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# MODEM Analysis

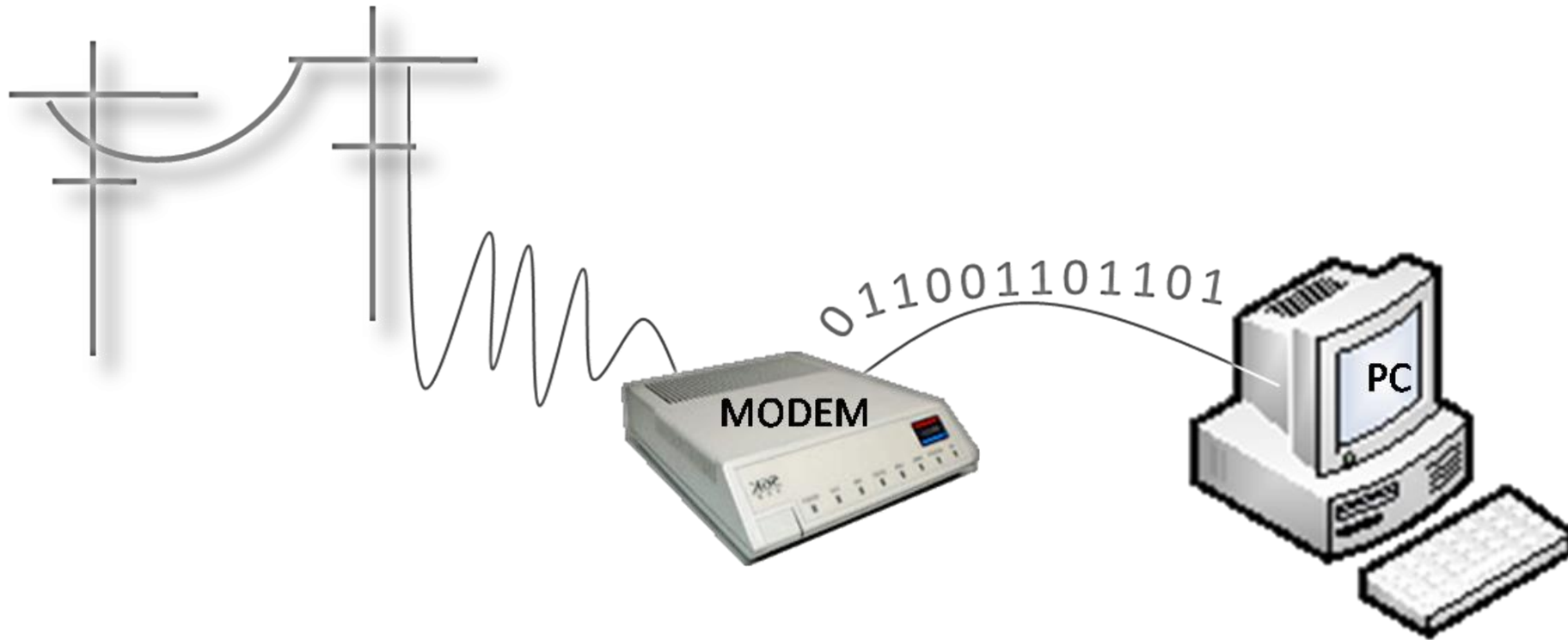
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Phone: (301) 670-4784 Fax: (301) 670-9187 Email: [info@gl.com](mailto:info@gl.com)  
Website: <https://www.gl.com>

# What are they ?



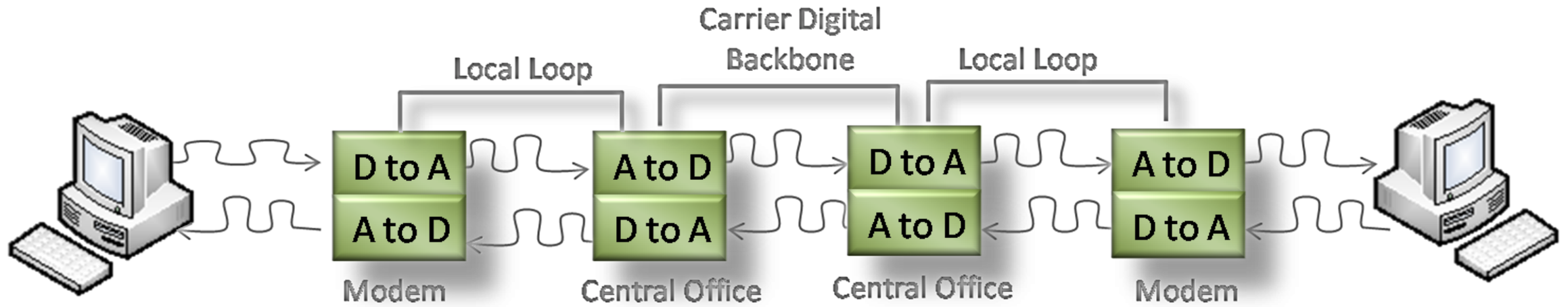
Short for modulator-demodulator. A modem is a device or program that enables a computer to transmit data over, for example, telephone or cable lines. Computer information is stored digitally, whereas information transmitted over telephone lines is transmitted in the form of analog waves. A modem converts between these two forms.

# Characteristics distinguishing Modems

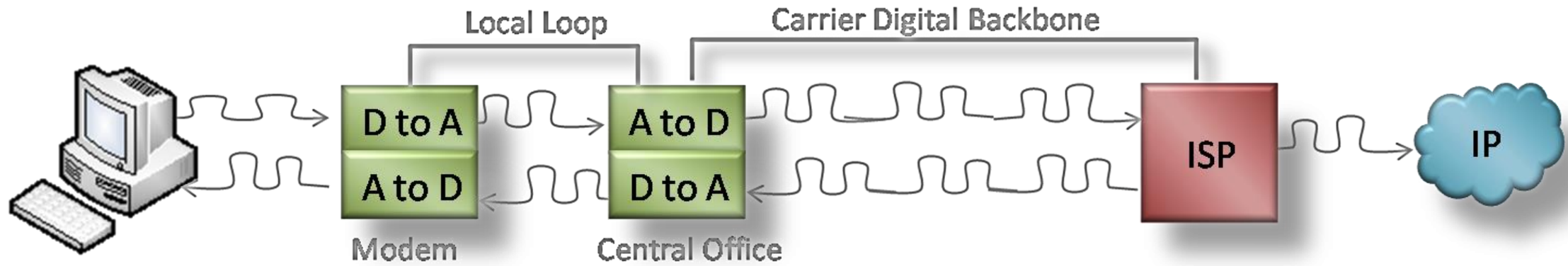
**Following characteristics distinguish one modem from another:**

- bps : How fast the modem can transmit and receive data:
  - At slow rates, modems are measured in terms of baud rates. The slowest rate is 300 baud (about 25 cps). At higher speeds, modems are measured in terms of bits per second (bps). The fastest modems run at 57,600 bps, although they can achieve even higher data transfer rates by compressing the data
- voice/data:
  - Many modems support a switch to change between voice and data modes. In data mode, the modem acts like a regular modem. In voice mode, the modem acts like a regular telephone
- data compression :
  - Some modems perform data compression, which enables them to send data at faster rates. However, the modem at the receiving end must be able to decompress the data using the same compression technique

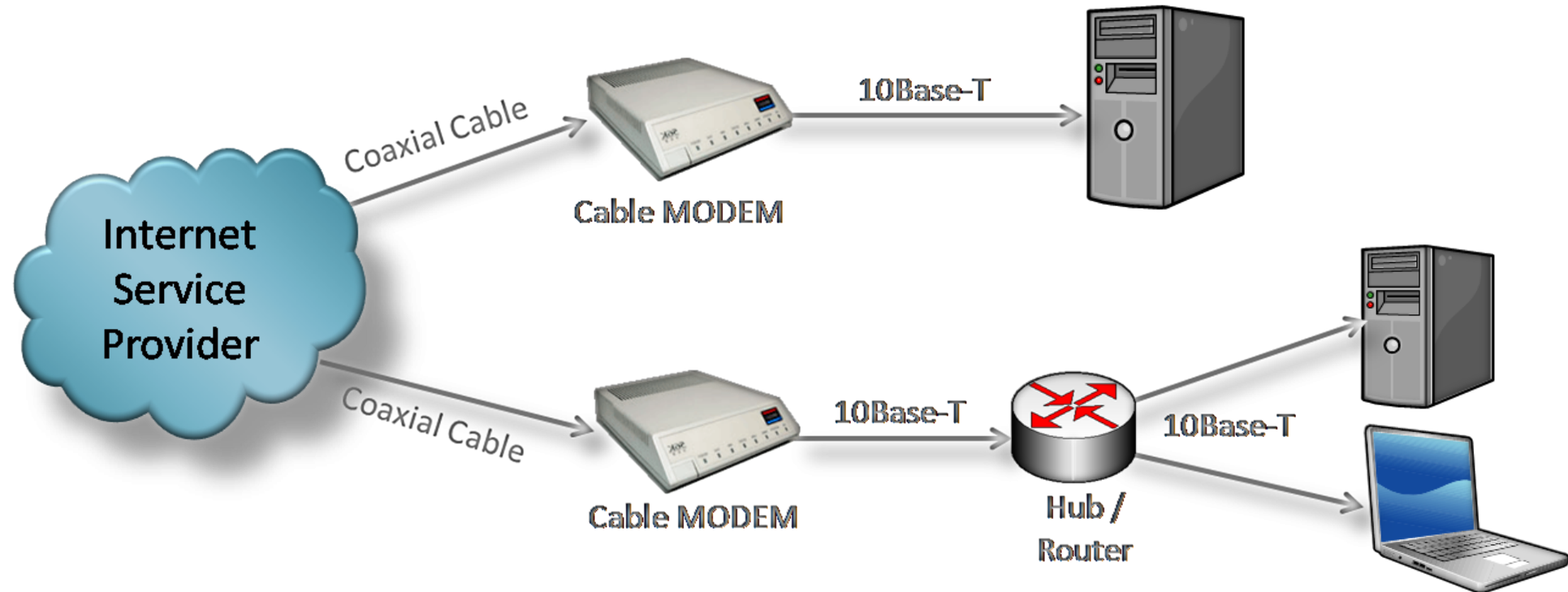
# Two Types of Modems



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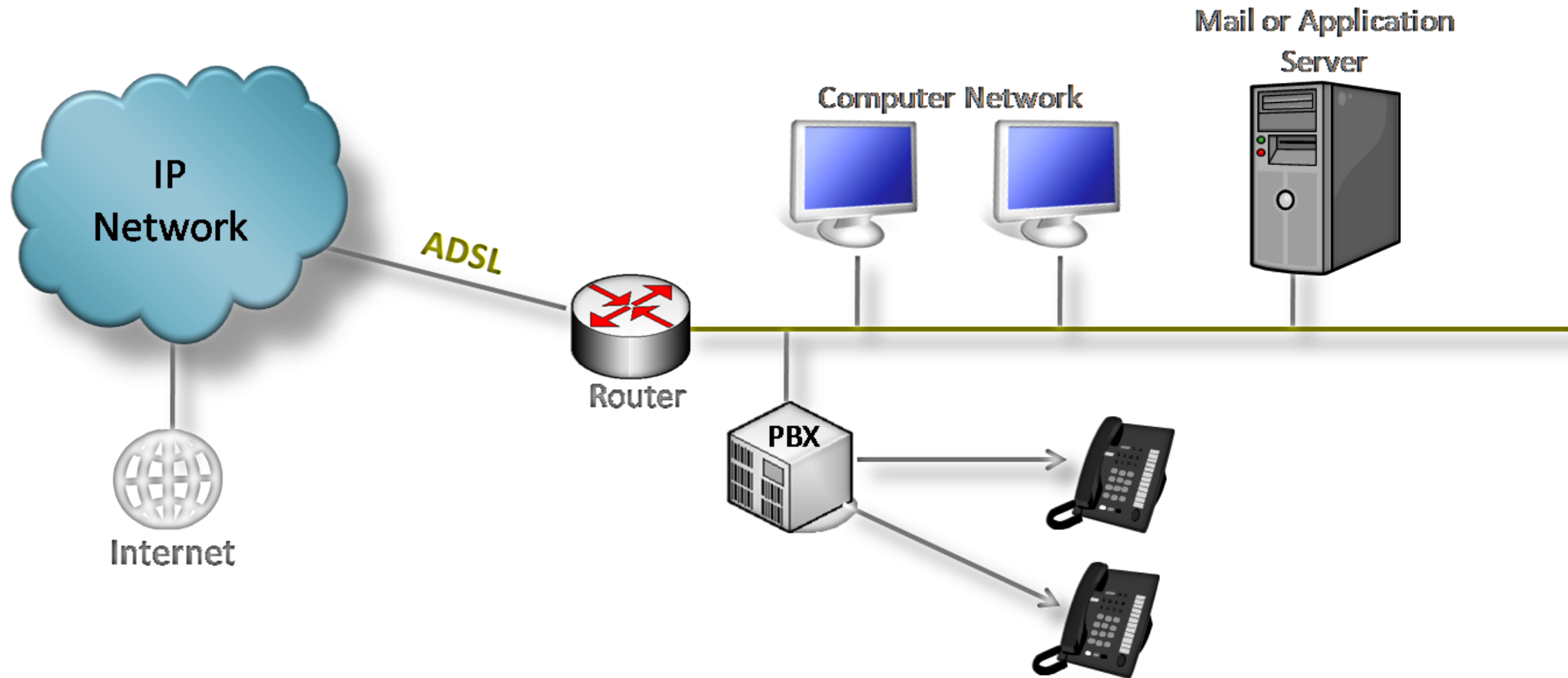


# Cable Modem



A cable modem is a network bridge that conforms to IEEE 802.1D for Ethernet networking (with some modifications). The cable modem bridges Ethernet frames between a customer LAN and the coax cable network

# Asymmetric Digital Subscriber Line (ADSL)

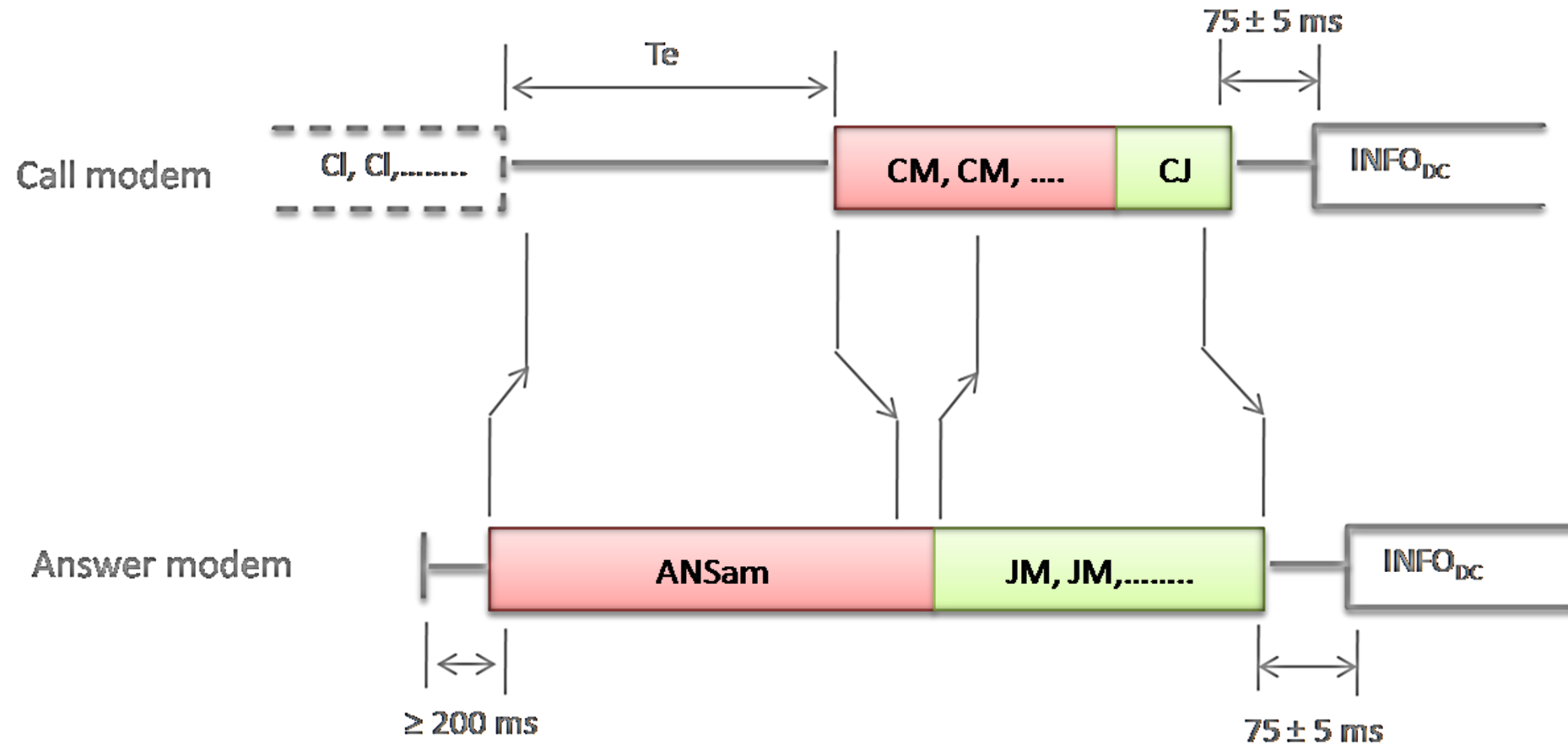


# Modem Communication Phases

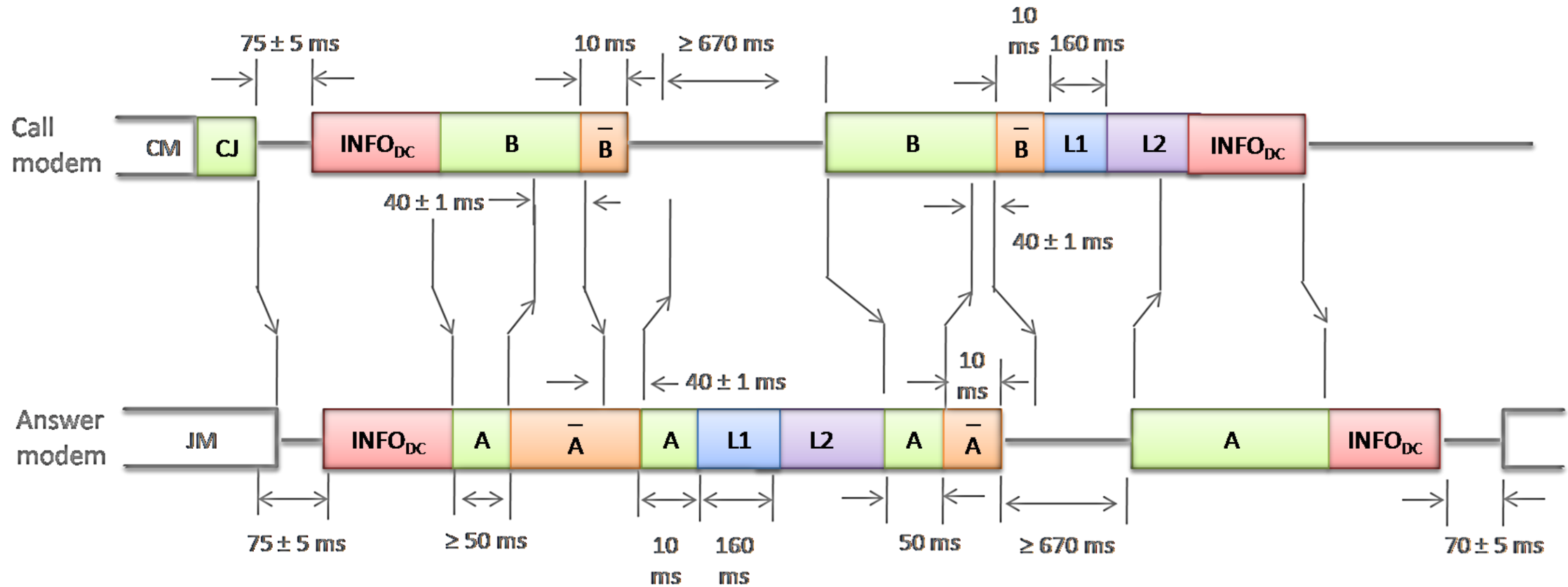
<b>Phase 1</b>	<b>Network Interaction</b>
<b>Phase 2</b>	<b>Probing / Ranging</b>
<b>Phase 3</b>	<b>Equalizer and Echo canceller training</b>
<b>Phase 4</b>	<b>Final training</b>



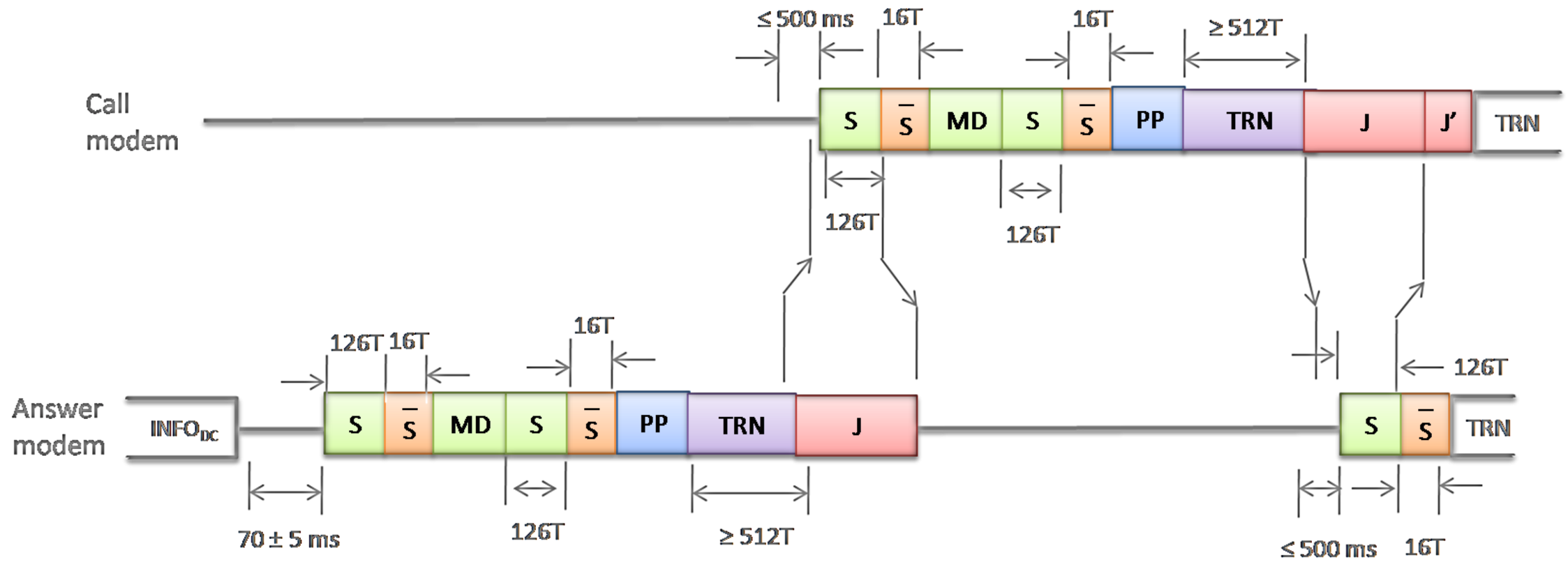
# Phase 1 – Network interaction (as per V.8)



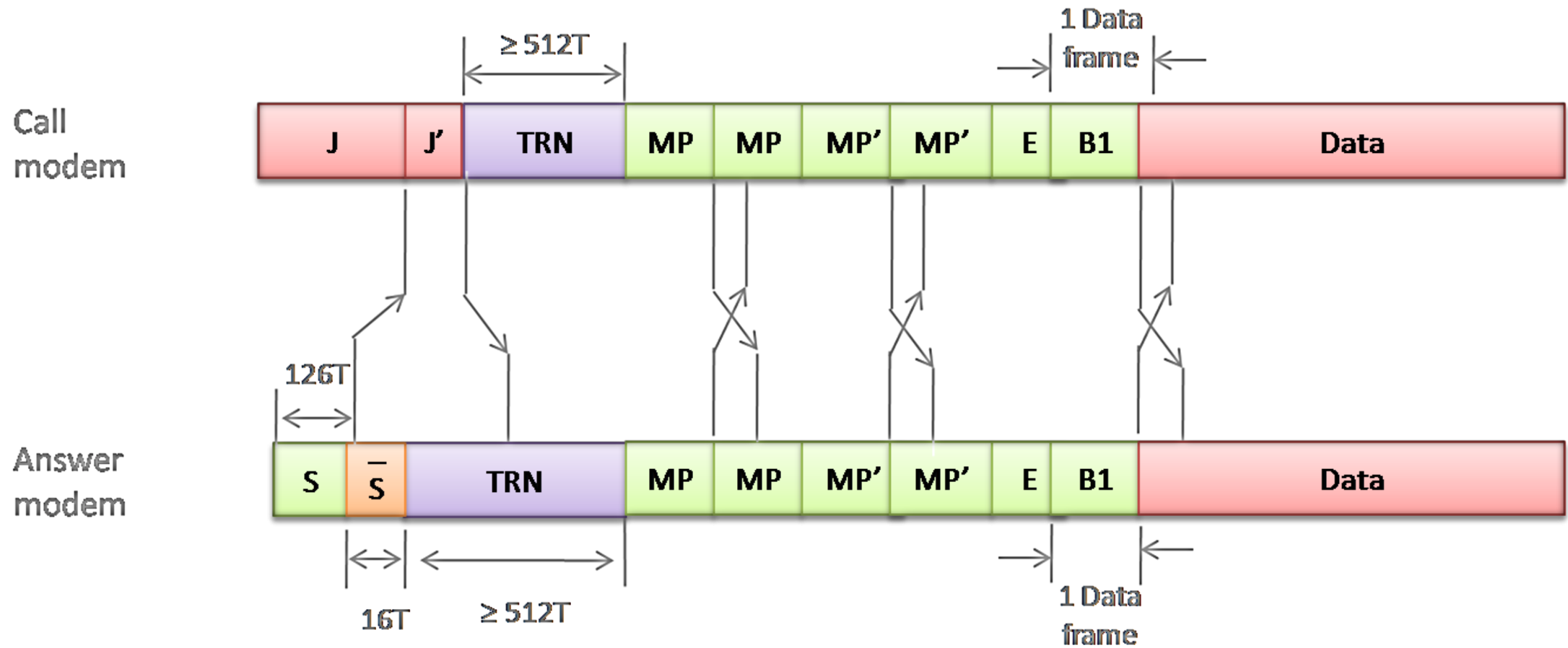
# Phase 2 – Probing / Ranging



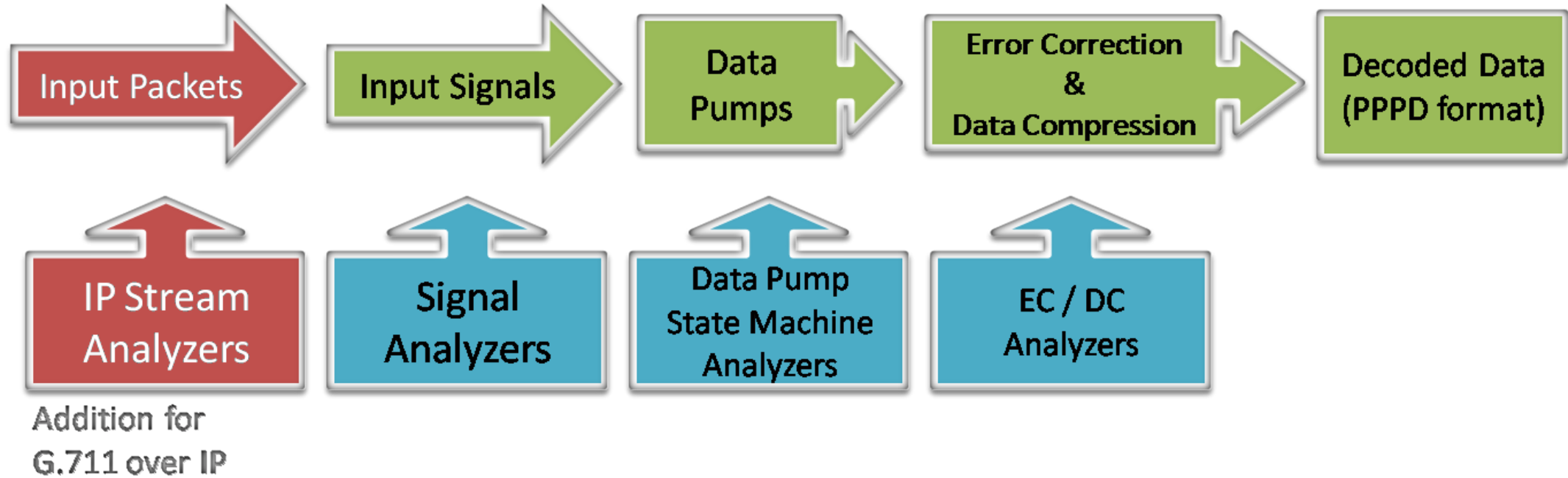
# Phase 3- Equalizer and Echo Cancellor Training



# Phase 4 - Final training



# GL's Modem Decoding and Analysis Software - GLInsight™



# GLInsight™ Modem Analysis

The screenshot displays the SurfInsight software interface for analyzing modem results. The window title is "SurfInsight - [V92\_33600W Modem Analyze Results 0]".

**Workspace Tree:** Shows a folder structure for "V92\_33600W" containing "Input" and "Output" folders. Under "Output", there is a "Modem [100% dc]" folder containing multiple instances of "V92\_33600W".

**Whole List:** A table showing a list of events:

Time (Min.Se)	Description
00:00.310	Automode Connection established
00:00.310	Calling Modem: V21
00:00.310	Answering Modem: V21
00:00.000	1650Hz tone detected at sample: 0
00:00.310	980Hz tone detected at sample: 2480
00:00.310	Discriminator: data pump type V.21

**Streams Panel:** Lists various analysis options, many of which are checked:

- ORG PDSNR
- ANS PDSNR
- ORG Energy
- ANS Energy
- Output Chars
- Error Correction Frames
- raw bits 1
- raw bits 2
- symbols 1

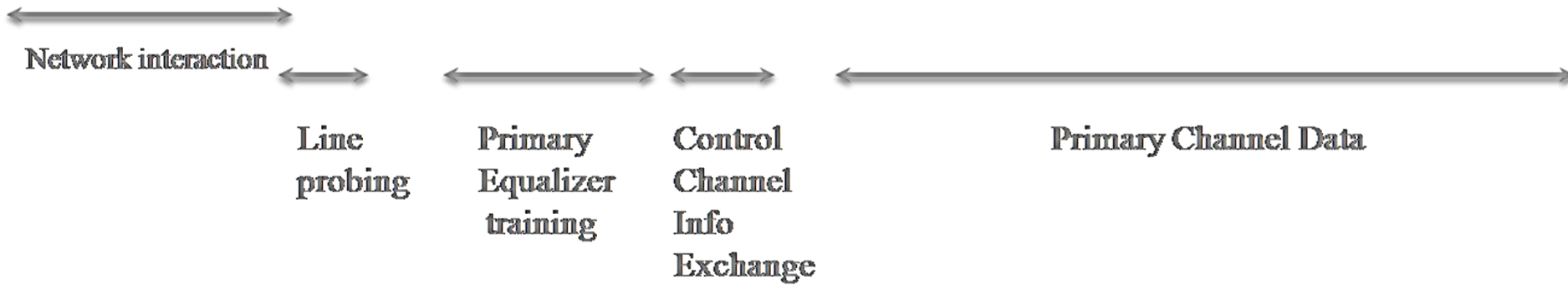
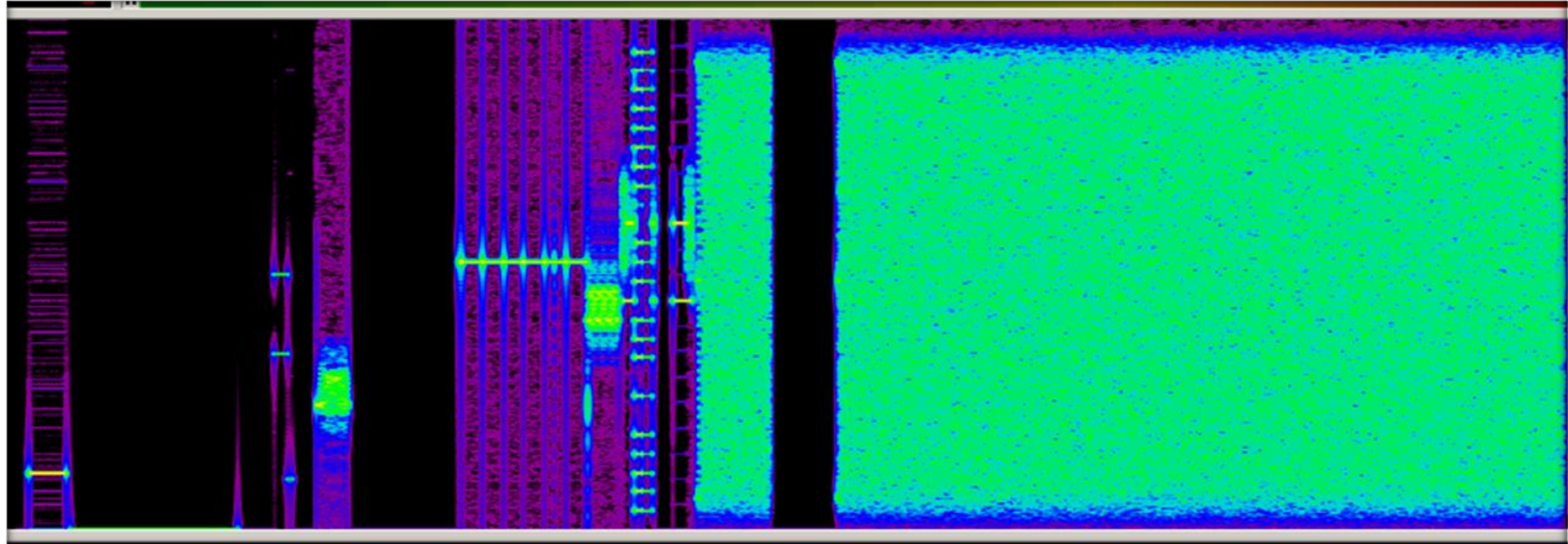
**Spectral Plot:** A frequency plot showing two tones. The top tone is labeled "V21\_Connection\_ORG,1650Hz,Session terminated" and the bottom tone is "V21\_Connection\_ANS,980Hz,Session terminated". The plot shows a red vertical line at 0:0.244. The x-axis represents time from 0:0.0 to 0:1.469. The y-axis represents frequency with markers at 1650Hz and 980Hz.

**Bottom Panel:** Shows a "Streams" tab with a "Modem" sub-tab. The status bar at the bottom indicates "Ready" and "NUM".

# GLInsight™ Decoded Files

<b>V34_33600energy_ans_lo.pcm</b> <b>V34_33600energy_org_lo.pcm</b>	It is Answer modem detected signal power . Shows the level of the signal level dBm of the answer side and origin of the connection. The energy files are in dBm(/100) units. Value of -1900 represent -19dBm.The energy files are generated only on V.34 and V.90 connections (lower data pump like v.32 and v.22 are not generating these files).
<b>V34_33600pdsnr_ans_lo.pcm</b> <b>V34_33600pdsnr_org_lo.pcm</b>	Post Detection Signal to Noise Ratio) files should be opened as 8000samples/sec, mono, 16 bit linear. Lo is low resolution (133.3 measurements per second) and Shows the value in dB (/100) of the Signal-to-Noise ratio of the answer side training data signal respectively.
<b>V34_33600raw_out_bits1.pcm</b> <b>V34_33600raw_out_bits2.pcm</b>	This file contains the bits extracted by the data pump before the ECDC layer. It means for example that in start stop connection – the start and stop bits will be found in this file
<b>V34_33600output_chars.bin</b>	This file contains the bits extracted after the ECDC layer in both directions in a PPPD format.
<b>V34_33600symbols1.pcm</b> <b>V34_33600symbols2.pcm</b>	The symbols received by the originate modem and shows the four-point TRN sequence (Phase 3), and the full constellation in the data stage (Phase 4). demodulated symbols in the 2-dimensional symbol space, received by the Originate modem

# Spectrogram view of ECM\_v17\_14400\_ans.pcm





**Thank you !**