



# D-STAR

A New Way to Communicate



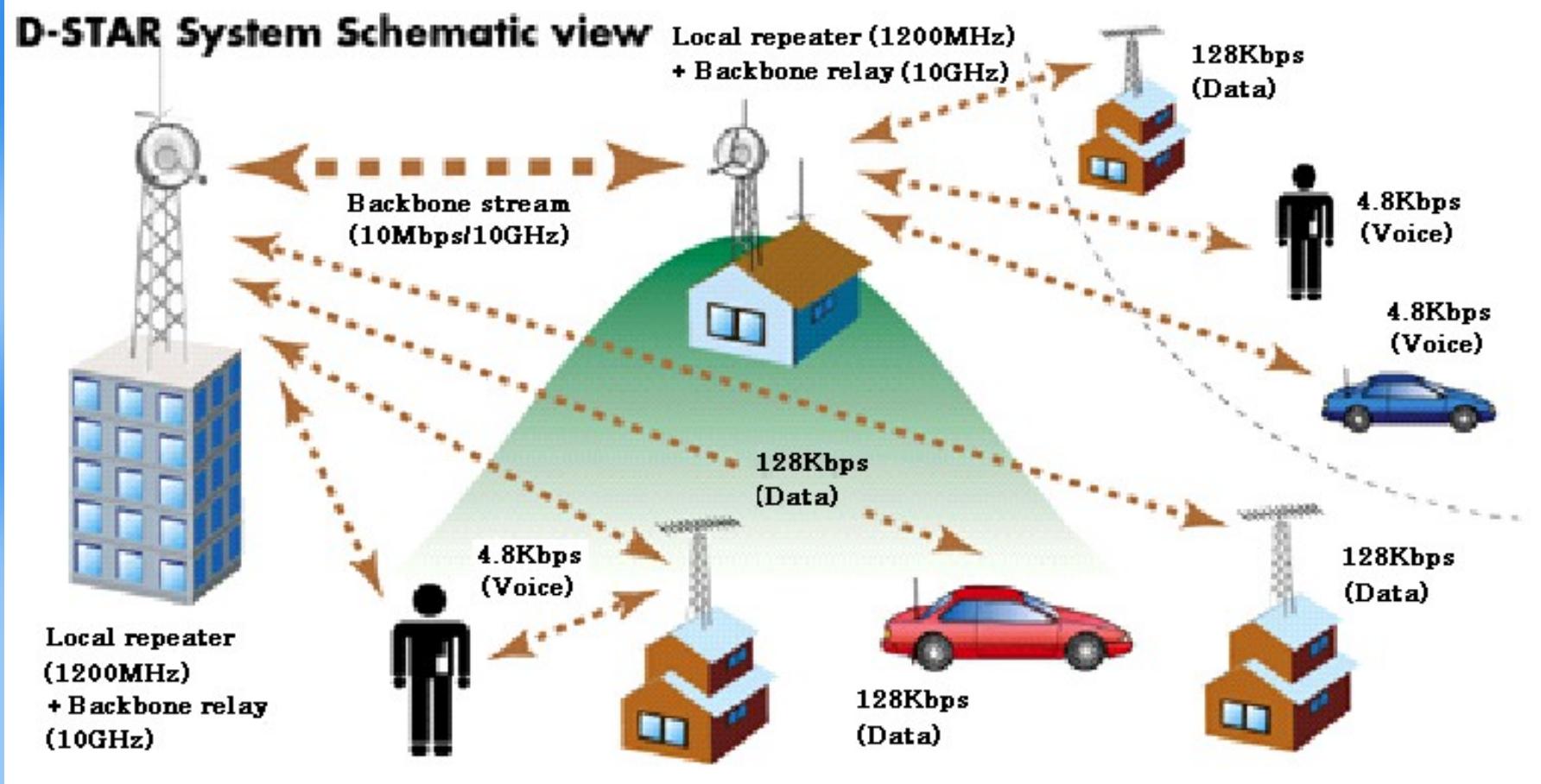
# Digital Radio System

Open System

Not Encrypted

JARL

## D-STAR System Schematic view





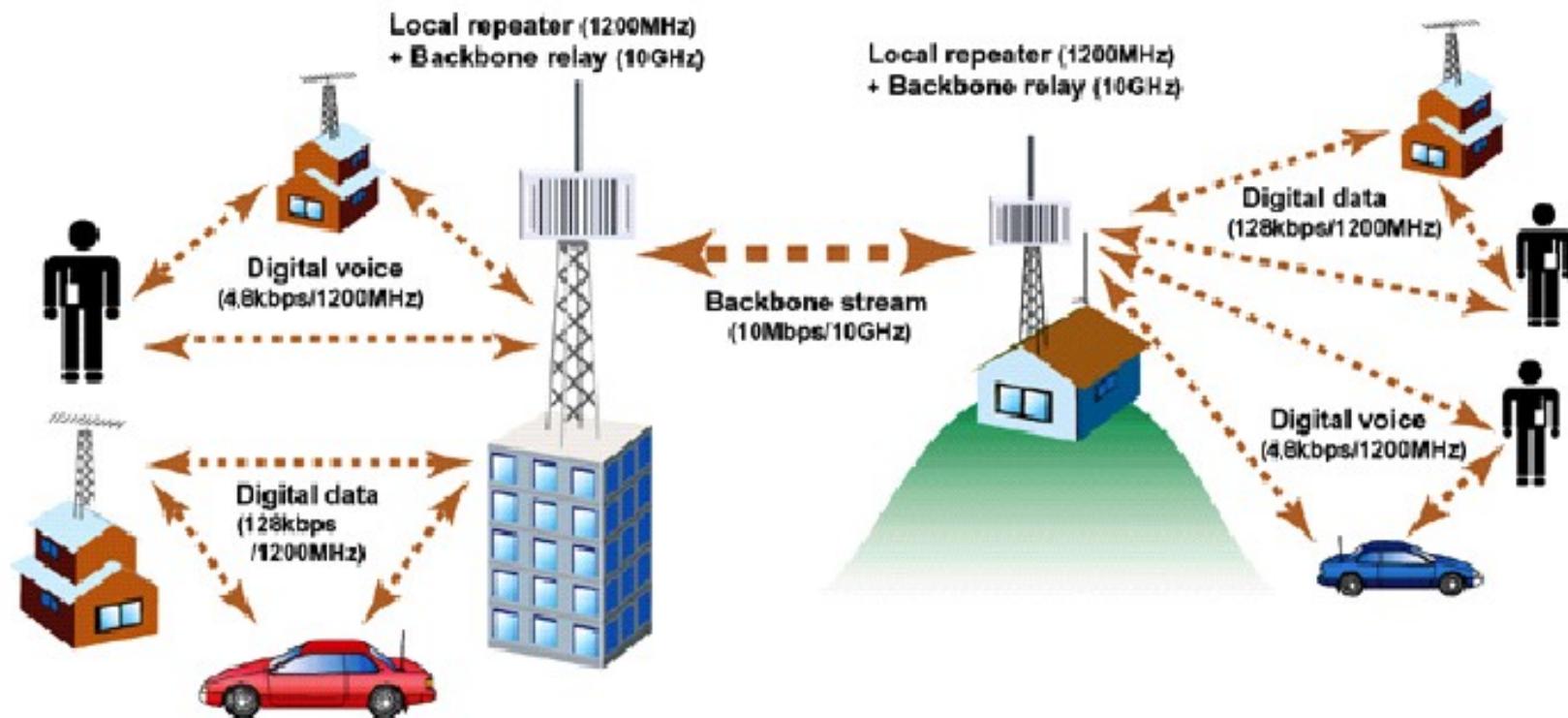
## Requirements of an Amateur Radio Digital System

- The terminal is **not heavily restricted by the system**
- **Compatibility with the Internet**
- Necessity for user's to be able to make by **themselves**
- Operation as a single system with sequential expansion possible via **infrastructure maintenance** .
- Necessity for communication with existing analog systems



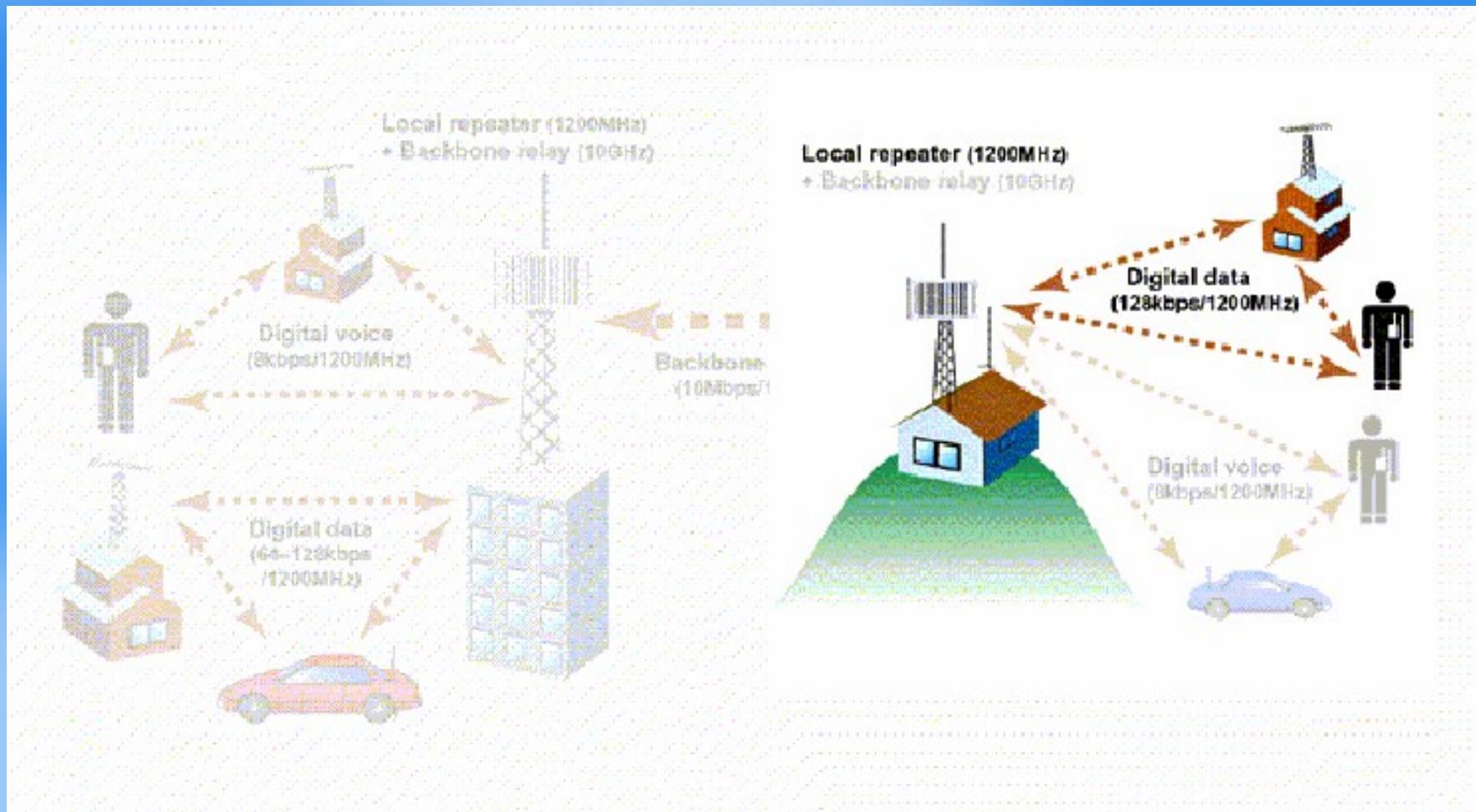
# Simplex Repeaters Backbone

Digital Voice  
High Speed Data



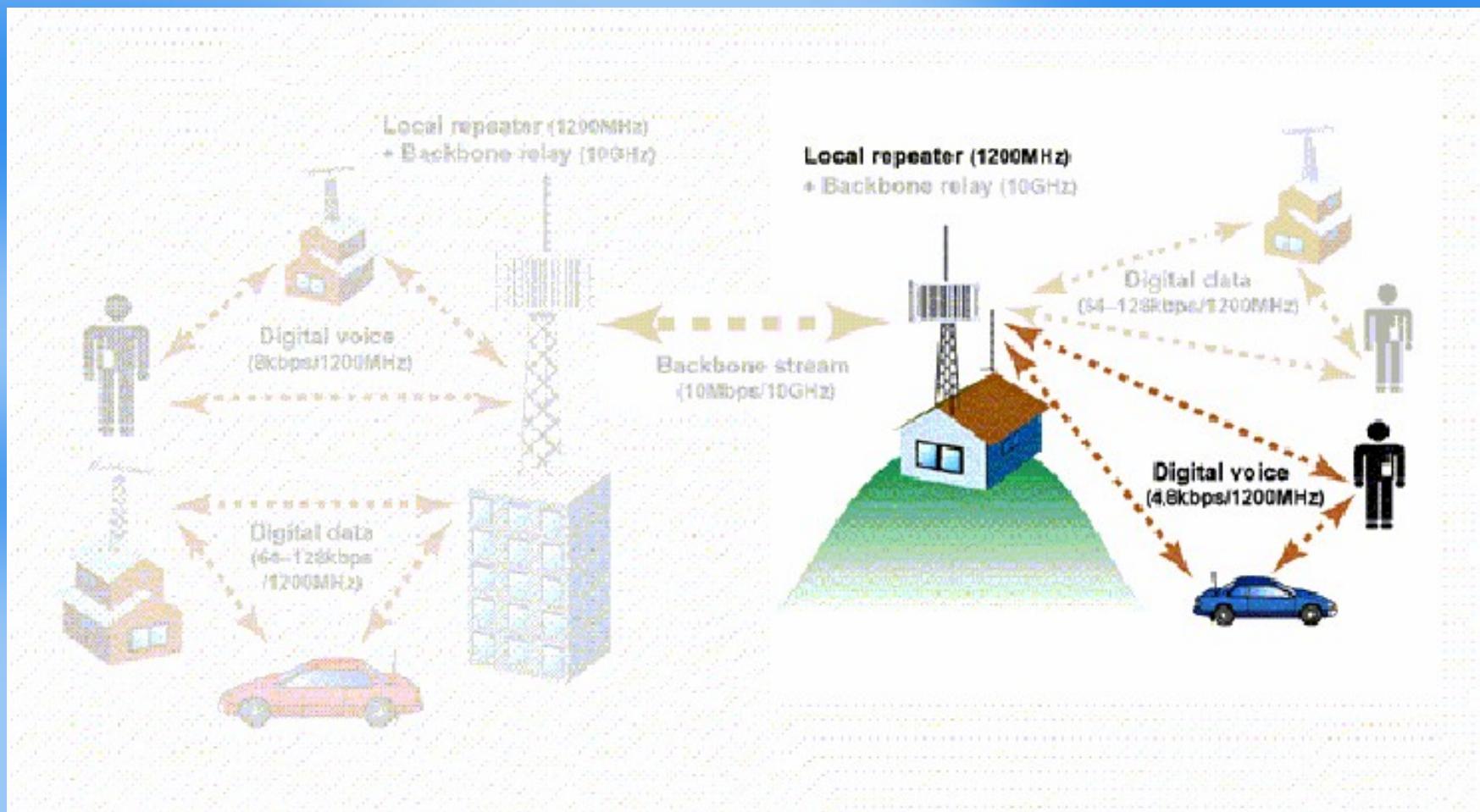


## Digital data communication via local repeater.



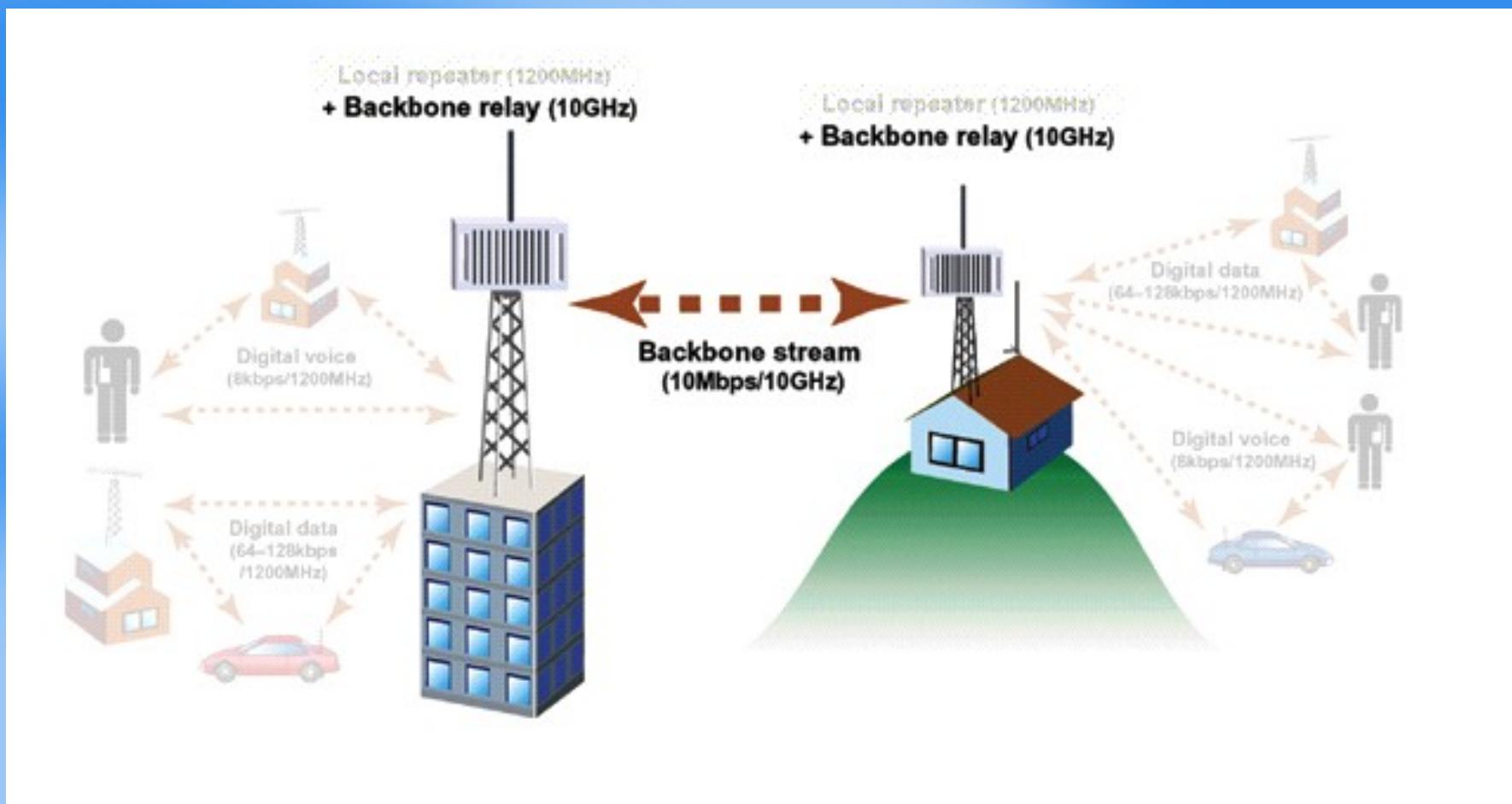


## Digital voice communication via local repeater.



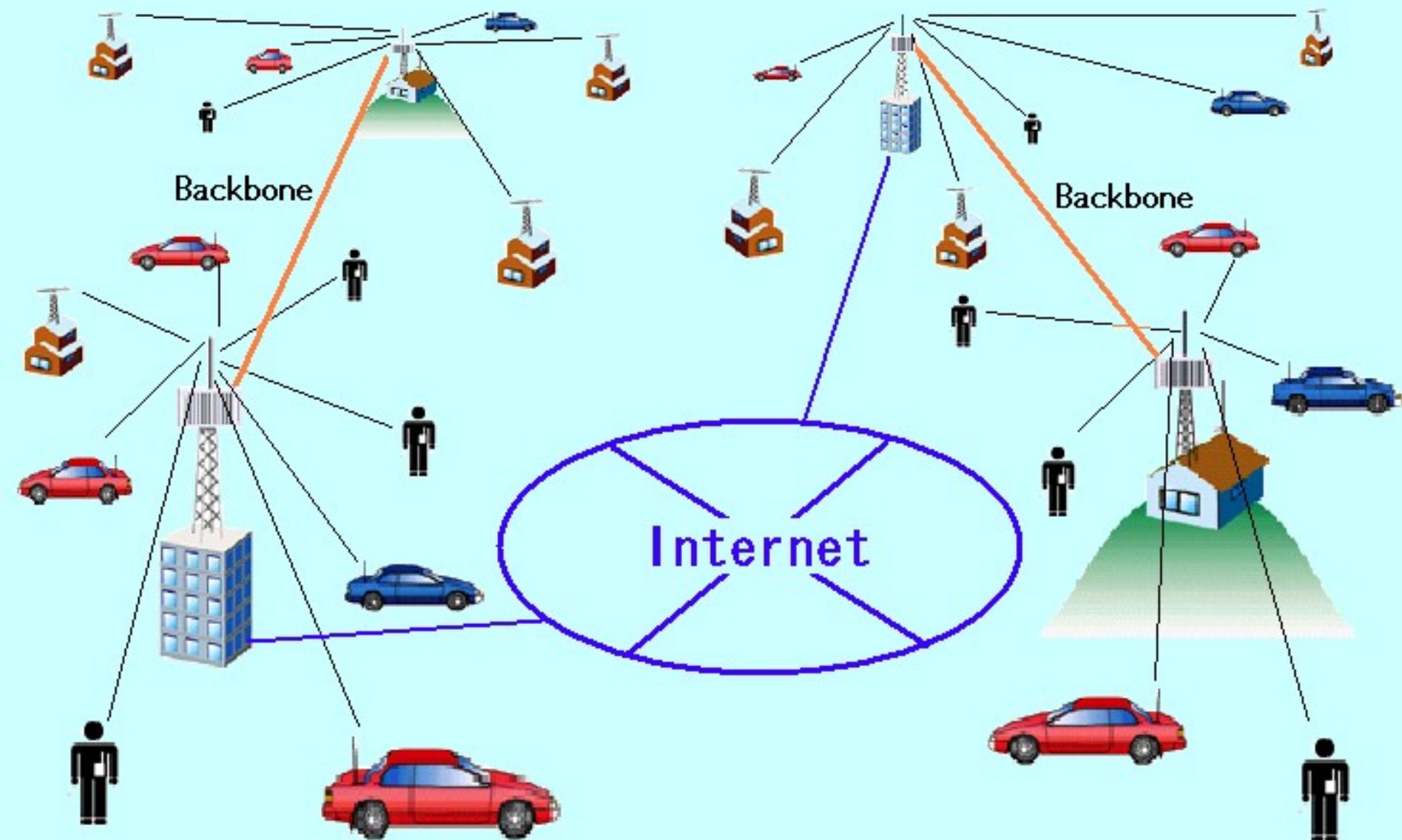


## Backbone communication between two repeater sites.





## Total communication via the Internet



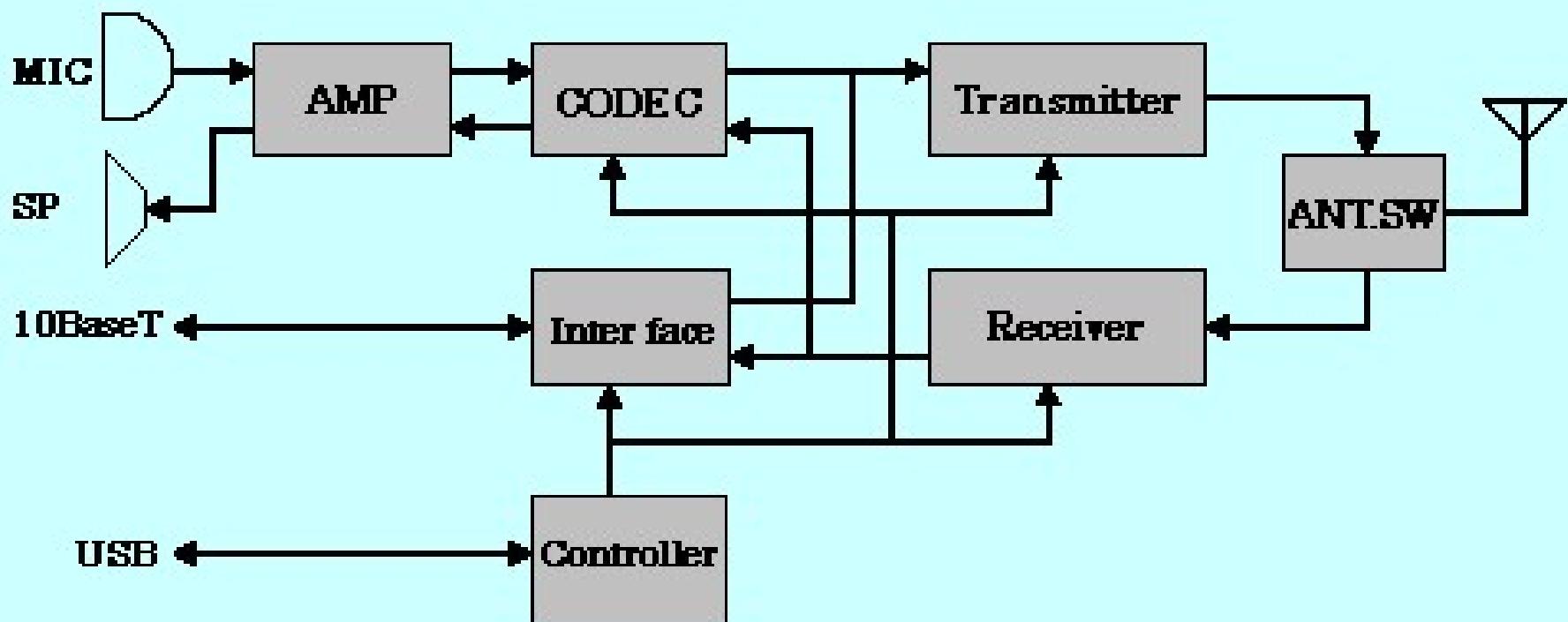


## Digital transceiver ID-1





## Block Diagram of ID-1





## Specification

Operating Frequency	: 1.2GHz Amateur Band
Operating MODE (FDMA)	: FM (analog voice) 0.5GMSK (Digital voice / DATA)
Data Rate	: 4.8kbps(voice) / 128kbps(data)
CODEC	: AMBE
Data interface	: IEEE802.3 (10Base-T )
RF Power	: 10W / 1W
Rx Sensitivity : FM (typical)	-16dBu 4.8kbps GMSK voice -10dBu 128kbps GMSK Data +2dBu
Switching Time:	10mS(Digital mode)
GMSK Modulation	: Quadrature Modulator / FPGA(Base Band)



## Local repeaters and antenna



1.2GHz Data Repeater



1.2GHz Voice Repeater



1.2GHz Antenna



fdsdsfdsfds and  
antenna



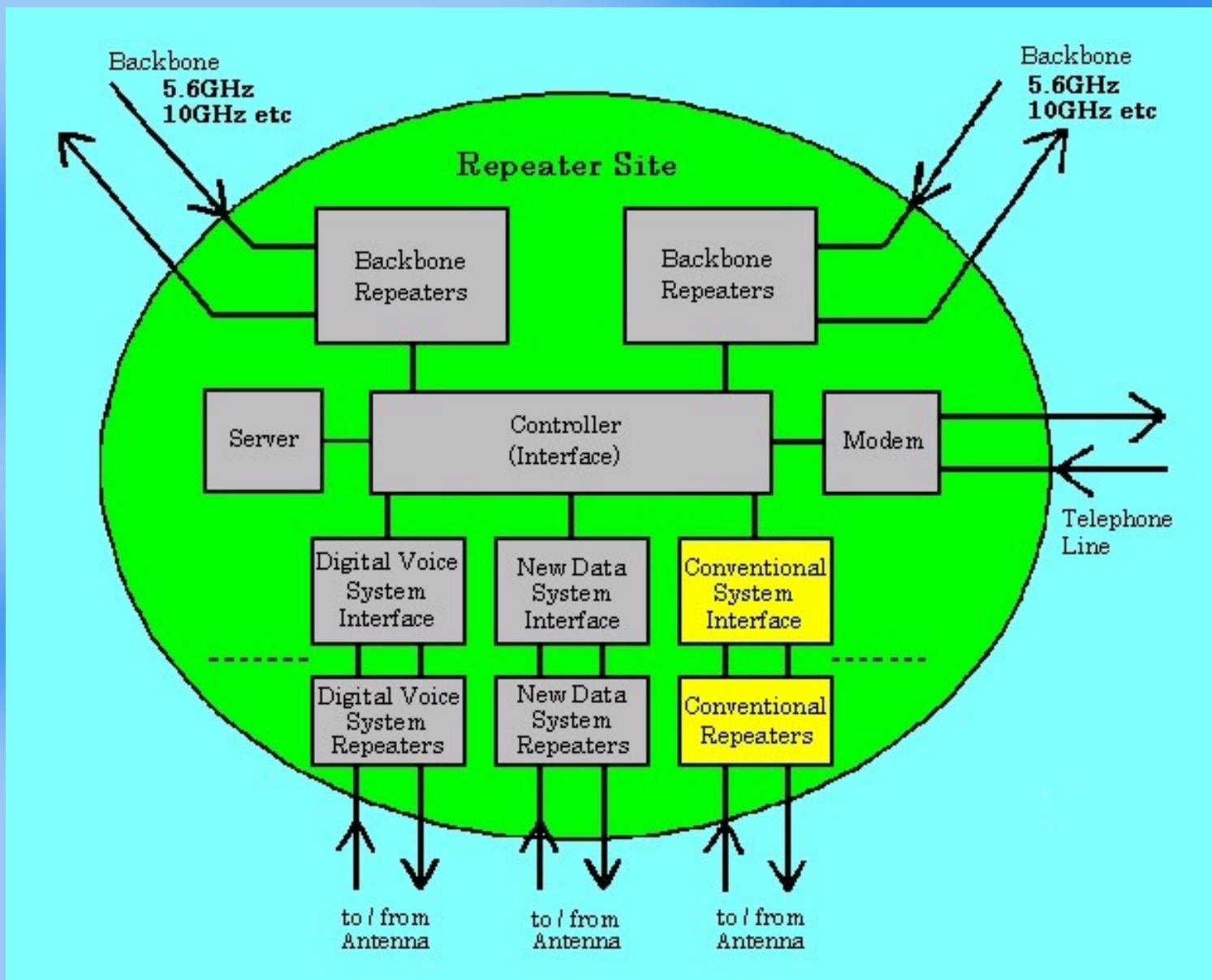
10GHz backbone repeater



10GHz 90cm  $\varphi$  parabola antenna

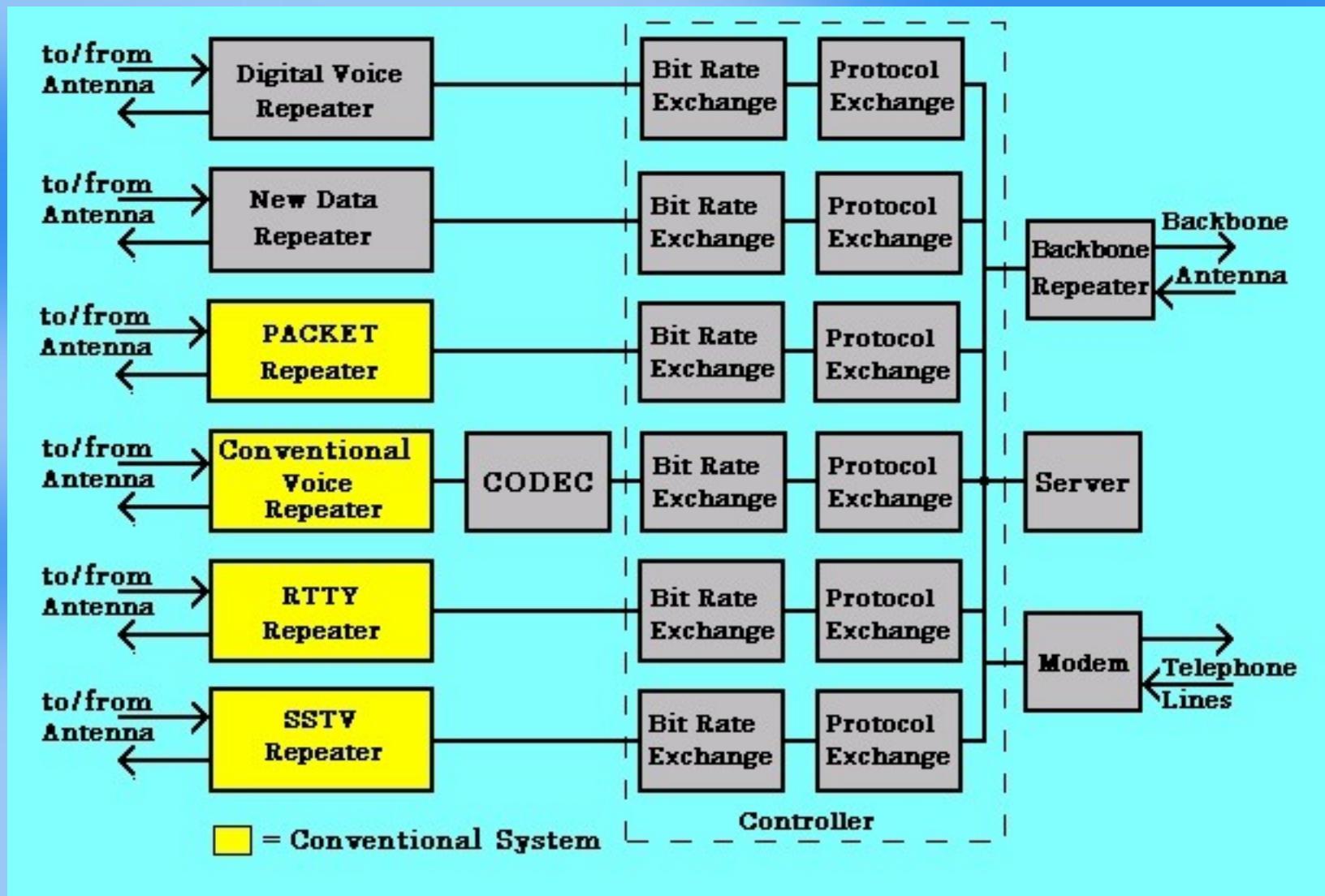


## Composition of the repeater site



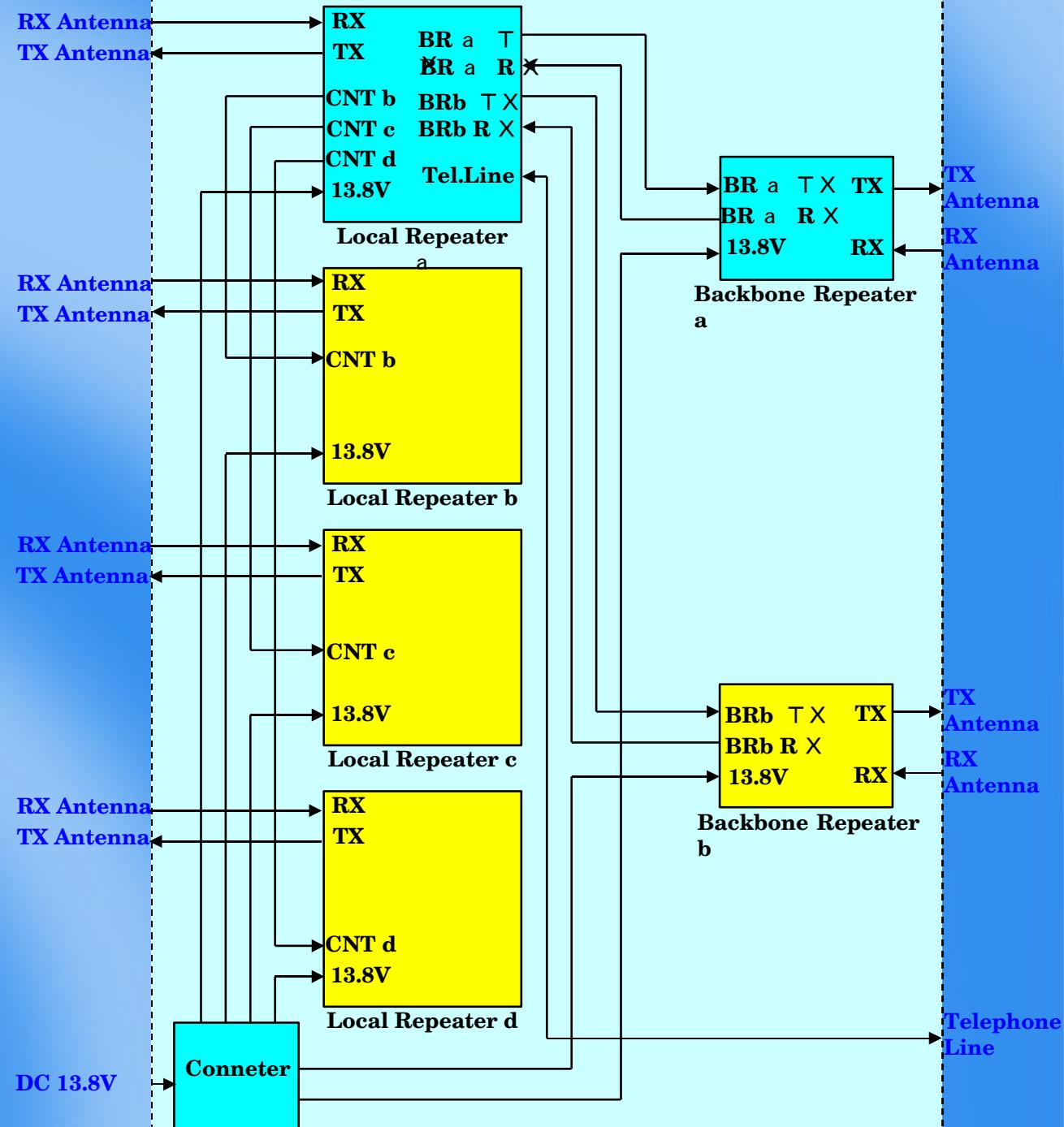


## Repeater site details





# Wire connection of the repeater site





## Software and protocol

D-STAR protocol

Data communication protocol

Voice communication protocol

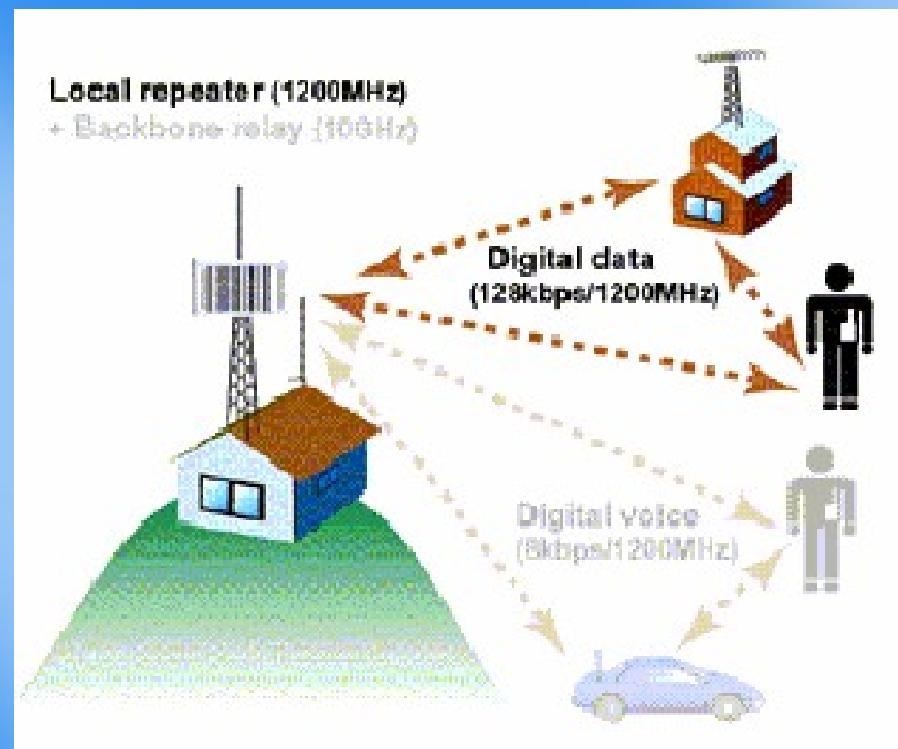
Backbone protocol

USB or ID-1 control software

Application software



# Data communication protocol



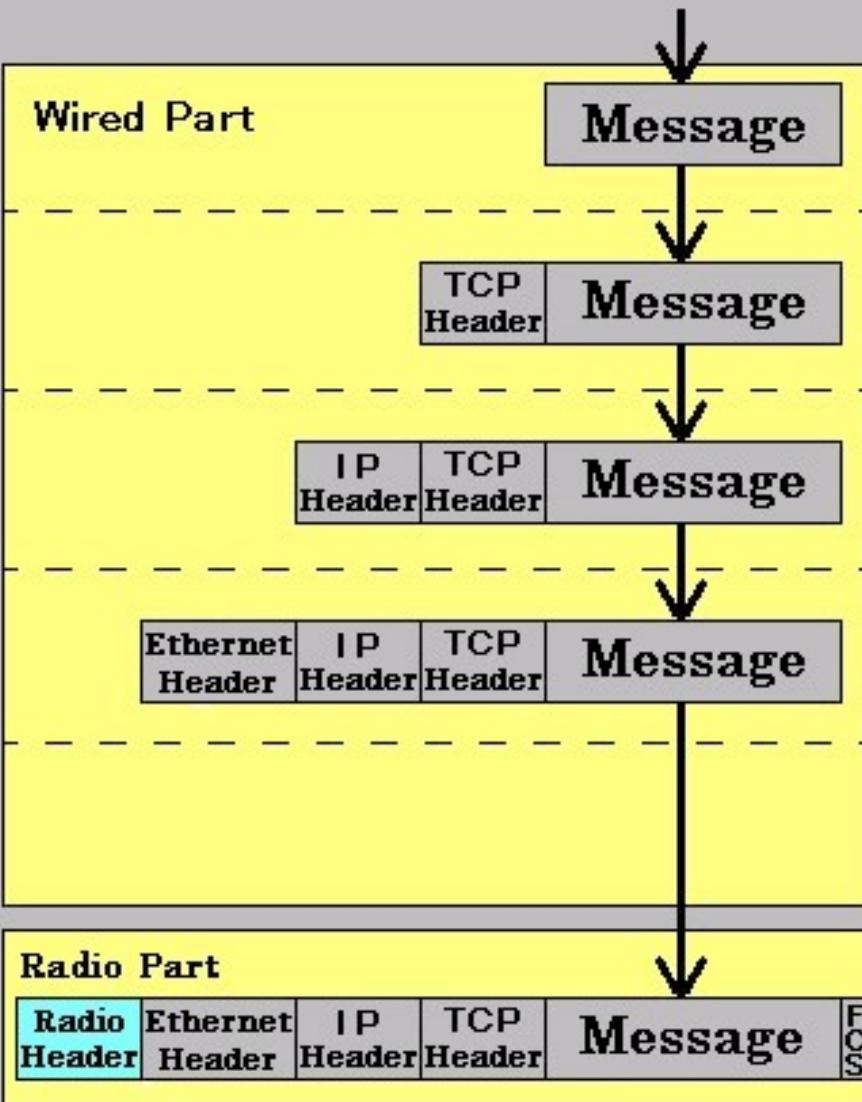
## Composition of Data packet frame

Radio Header								Data				FCS	
Bit Sync	Frame Sync	Flag	ID				PFCS	ELen	MAC Header			Data Frame	CRC
			Destination Repeater Callsign	Departure Repeater Callsign	Companion Callsign	Own Callsign			SA	DA	Type		
64bit	15bit	1byte	8byte	8byte	8byte	8byte	2byte	2byte	6byte	6byte	2byte	46-1500byte	4byte

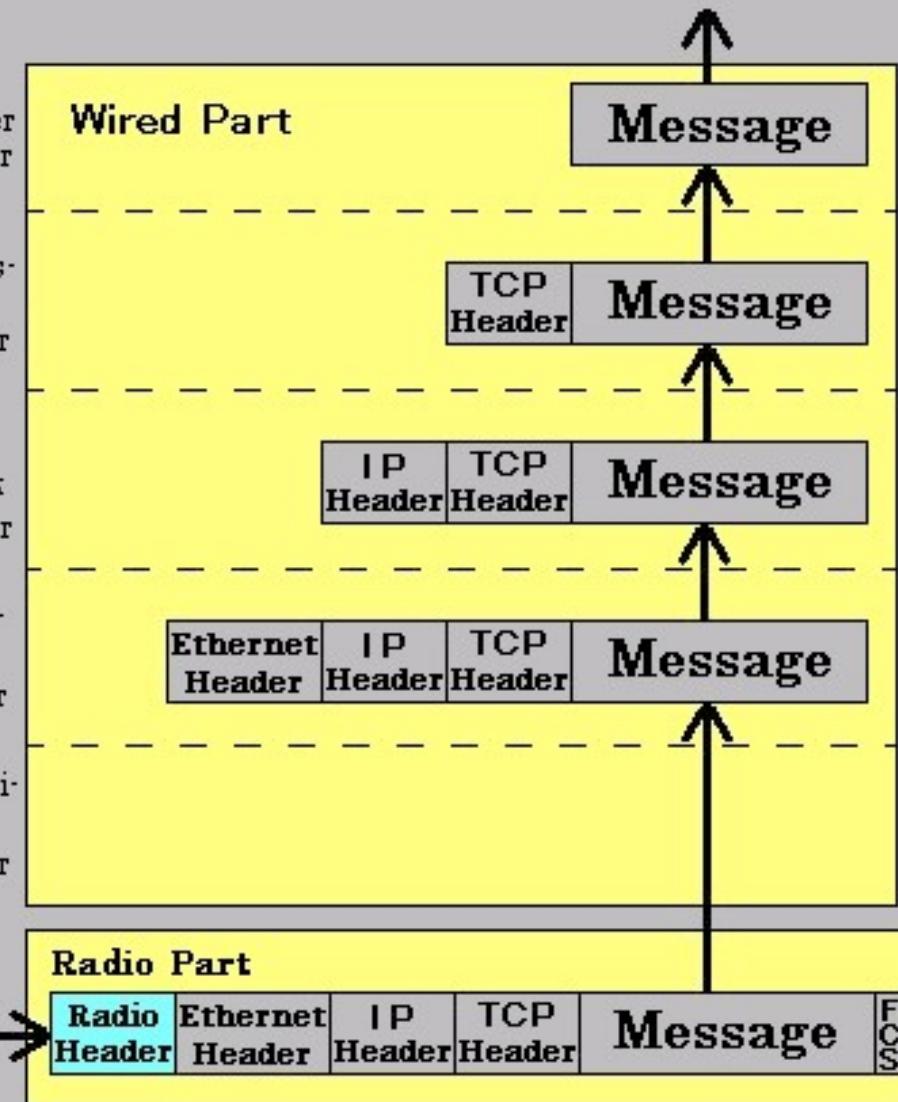


## Message transfer

User A sends a message to user B

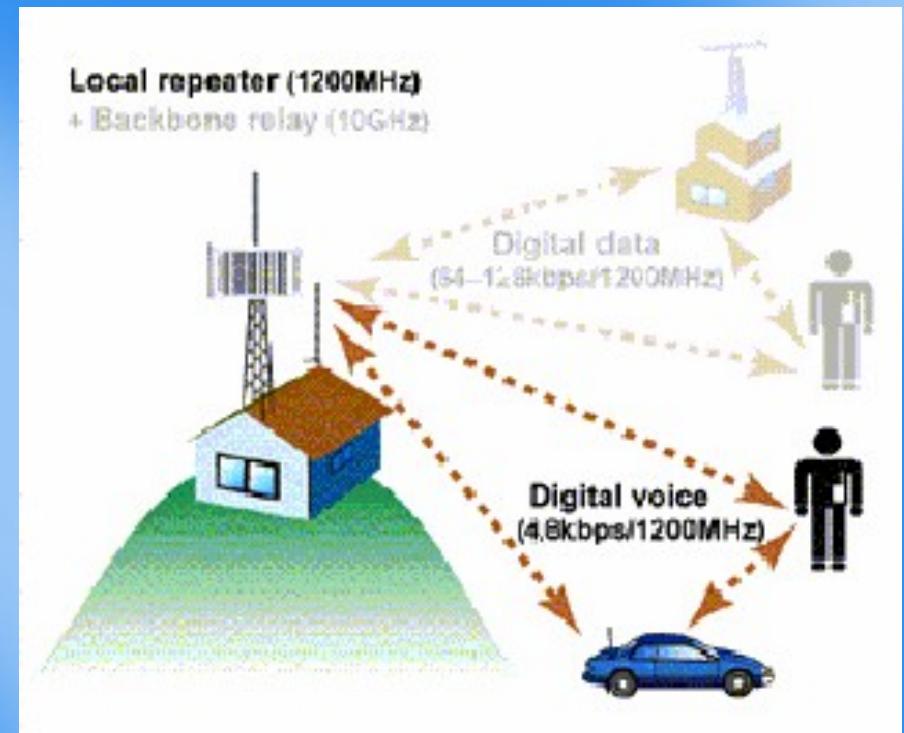


User B receives a message from user A





# Voice communication protocol



## Composition of Voice packet frame

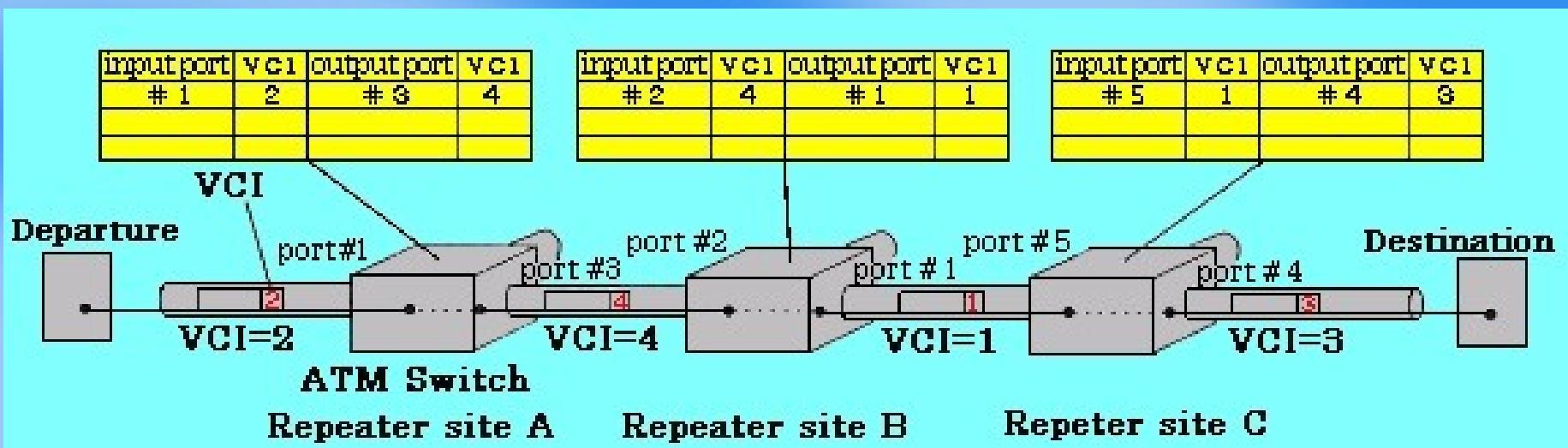
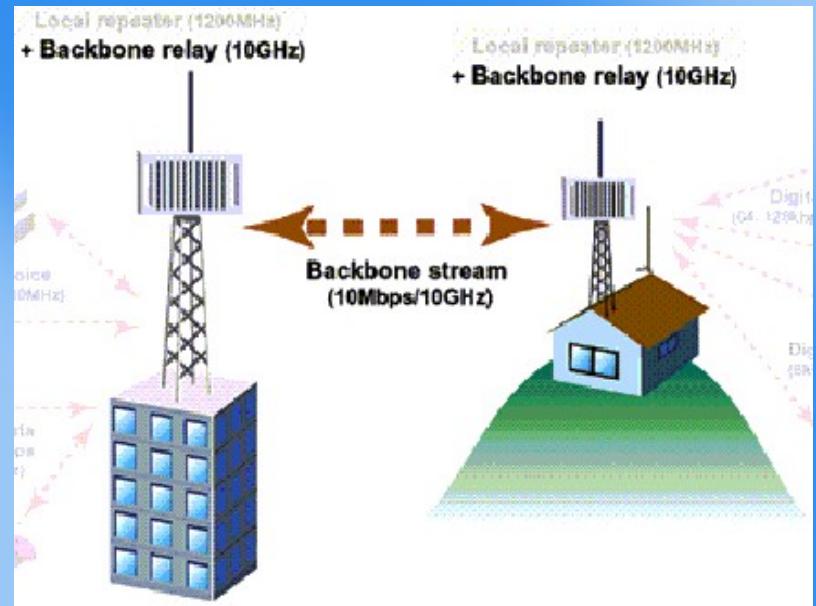
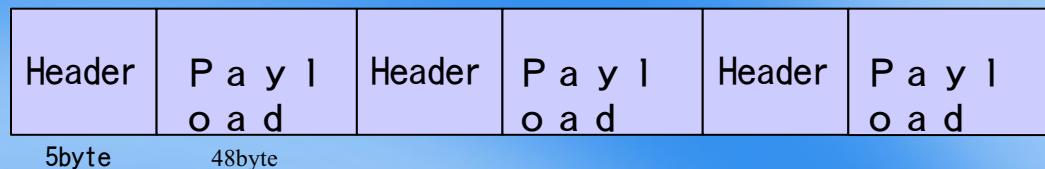
Radio Header								Data							
Bit Sync	Frame Sync	Flag	ID				PFCS	Voice Frame	Data Frame	Voice Frame	Data Frame	---	Voice Frame	Last Frame	
			Destination Repeater Callsign	Departure Repeater Callsign	Companion Callsign	Own Callsign									
64bit	15bit	1byte	8byte	8byte	8byte	8byte	2byte	48bit	48bit	48bit	48bit	---	48bit	48bit	



# Backbone protocol

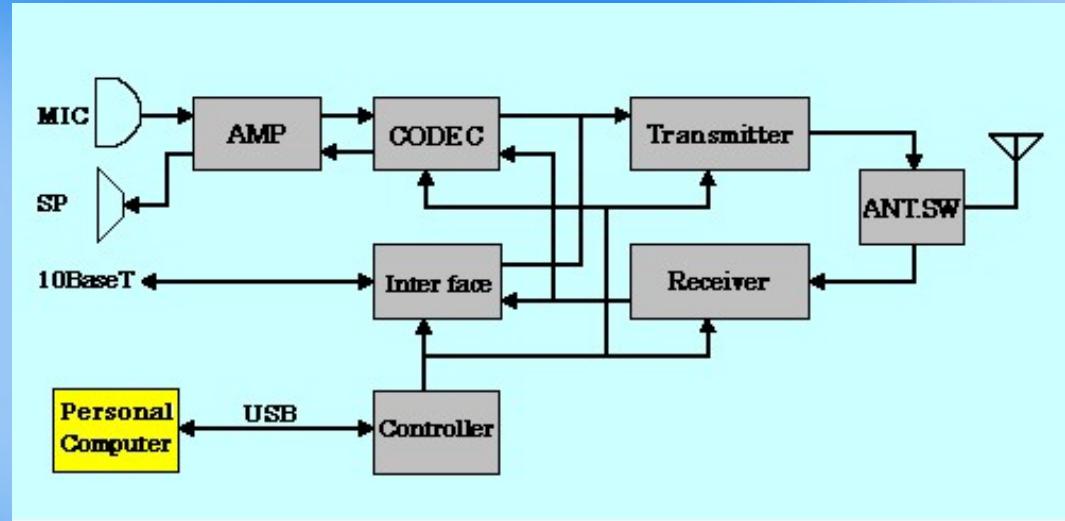
ATM ( Asynchronous Transfer Mode )

ATM Cell (53byte)

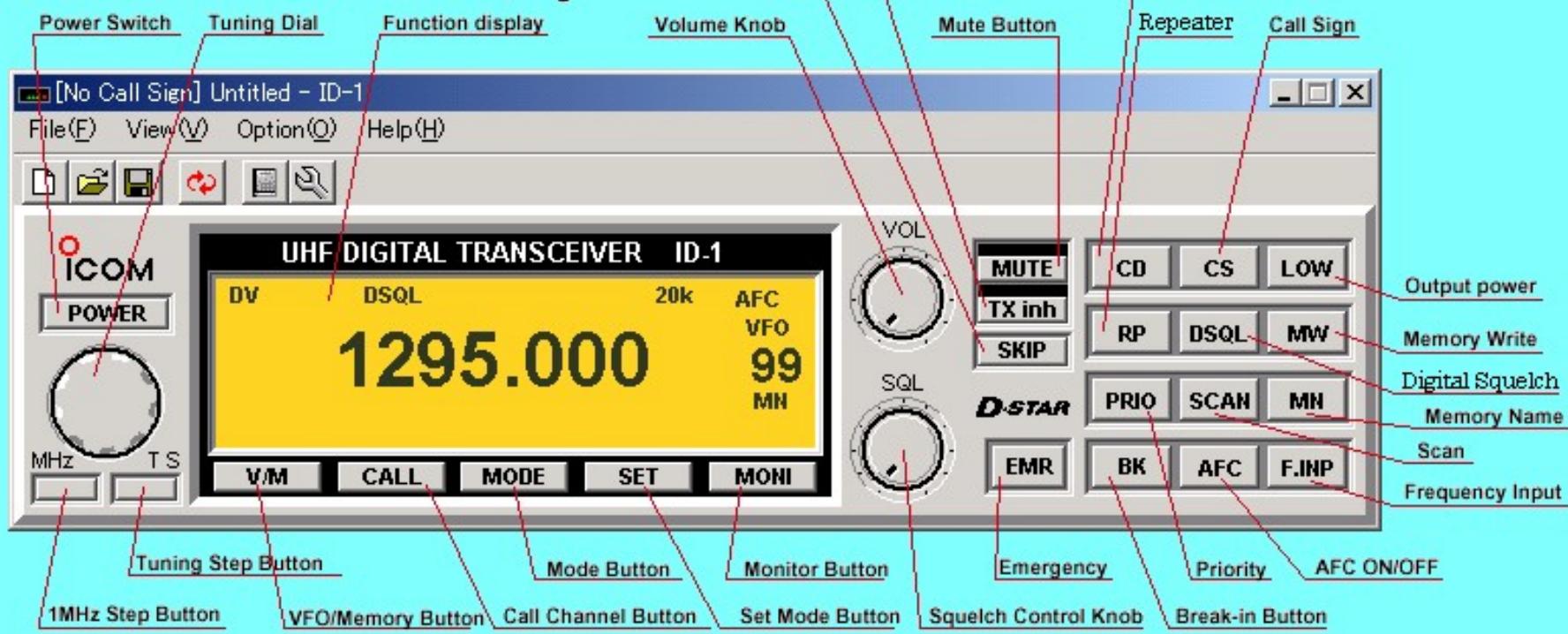




## Remote control by personal computer



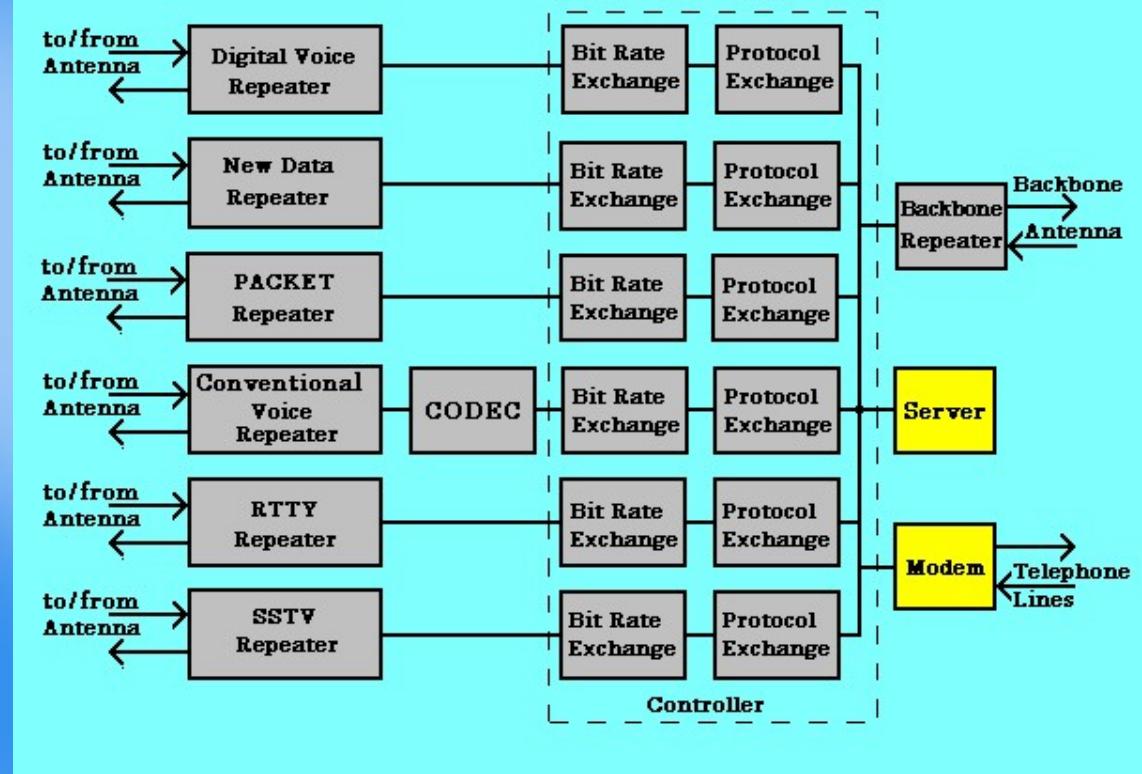
### Controller view of the PC display





## Applications

The Internet or  
server access





# Applications

Small data communications to use data frames in the voice packet.





## CODEC



- ACELP (Algebraic Code Excited Linear Prediction) (ITU G723.1)
- AMBE (Advanced Multi-Band Excitation)
- VSELP (Vector Sum Exited Linear Prediction)
- CELP (Code Exited Linear Prediction)
- RELP (Residual Excited Linear Prediction)



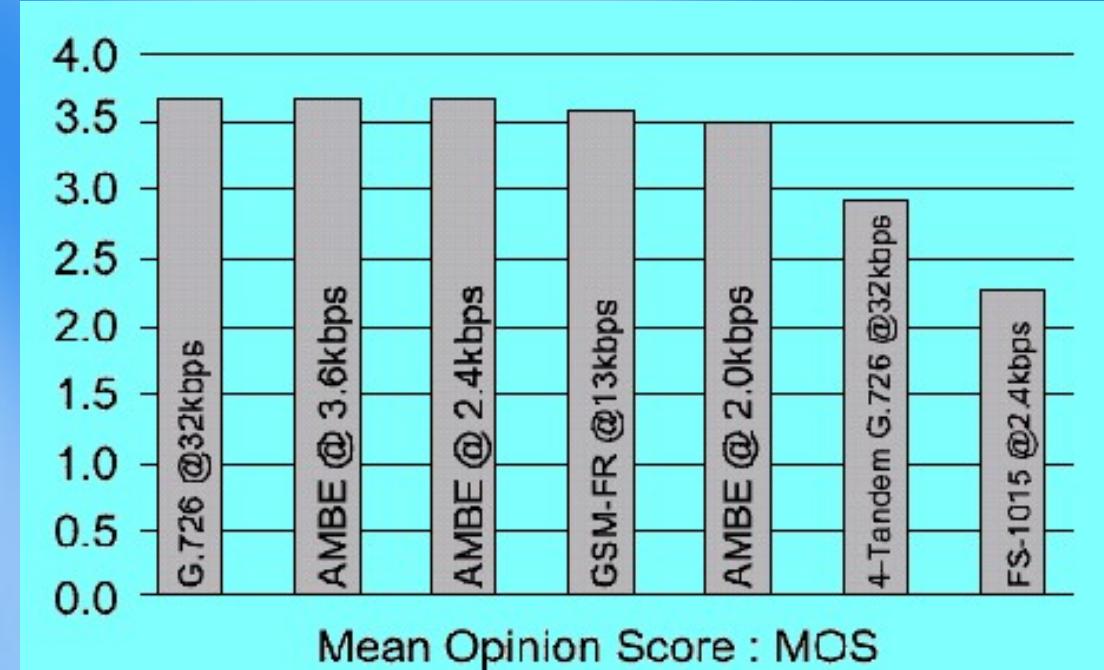
## AMBE CODEC IC

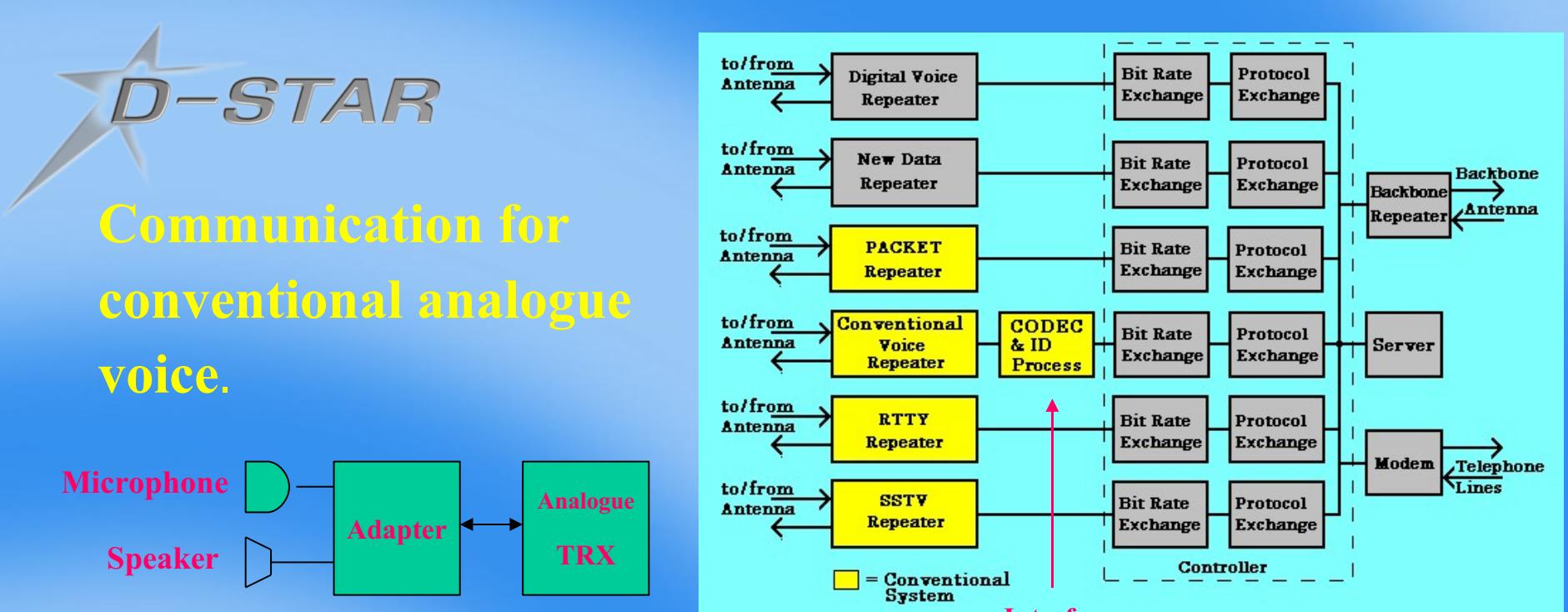


DIGITAL VOICE SYSTEMS, INC.

*The Speech Compression Specialists*

- AMBE Coder divides each segment of speech into distinct frequency bands.
- And makes a voiced/unvoiced decision for each frequency band.
- This allows the excitation signal for a particular speech segment to be a mixture of periodic and noise-like energy.





- Conventional analogue transceiver with an ID adapter.
- The adapter is connected to analogue I/O as Microphone connector.
- ID short packet included callsigns transmits before analogue voice signal.
- Analogue repeater detects the ID in the packet and recompose for D-STAR.
- Analogue repeater sends the ID packet to the transceiver before analogue voice signals.
- The transceiver can recognise callsigns as repeaters, companion and own.



# D-STAR System

