TTY & CTM Education

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# Agenda

- Introduce TTY/CTM solution

What is TTY?

- TTY (Text Telephone) is used by people with hearing and/or talking problems.

- The TTY terminal is used to transfer/receive text over standard voice channels.

- The TTY terminal is composed of a keyboard, a screen and a modem.

- The modem is responsible to transform the keyboard letters to voice signals (named Baudot) which are sent over voice channel of the telephony PSTN network and vice versa.
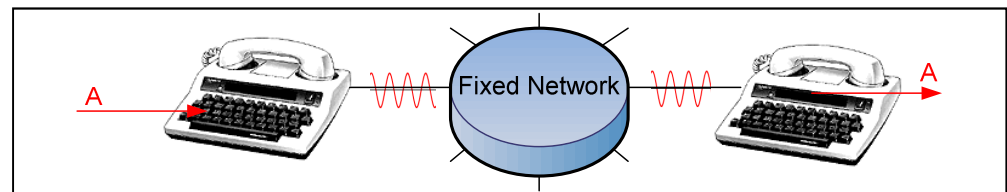
Baudot Code

- The TTY modem send/receive Baudot codes.

- The codes are based on FSK modulation, using 1400 Hz ("1") and 1800 Hz ("0").

- The letters are represented by 5 bits per letter, with start and stop bits with rate of 45.45 or 50 bits/sec, depends on the terminal.

- Example: Sending "TH"

M A R V E L L
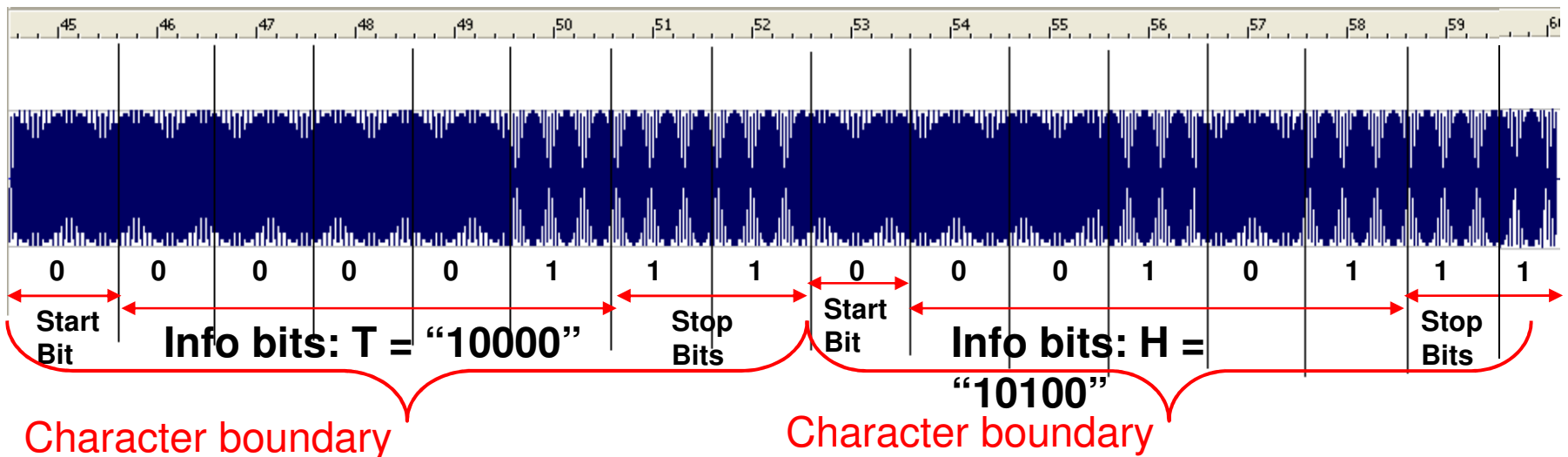
Using TTY Terminal over cellular network

- The TTY "as is" could not work over cellular network due to several reasons:
  - Cellular UEs are adapted to transfer speech signals, while baodot codes can be detected as non-speech.
  - Fading
  - Handovers can cause lost of data and sync.

14-May-14   5

The Solution -CTM

- The FCC has required a reliable solution for TTY transmission using cellular UEs that should support emergency and SIM-less calls.

- A modem, named CTM (Cellular Text Modem), was developed to answer the FCC requirements to allow reliable transmission of text over speech channels of cellular networks.

- The reliability is achieved using improved modulation, error protection and interleaving.

- The CTM convert the Baudot signals from the TTY terminal to CTM codes which are transmitted over the voice channel.
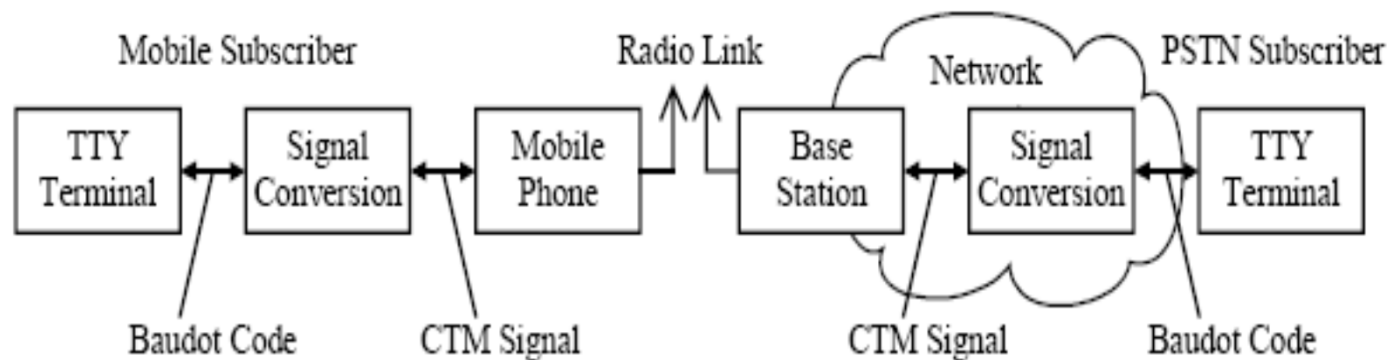
The CTM Modem

- The CTM transmitter is composed of error protection block, Interleaver and advanced Modulator.

- The CTM receiver performs the opposite operations of the transmitter.

- It is also possible to transfer/receive speech only:
  - VCO: Voice Carry Over: Send Mic samples
  - HCO: Hearing Carry Over: Receive speaker samples.

   14-May-14   7
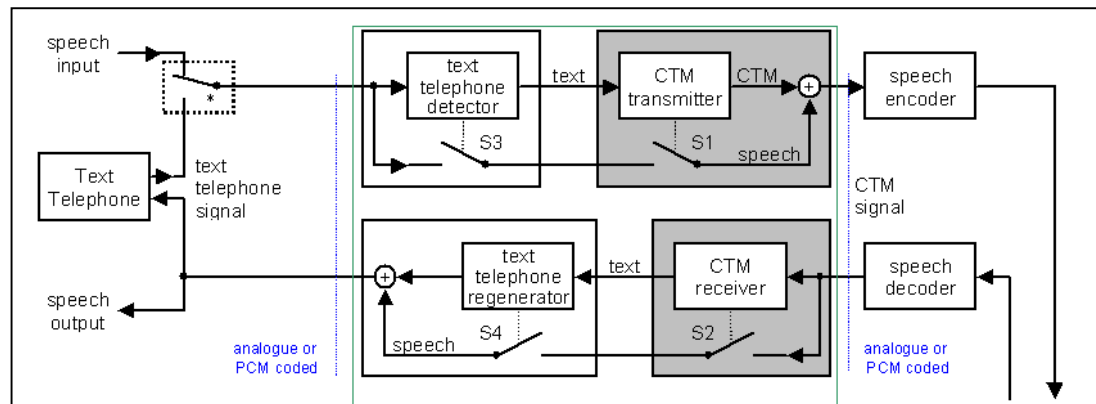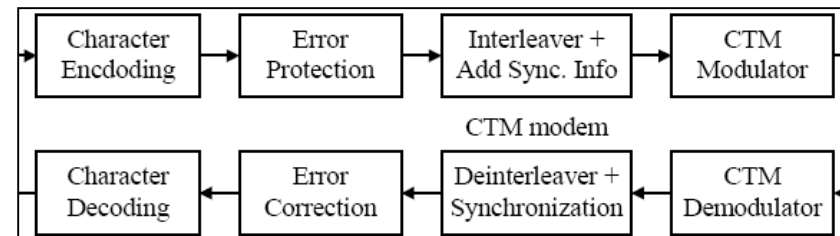
CTM Integration in Voice Path

- 4 blocks are added to the voice task: Baudot detector and CTM Transmitter to the TX voice task, CTM receiver and Baudot generator to the RX voice task.

- On TX side, CTM modem follows AEC, to solve line echo problems

- On both TX and RX side there is volume control for the Baudot signal (i.e., the amplitude of the input to the Baudot detector and the amplitude of the output from the Baudot generator.
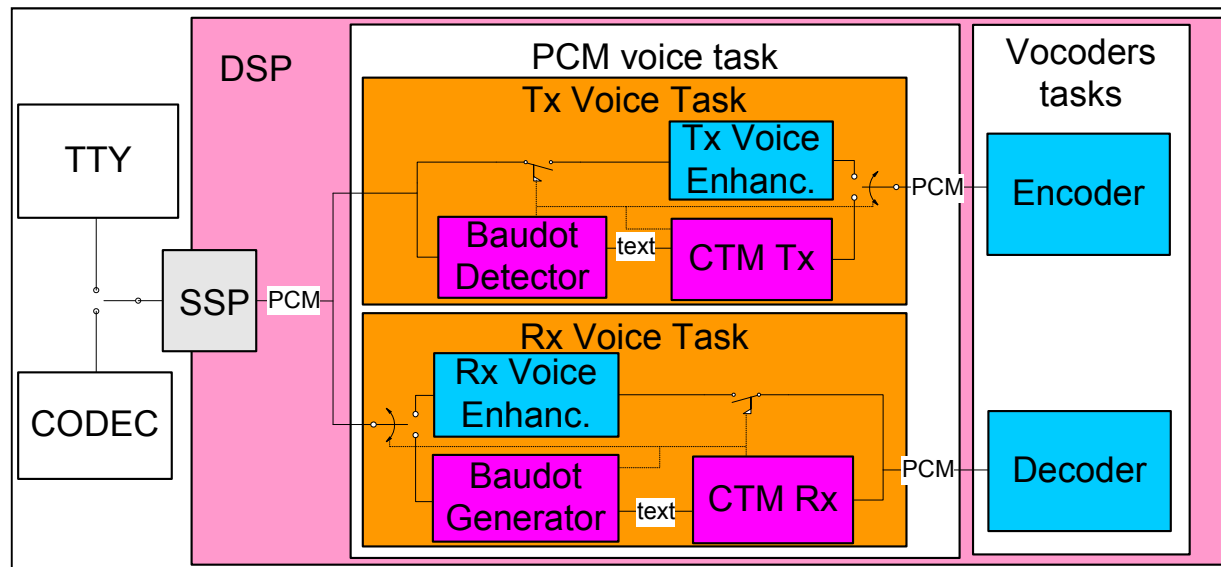
CTM Support in VCM

- Support 7 profiles for TTY

  VCM_PROFILE_TTY
  VCM_PROFILE_TTY_HCO_EARPIECE
  VCM_PROFILE_TTY_HCO_SPEAKER
  VCM_PROFILE_TTY_VCO_EARPIECE
  VCM_PROFILE_TTY_VCO_SPEAKER
  VCM_PROFILE_TTY_VCO_EARPIECE_MM

  VCM_PROFILE_TTY_VCO_SPEAKER_MM

- Support 2 applications for TTY

  VCM_APP_TTY_45
  VCM_APP_TTY_50

- Add CTM structure to the Voice NVM

  baudotRate
  baudotInterface
  forceNegotiationIsOn
  disableNegotiation
  disableVcoOrHco
  volumeDifferenceIndex

AT CMDs Support for TTY

- 2 Proprietary AT CMDs were added:
  - CTTY
    - Set user preferences (TTY mode, Baud rate)
  - DTTY
    - Initiate a TTY call by Telephony.

Tests

- CTM/TTY has passed AT&T tests

Backup

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TTY Terminal connected to UE

14-May-14   14