



Sorting out all the DATA TECHNIQUES
(TEXT data, not FM Codec Voice techniques)

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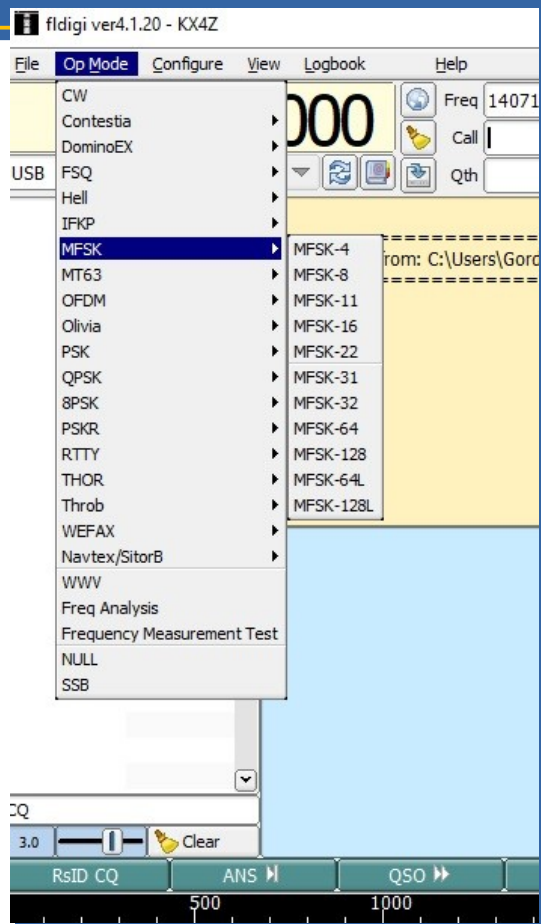
The very beginnings....

- Phone Company: Bell 103. 1962. 300baud FSK
- Phone Company: Bell 202, Bell 212A, 1200baud
- DARPA: TCP/IP (packet-based wire transmissions)
- RTTY (modulation)
- Development of amateur radio DATA communications Techniques.....Phil Karn KA9Q
- AX.25: Phil Karn took wired packets and turned to ham radio.
- Back Then: Amtor G-TOR....lots of TOR's (teletype over radio)

Broadcast Modes

- CW
- AM (amplitude modulated voice)
- SSB (invented via phasing, then filtering)
- RTTY – 2 tone mark/space, still used LOTS
- All PSK-type modes.
- FSK modes, e.g. MFSK
- Then there were literally DOZENS of modes.....

FLDIGI shows zillions of modes



Recently: Low Signal Modes

- Started with moonbounce work
- Time-locked slow tones very carefully chosen frequencies
- Eventually developed into FT8 and became the most popular DX mode on the planet
- JS8 developed for conversations
- DEVELOPED FOR SINGLE SIDE BAND!!!!!!!!!!!!!!!

Available resources on BROADCAST

- <https://qsl.net/kx4z/FLDIGICheetsheetforVolunteers.pdf>
- Talk I gave to GARS:
- <https://qsl.net/nf4rc/2021/JS8FT8Talk.pdf>
- 2010 Talk:
http://www.w3hzu.com/content/emcomm/wa3wsj_nbems.pdf
- Latest news (nbems@group.io) 6,170 topics
- <https://rsgb.org/main/get-started-in-amateur-radio/operating-your-new-station/psk31-work-the-world-with-low-power/>

NICHES FOR BROADCAST

- Any “net” operation (CW, Voice, Data)
- Special niche for DATA broadcast:
 - 1) PARTICULARLY DATA TECHNIQUES for SSB (due to enormous S/N advantages)
 - 2) Less useful on FM....no signal to noise advantage....

Classifying Techniques

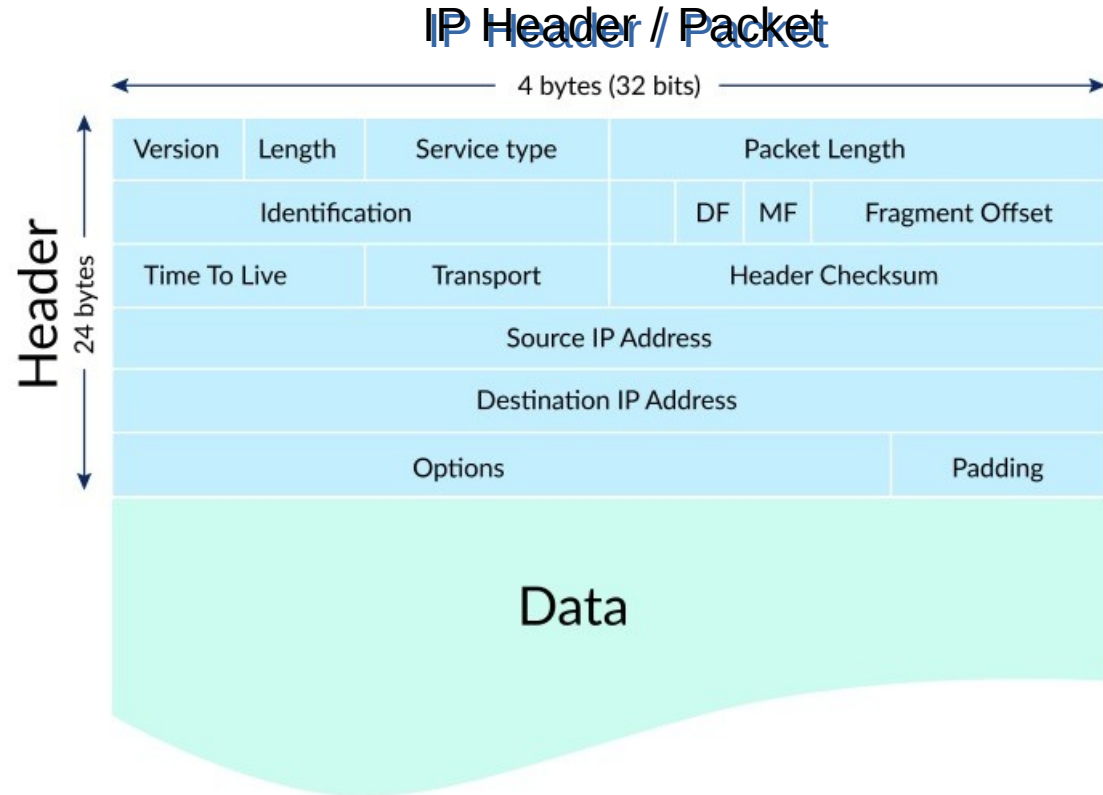
- There is no ONE classification. Instead, there are LOTS of ways to slice and dice the available techniques
- Broadcast versus ARQ
- Useful for SSB low signal versus no improvement
- Peer to peer versus GATEWAY versus BOTH
- Requires electrical connection versus audio connection OK
- Automatic forwarding versus manual forwarding

Almost any broadcast mode....ARQ

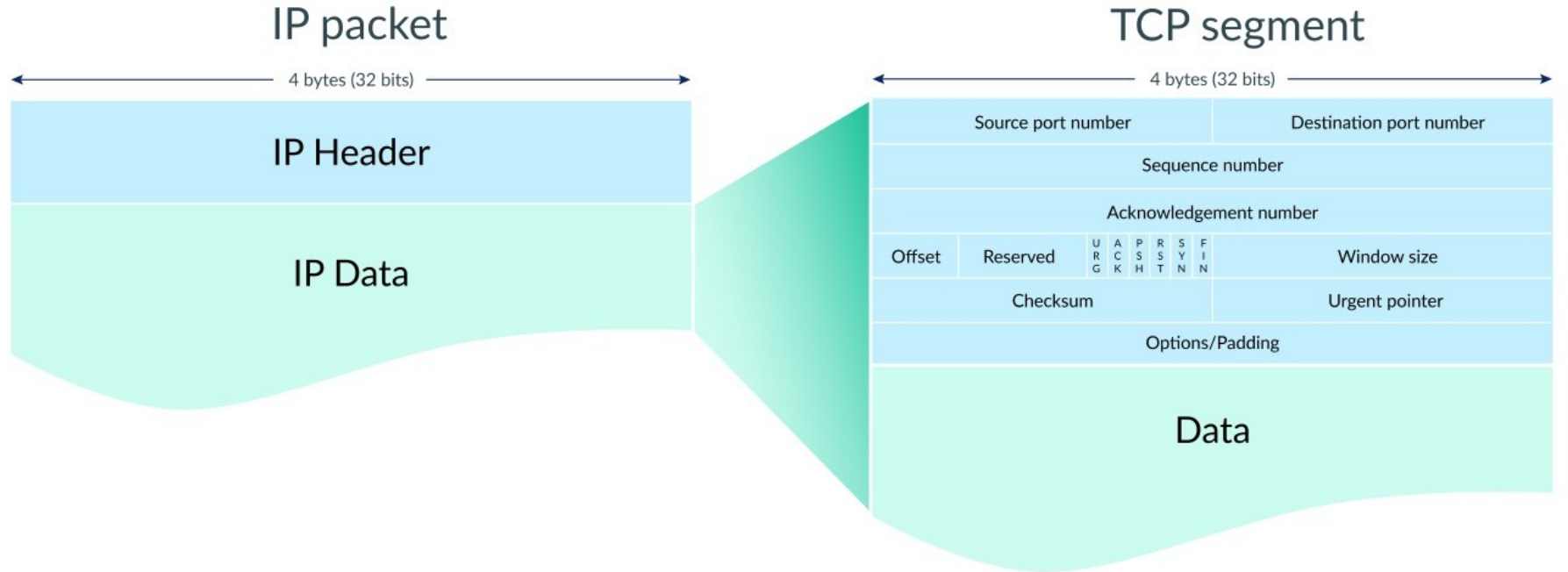
- Can be used to transport data in an ARQ protocol.
- Most famous ARQ protocol is AX.25 (Phil Karn)
- Protocol: <http://www.tapr.org/pdf/AX25.2.2.pdf>
 - STRONGLY suggest that anyone teaching data techniques read this document.
 - Explains ALL KINDS OF THINGS that you'll need to know about headers and frames.

Layers

- Both AX.25 and TCP/IP were built BEFORE the OSI layers model....but they resemble it.

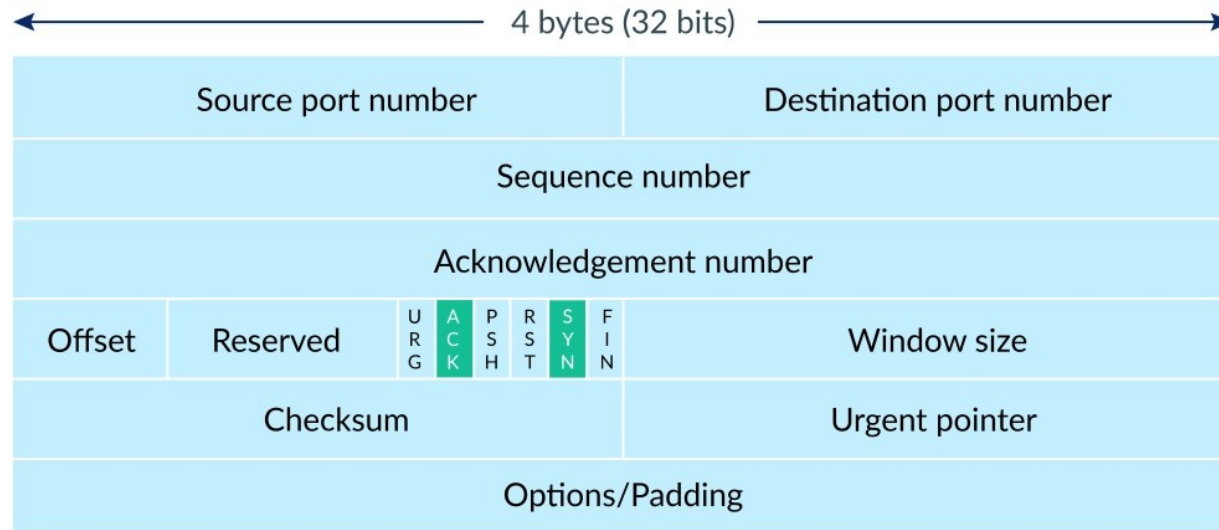


TCP provides reliability inside IP



TCP Header

The SYN and ACK bits are both part of the TCP header:



Ham radio ARQ is more lean!

- AX.25 includes much of the same, but quicker, shorter, simplified
- Source, Destination “call signs”
- Digipeating
- Acknowledgement / request for repeat
- Packet numbers to allow reassembling out of order.

NBEMS adds layers to add ARQ

- FLARQ / FLMSG provide ARQ procedures
- Peer-to-peer design
- Popular in some sections of USA
- Most literature seems to be from a decade ago
- Stronger on Red Cross forms, weaker on some others.

Available Resources on ARQ

- Older:
<https://www.qsl.net/kx4z/CreatingResidentialBackbone.pdf>
- <https://qsl.net/nf4rc/2021/SettingUpWinlinkRMS.pdf>
- <https://www.qsl.net/nf4rc/UnderstandingAudioChannelConfiguration.pdf>
- <https://www.cantab.net/users/john.wiseman/Documents/Commands.htm>
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Weak Signal: FM vs. SSB

- Weak signal modes have advantages on SSB that VASTLY ECLIPSE KILOWATT AMPLIFIERS
- Weak signal modes have revolutionized HF apartment / HOA dweller's HF participation
- FM is more common on VHF/UHF....
- My experience: NO S/N ADVANTAGE TO DATA MODES ON FM. Primary advantages are *error free* **detail** and **auto relay** abilities.

FORMAL

- Much better for unattended capture
 - Much better for detailed data (reports, attachments)
 - Emphasis on NOT REQUIRING MANUAL INTERVENTION
- 1) Nice to have peer to peer
 - 2) Even nicer to have unattended GATEWAYS
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TACTICAL vs. FORMAL

- Impossibility of running a tactical net by WINLINK!
- Difficulty of running tactical net by ARQ CHAT
- Ease of running tactical net by broadcast techniques (VOICE, broadcast data)
 - Huge S/N advantage on SSB Broadcast Data!
 - ZERO S/N advantage on FM Broadcast Data!

Influence of GEOGRAPHY

- Whatever WORKS in a geography becomes more prevalent.
- West Coast cities with high mountains outside of town can be well served by MICROWAVE.
- Florida coastal cities with dominating high rises and emplaced microwave also allow success
- OREGON with lots of mountains and valleys and very spread out population – HF (NVIS) becomes a way around the mountains.
- CITIES – voice repeaters on tall towers did very well until the advent of cell phones and texting
- Hilly terrain with lots of vegetation – per mile UHF signal losses > 25dB

Influence of Authorities

- Served Agencies just want the JOB DONE.
- Many simply develop their own radio infrastructure
- SOME have needs that exceed their staff & welcome carefully selected volunteers WHO DONT GET IN THE WAY
- Simple voice connections help with Shelters
- @ State Level, +/- on interest
- Reticence of volunteers to provide non-error-corrected data.

Craig Fugate's Big Point:

- The EOC cannot do everything simultaneously.
- Planning to do a dozen modes....means nothing will get thru.
- You plan for Primary; if not working, everyone knows to go to Secondary; if not working, everyone goes to Tertiary
- GOAL IS TO GET THE MESSAGE THRU
- Not necessarily to use every technique possible.....because no one will KNOW you have decided to transmit using XYZ technique....

Material not covered:

- Ability for individual client AX.25 soundmodem-based stations to also be a digipeater (possibly with a different SSID to be more clear?)