D-STAR

Digital Smart Technology for Amateur Radio

D-STAR Introduction

History

- Open protocol developed by the JARL (Japanese Amateur Radio League) under a grant from the Japanese Government
  - Project began about 1999
  - Specification published in 2001
  - Original documents are in Japanese, a subset have been translated into English

http://www.jarl.com/d-star/shogen.pdf

Terminology

- Digital Voice (DV)
  - 4800 bps data stream real time encoded with
    - 2400 bps voice (AMBE encoded)
    - 1200 bps Forward Error Correction (FEC) for voice
    - 1200 bps data (text messages, GPS, telemetry, etc.)
  - 6.25 kHz. Bandwidth using GMSK
- Digital Data (DD)
  - 128 kbps data stream
  - 150 kHz. Bandwidth
  - Possible extensions to other rates and bandwidths
    - E.g. 4800 bps in 6.25 kHz. (not current standard) on repeaters

Terminology

- AMBE
  - **Advanced Multi-Band Excitation** (**AMBE**) is a very powerful proprietary speech coding standard developed by Digital Voice Systems, Inc.
    (From: http://en.wikipedia.org/wiki/Advanced_Multi-Band_Excitation)
  - Converts audio to and from the digital format used in D-Star Digital Voice at 2400 bps with 1200 bps of FEC.

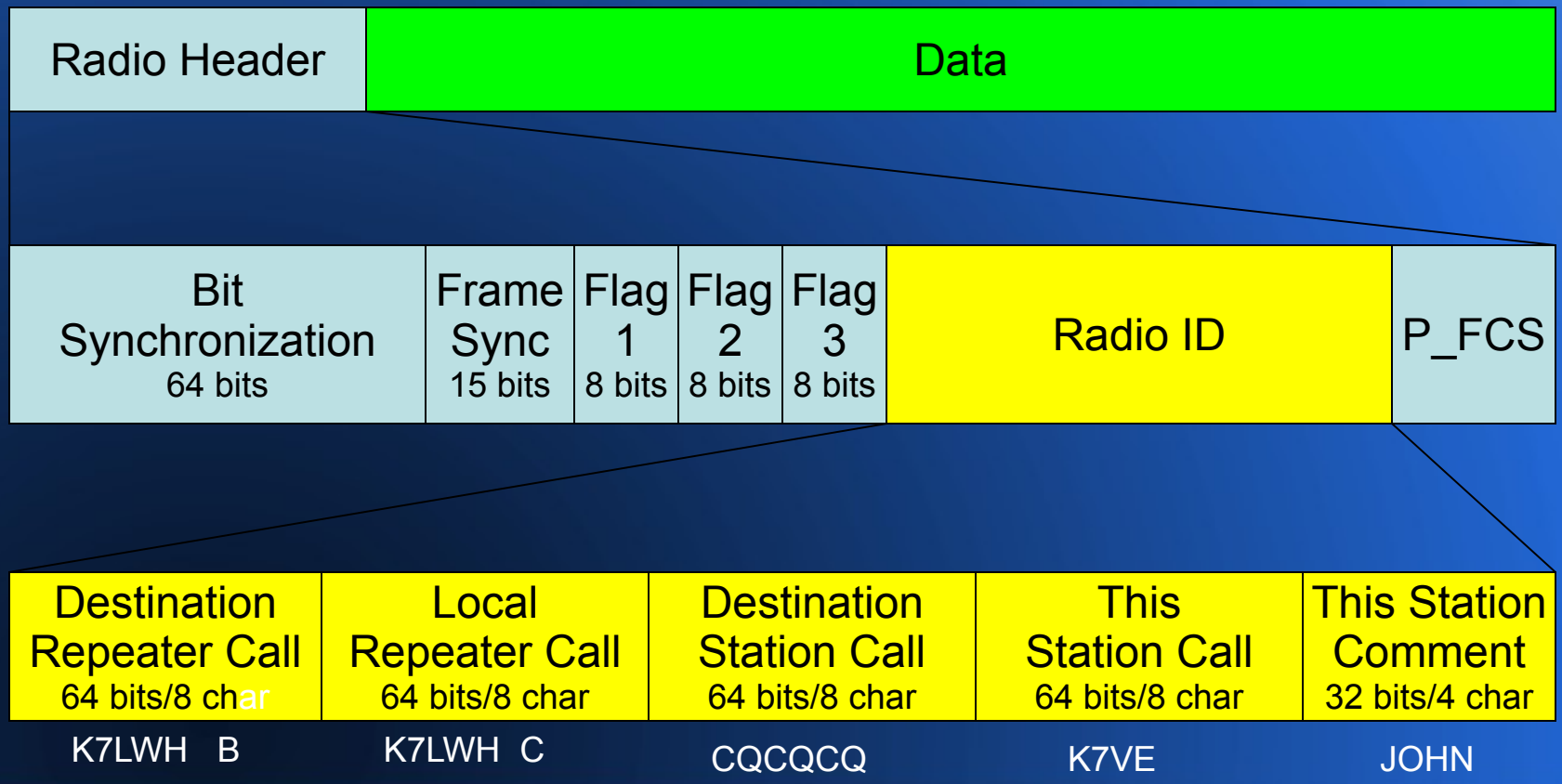
- FEC
  - Forward Error Correction

Implementations

- 2m, 70cm, 23cm Digital Voice mobile/handheld
- Soon: IC-9100 base includes 10m, 6m, 2m, 70cm, 23cm Digital Voice
- 23cm Digital Data
- 10 mbps ATM over 10 ghz.
- GMSK modems (Node Adapters and Soundcards)
- Gateways

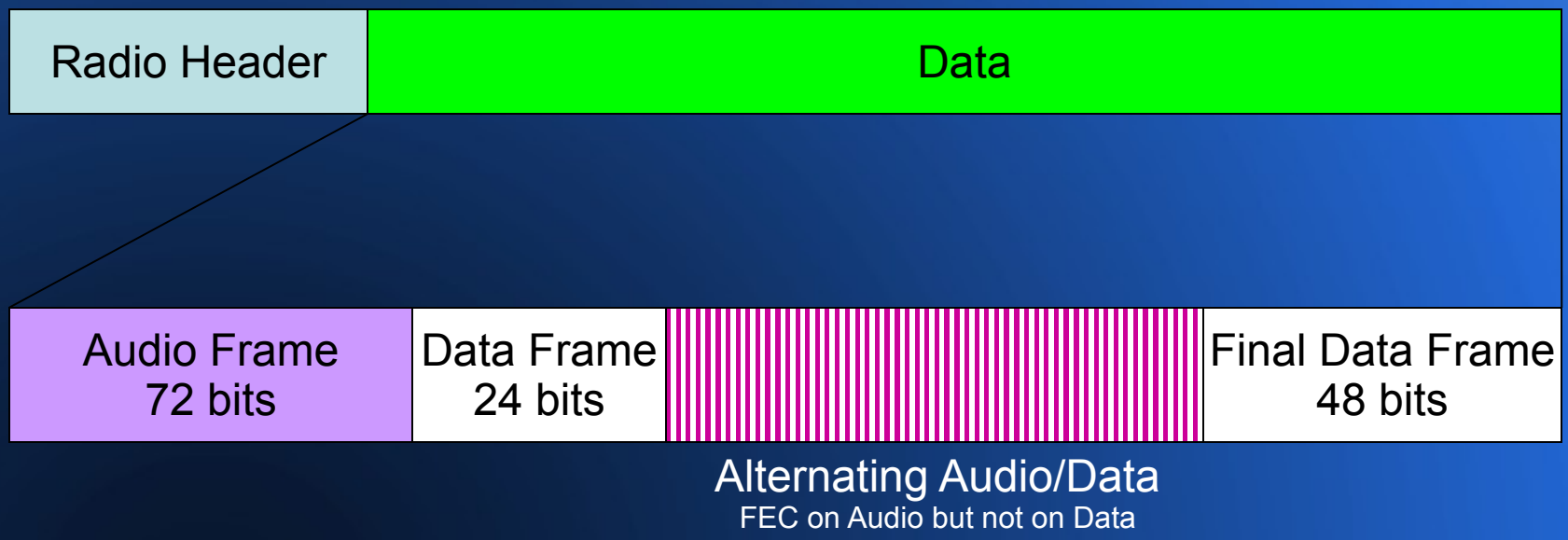
The DV Protocol

Common Air Protocol – Techie Stuff



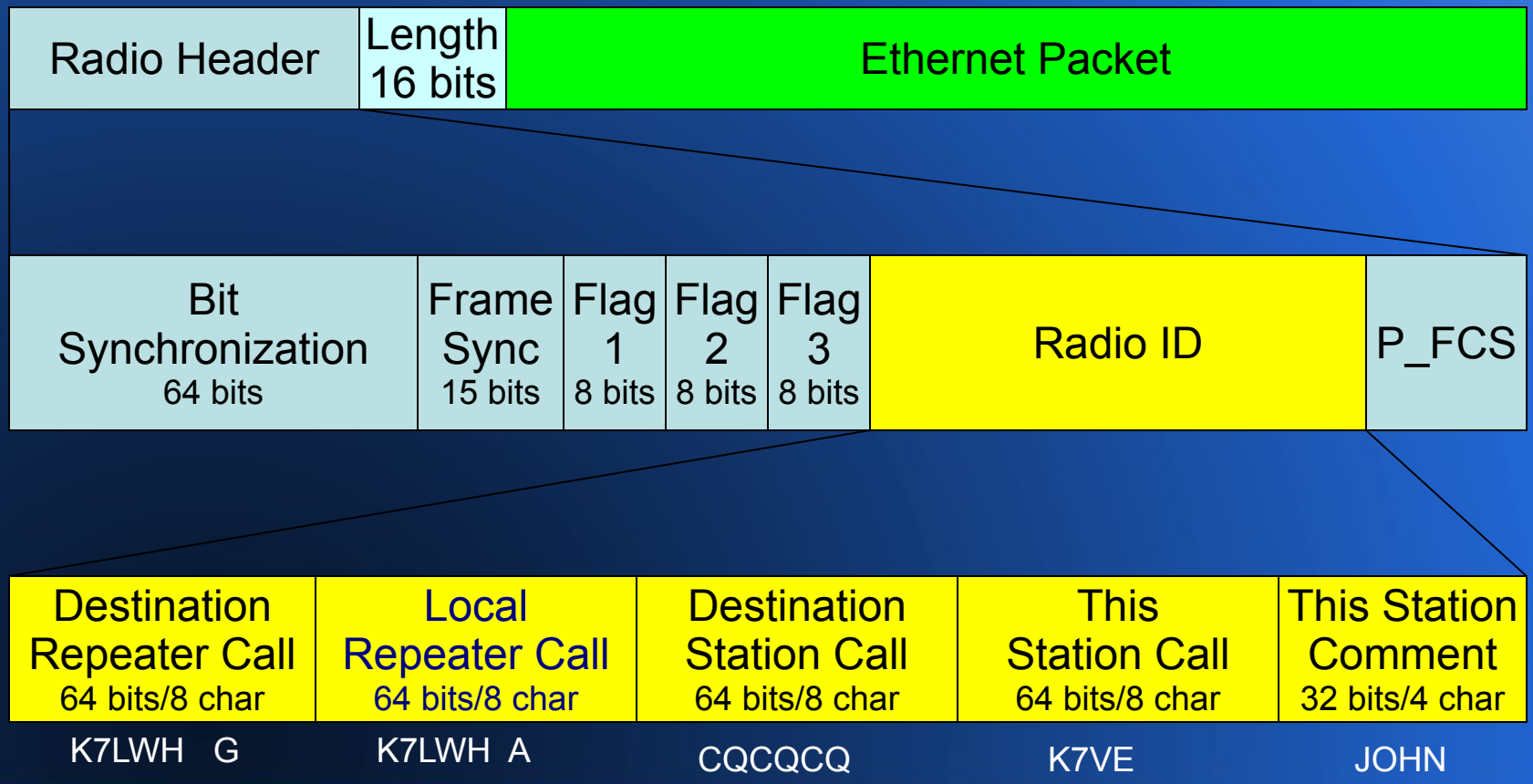
The DV Protocol

Common Air Protocol – Techie Stuff



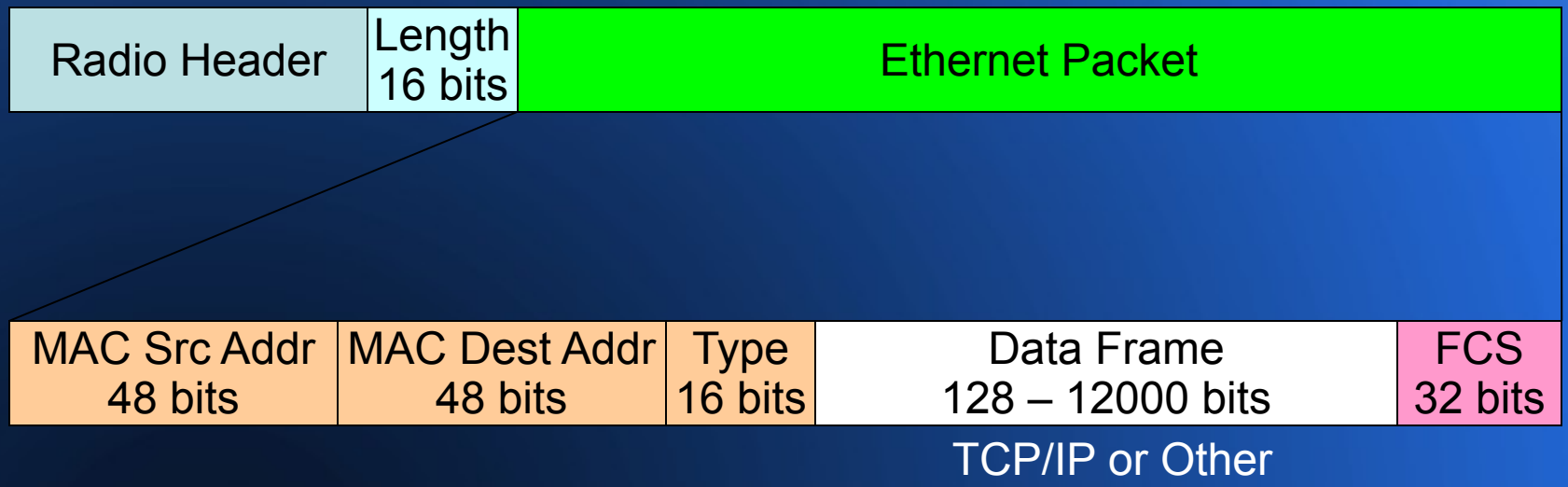
The DD Protocol

Common Air Protocol – Techie Stuff



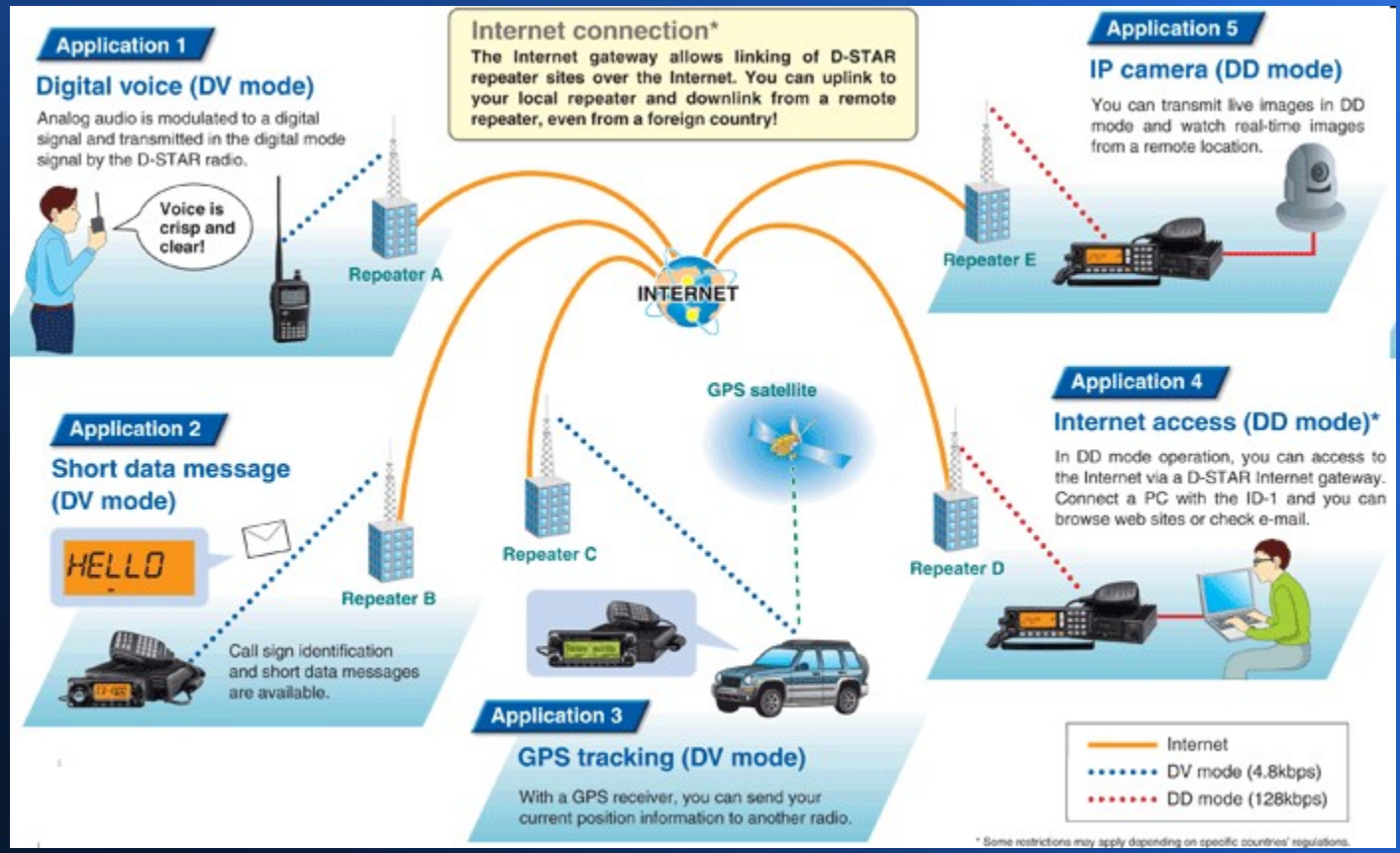
The DD Protocol

Common Air Protocol – Techie Stuff



The Internet/Gateway

Icom America Graphic



Transports

- Backbone
  - D-STAR specification:
    10 mbps data rate,10.5 mHz. bandwidth, ATM
  - Alternatively: 33 cm, 13 cm and 5 cm
    - using stock or modified Part 15 devices (WiFi/WiMax)
    - Not D-STAR Standard
- Gateway
  - Internet routing of D-Star Repeaters and APs
  - Icom
  - Non-Icom http://g4ulf.blogspot.com/

How Does DV Sound?

http://www.w2sjw.com/sounds/Weak Signal D-STAR.mp3

Sound samples courtesy KC5ZRQ

Making a Contact: Simplex

- General Call
  - Your Call: CQCQCQ
  - RPT1:
  - RPT2:
  - My Call: K7VE
- Specific Station
  - Your Call: KZ7ZZZ
  - RPT1:
  - RPT2:
  - My Call: K7VE
- Call Groups
  - 100 groups (00-99)
- General Call
  - Calling CQ
  - Roundtables/Nets
  - Most Common
- Specific Station
  - When other station is using callsign squelch
  - Send Message
- Emergency Override

Making a Contact: Local Repeater

- General Call
  - Your Call: CQCQCQ
  - RPT1: WA7GIE C
  - RPT2:
  - My Call: K7VE
- Specific Station
  - Your Call: KZ7ZZZ
  - RPT1: WA7GIE C
  - RPT2:
  - My Call: K7VE
- Call Groups
  - 100 groups (00-99)
- General Call
  - Calling CQ
  - Roundtables/Nets
  - Most Common
- Specific Station
  - When other station is using callsign squelch
  - Send Message
- Emergency Override

Making a Contact: Zone Repeater

- General Call
  - Your Call: CQCQCQ
  - RPT1: WA7GIE C
  - RPT2: WA7GIE B
  - My Call: K7VE
- Specific Station
  - Your Call: KZ7ZZZ
  - RPT1: WA7GIE C
  - RPT2: WA7GIE B
  - My Call: K7VE
- Call Groups
  - 100 groups (00-99)
- General Call
  - Calling CQ
  - Roundtables/Nets
  - Most Common
- Specific Station
  - When other station is using callsign squelch
  - Send Message
- Emergency Override

Zone Repeater Illustration

WA7GIE B

WA7GIE C

Controller

70 CM
UR: CQCQCQ
RPT1: WA7GIE B
RPT2: WA7GIE C
MY: K7VE

2 M
UR: CQCQCQ
RPT1: WA7GIE C
RPT2: WA7GIE B
MY: KC7PAA

Zone Repeater Illustration

WA7GIE B

WA7GIE C

Controller

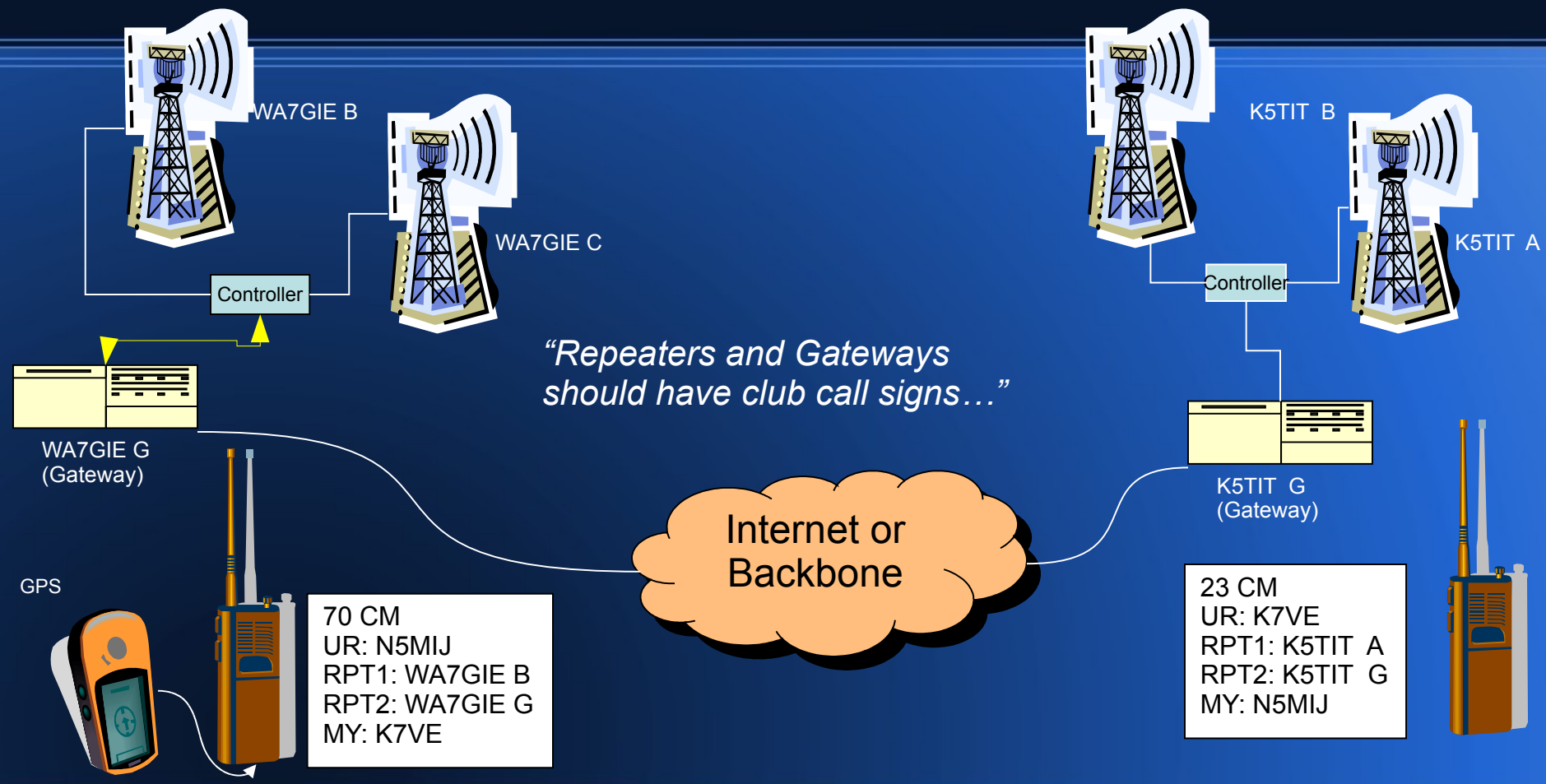
70 CM
UR: KC7PAA
RPT1: WA7GIE B
RPT2: WA7GIE C
MY: K7VE

2 M
UR: K7VE
RPT1: WA7GIE C
RPT2: WA7GIE B
MY: KC7PAA

Making a Contact: Gateway

- General Call
  - Your Call: /K5TIT
  - RPT1: WA7GIE C
  - RPT2: WA7GIE G
  - My Call: K7VE
- Specific Station
  - Your Call: KZ7ZZZ
  - RPT1: WA7GIE C
  - RPT2: WA7GIE G
  - My Call: K7VE
- General Call Through Gateway
  - Calling CQ
  - Most like IRLP
  - Be sure to give reverse routing
- Specific Station Through Gateway
  - Calling specific Station
  - Don't need to know other station's location (City, Repeater, Freq., …)
  - When other station is using callsign squelch
  - Send Message

Gateway Illustration



DPLUS Linking

- Created by Robin, AA4RC
- Shim between the Gateway, Network, and Controller
- Acts more like traditional RF linking or IRLP/Echolink
- Conference Bridges
- DV Dongles
- DVAP and DVAR Hotspot

DPLUS Linking Commands

- NW7DR E – Local Gateway Echo Test
- NW7DR I – Local Gateway Status
- WA1XXXBL – Link to WA1XXX Module B
- .....U – Unlink (Gateway or Reflector)
- REF035CL – Link to Reflector 035 Module C

(Substitute Local and Remote Callsigns)

D-PRS

- D-STAR – Position Reporting System
  D-PRS is a Trademark of Icom America
- It is not APRS but reports into APRS-IS
- It uses the interleaved data of DV
- Two modes GPS and GPS-A
- Not error corrected
- DO NOT BEACON ON REPEATER!
  Your position is continuously reported every time you key the microphone.
  You will cause “roger beeps” on everyone’s radios when you beacon
- JFINDU Reporting Example (If WiFi is working)

Interesting Developments

- G4ULF implementation of compatible repeater and gateway - NI-STAR
- Node Adapters
- Radio Kits (Dutch Star in the Netherlands)
- 6M/10M D-STAR (IC-9100 HF/VHF/UHF/SHF Multimode Radio)
- Multi-Trust
- IRCDDB

Questions