/B2F

To: W7OEM
From: AC1ES

To: W7OEM
From: AC1ES

To: AC1ES
From: W7OEM

W7OEM

To: AC1ES
From: W7OEM
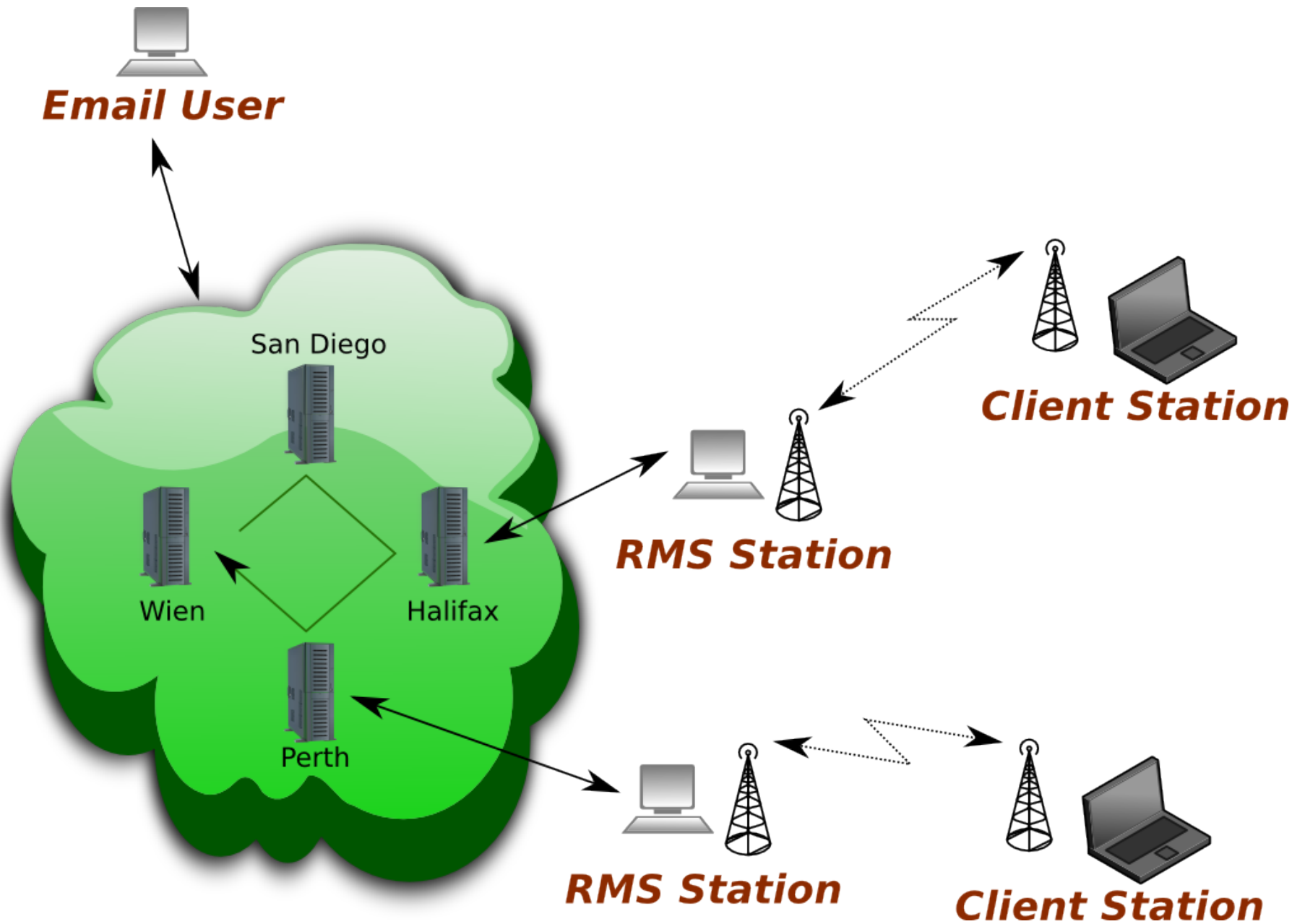
AC1ES

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

Email User

San Diego

Wien   Halifax

Perth

RMS Station

Client Station

RMS Station

Client Station

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
<?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>
```

D-RATS

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
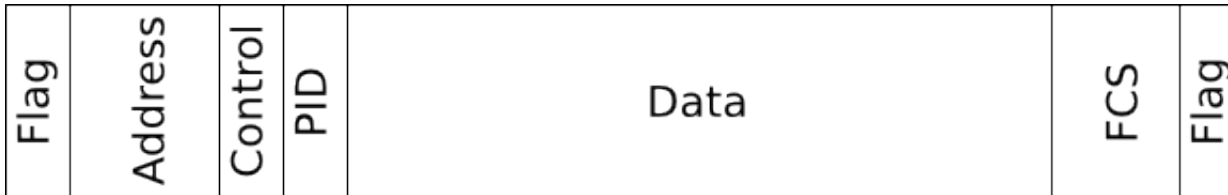
    - Non-KISS TNCs

D-RATS

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`

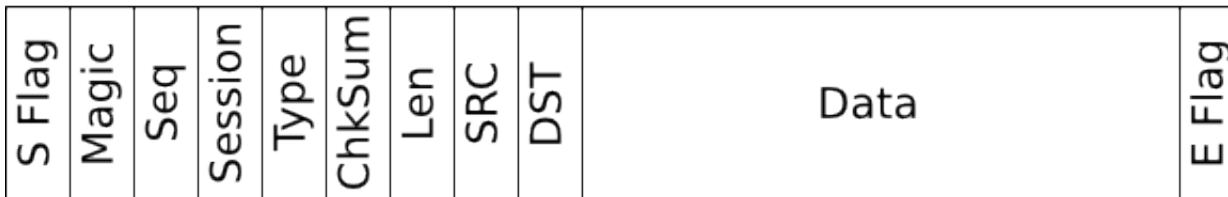- D-RATS does something similar on D-STAR radios

AX.25 Encapsulation

Flag	Address	Control	PID	Data	FCS	Flag

AX.25 Information Frame

S Flag	Magic	Seq	Session	Type	ChkSum	Len	SRC	DST	Data	E Flag

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 mprovements:

  - 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!