

K5TIT



Texas
Interconnect
Team



D-STAR

Under the Covers

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- WNOFEW – 1971
- WBOFEW (Advanced) – 1972
- RTTY – 1972
- Packet – 1986
- APRS – 1996
- AE5PL (Extra) – 2000
- Author – javAPRSSrvr – 2002
- Author – DStarMonitor – 2005
- Author – D-PRS – 2005

D-STAR 101



- D-STAR owned by JARL
 - Not owned by vendors
 - Not Public Domain
 - Is Open Protocol
- Disclaimer
 - Not going to debate “what should be” or “why didn’t they...”

D-STAR 101



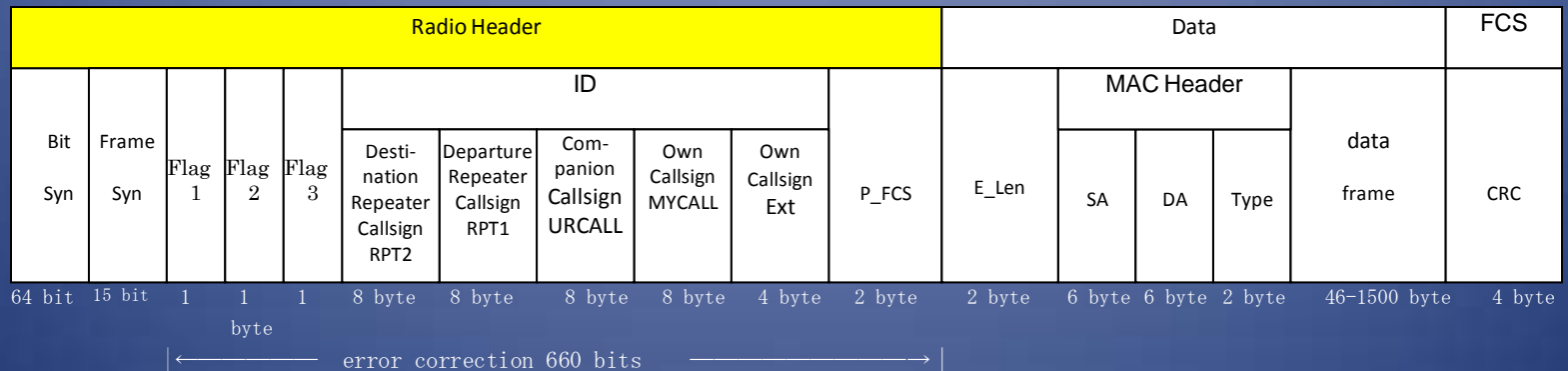
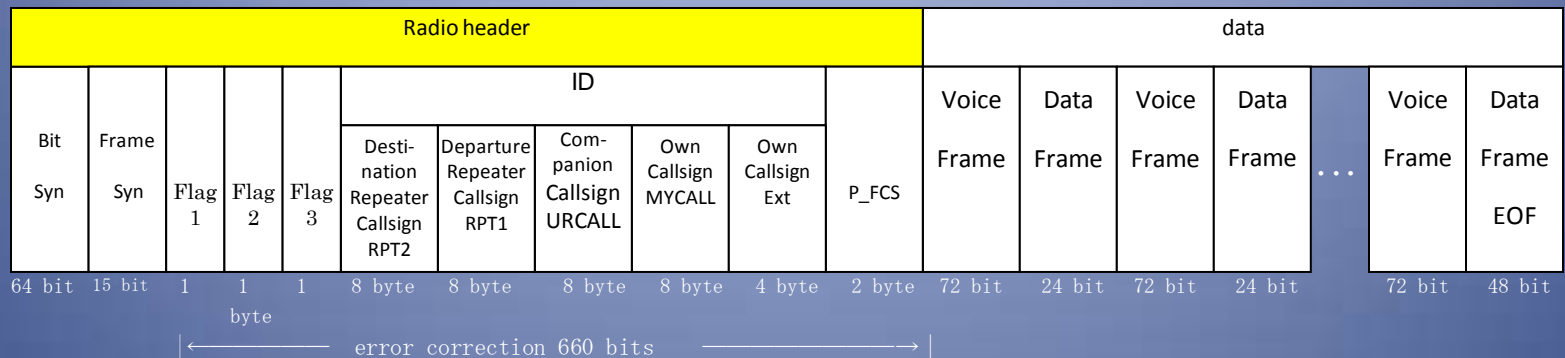
- D-STAR Digital **Voice** (DV)
 - 3600 bps dedicated to AMBE voice and FEC (72 bit voice frames)
 - 1200 bps designated for synchronization and undefined (24 bit data frames)
 - Icom defines signaling and text services
 - About 900 unprotected bps for radio-defined usage

D-STAR 101



- D-STAR Digital **Data**(DD)
 - Ethernet bridge
 - Available only on Icom ID-1 (1.2 GHz)
 - Direct Ethernet 10 base T connection between radio and computer/router
 - Radio does not have an IP address
 - DD “Repeater” is half-duplex Access Point

Bit Stream Format



RF Header Key Factors



- Flags indicate type of D-STAR transmission and miscellaneous control information.
- “Own Callsign” 1 & 2 (extension) must never be modified after transmission.
- “Companion Callsign” is the station intended to hear the transmission.
 - “Companion Callsign” is used solely for D-STAR routing
- “Departure Repeater Callsign” is the repeater local to the transmitting station.
- **“Destination Repeater Callsign” is the “second” “repeater” the transmission is to pass to/through. This will normally be the local gateway or blank (spaces).**
- No other routing information is contained in the D-STAR protocol. None may be added as any additions would break the existing networks.
- No modification of the RF header is allowed on RF (repeaters, etc. must leave the header intact).

RF Header

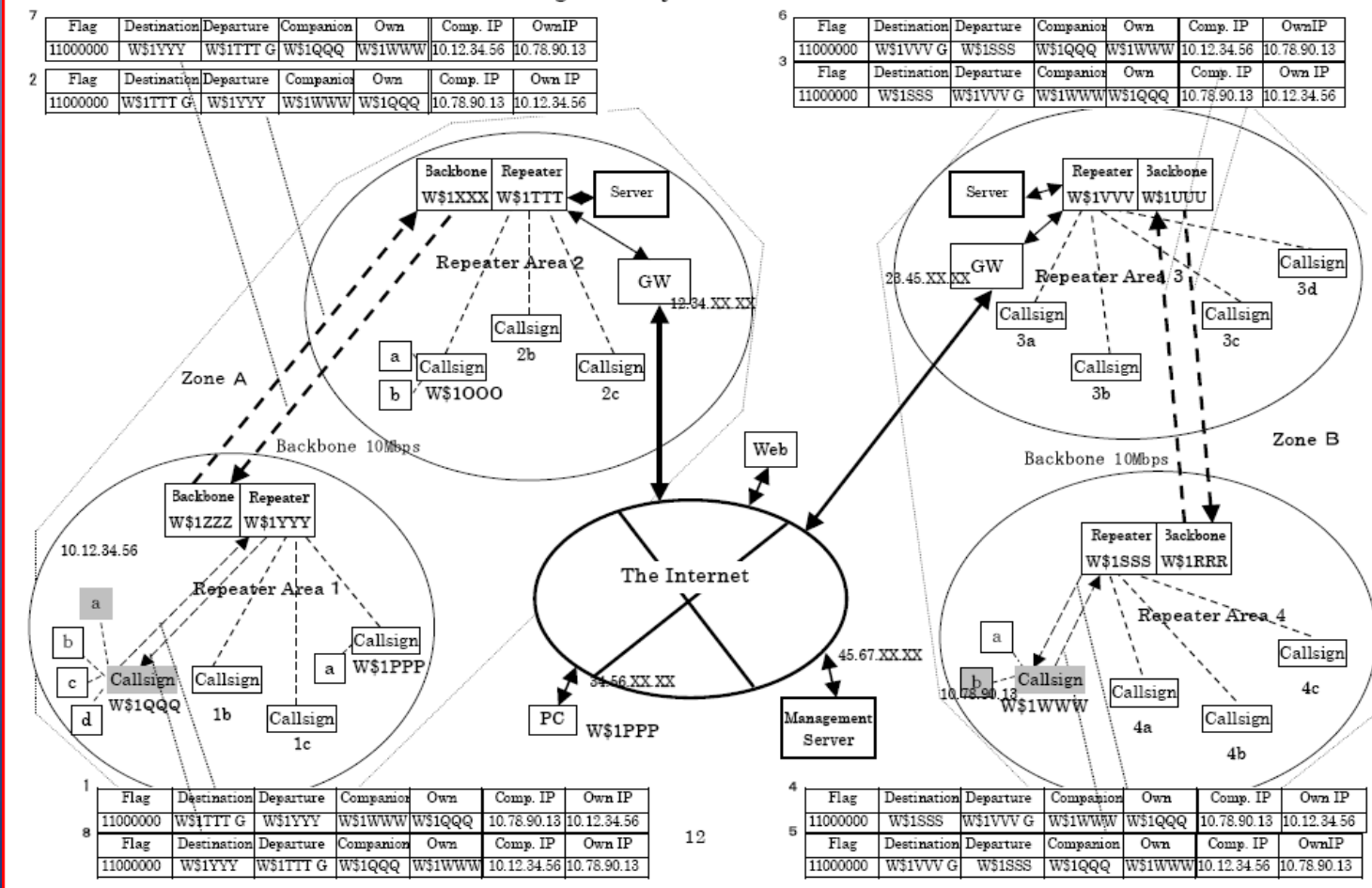


- Protected by FEC and FCS
- Critical for all routing
- Defines only the current transmission
- Sole transmission identification mechanism
- Non-protocol manipulation breaks protocol

Network Definition



Figure of System constitution



Routing Key Factors



- Simplex uses only “Own Callsign” and “Companion Callsign”. The repeater callsigns are set to spaces. “CQCQCQ ” is the universal “calling everyone” callsign and ID for the “Companion Callsign” only.
- Local repeater use sets only the “Departure Repeater Callsign” repeater. “Destination Repeater Callsign” is set to spaces.
- **Accessing the gateway requires the local repeater in “Departure Repeater Callsign” and the local gateway in “Destination Repeater Callsign”.**
- **Routing outside of the local zone requires programming the radio to access the gateway.**
- Inter-zone and inter-area routing by station callsign and ID requires the radio to be programmed to access the gateway.
- Inter-zone and inter-area routing using the slash with a repeater callsign and ID requires the radio to be programmed to access the gateway.
- DD routing based on assigned 10.0.0.0/8 IP address requires the radio to be programmed to access the gateway.
- **Routing is unidirectional. Responding station(s) must program their radios correctly to reach the calling station.**
 - **D-STAR routing is not linking, it is routing of the bit stream from source to destination.**
 - **Responding requires proper configuration of the responding radio.**

Icom Enhancements

FP Messages



- Front panel display of up to 20 characters can be transmitted to remote radio
- Front panel “message” is encoded within DV data frames
- Front panel “message” is not available via the radio serial port

Icom Enhancements

Serial Data



- Serial data port on all radios
 - (USB on ID-1)
- Serial data is encoded within DV data frames
- Serial data uses different encoding from front panel “message”
- MAXIMUM throughput approximately 740 bps unprotected (NO FEC/FCS) on the 4800 bps DV bit stream

Icom Enhancements

GPS (Serial Data)



- Icom implements GPS capability in VHF and UHF D-STAR radios
- GPS NMEA strings transmitted with callsign and message
- GPS & GPS-A encoded within the DV data frames as standard serial data
- GPS strings and callsign/message lines and GPS-A available on Icom serial port

Summary



- Protocol well-defined
- Some holes are being addressed by JARL
- Digital protocol, not data protocol
- Callsign addressing/routing
- Icom enhancements primarily with DV
- Icom enhancements do not break protocol
- High growth, potential for next SSB

Q&A



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