



Software-Defined Real-Time Baseband Receiver

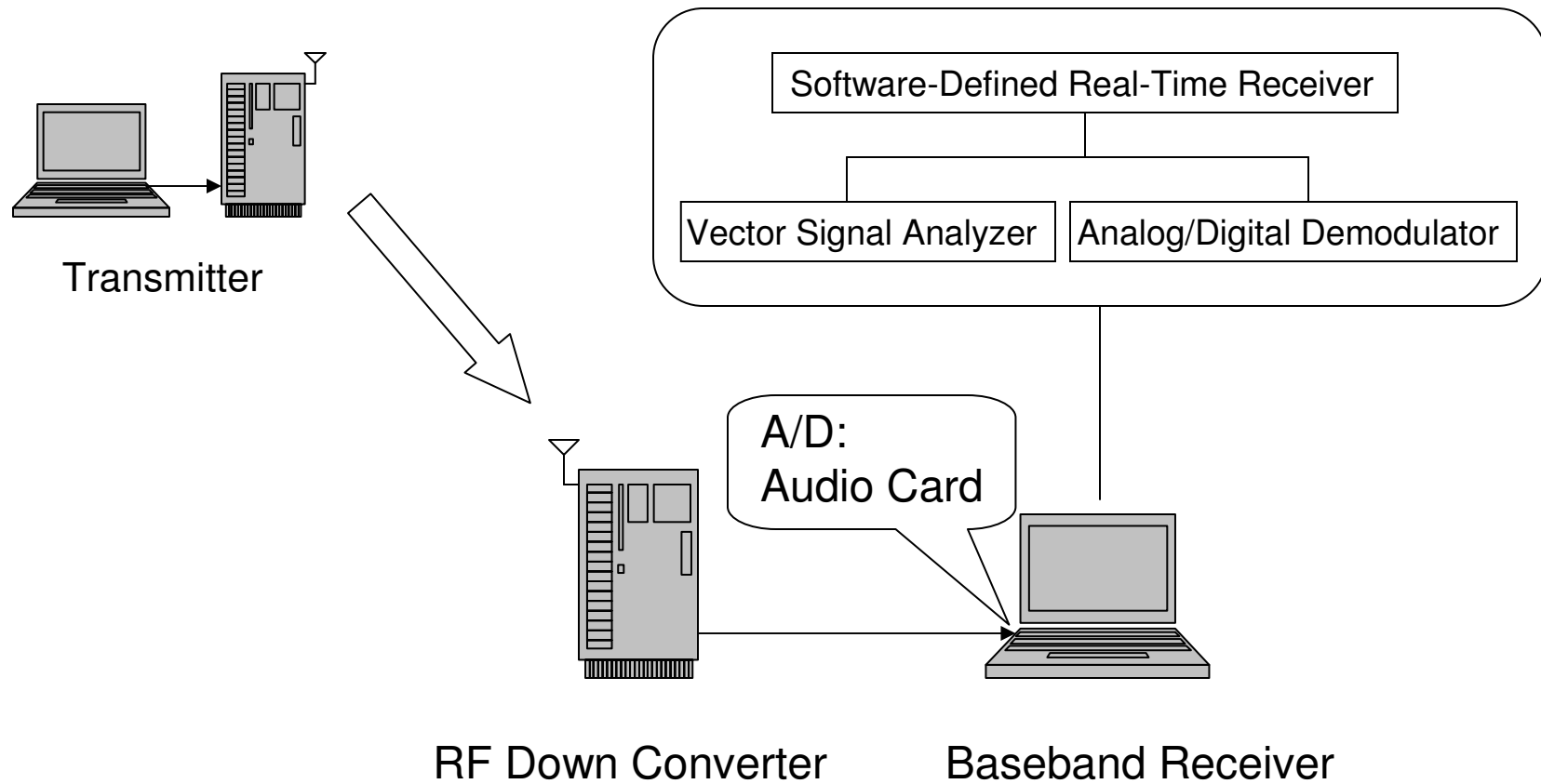
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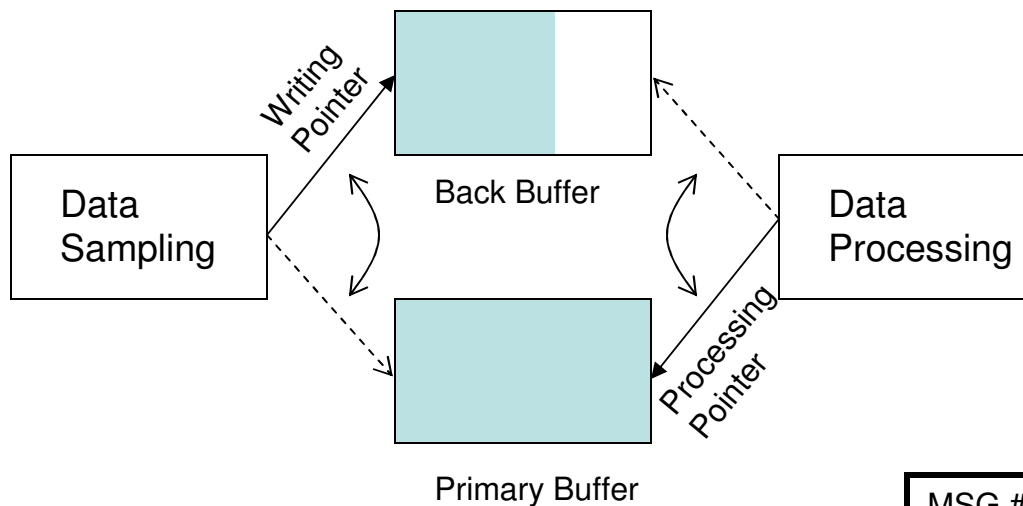
October 10, 2003

Hardware Connectivity: Simplex



Real-Time Data Acquisition

Double-Buffering



When the new data is complete and self consistent, redirect the asynchronous processor to the alternate buffer.

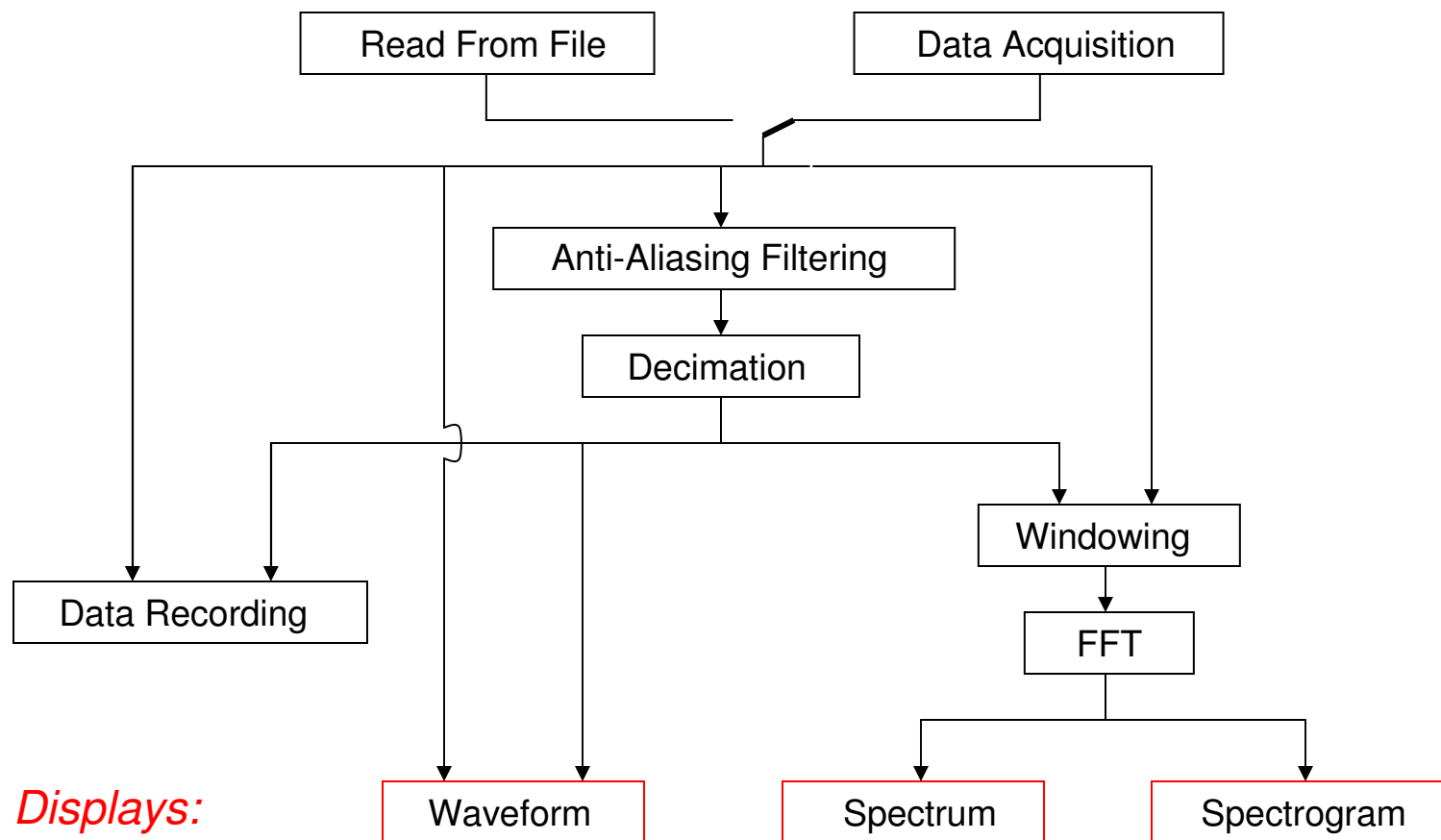
Windows XP Operating System for Real-Time Application



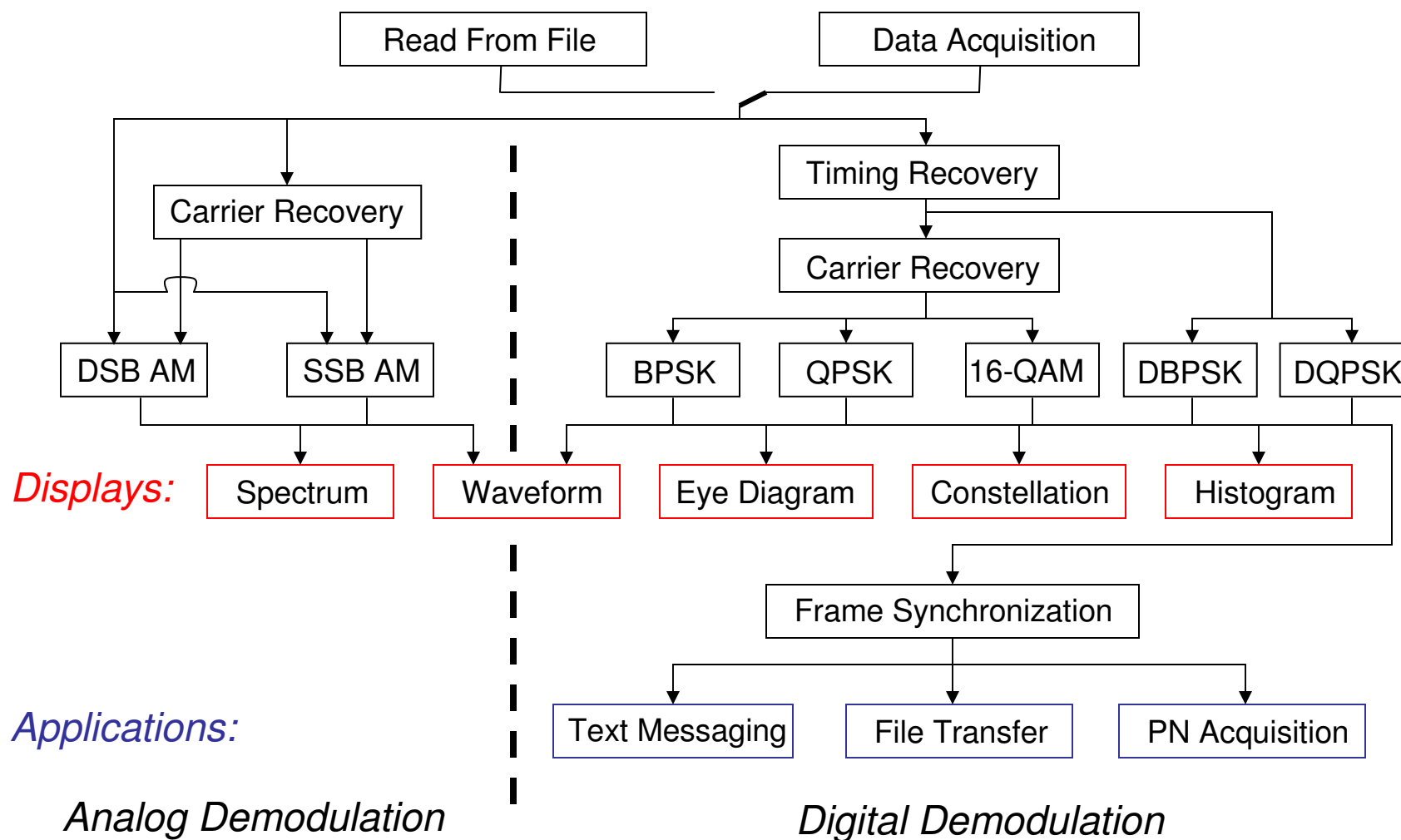
Set high priority to Audio Card messages:

MSG #	MSG ID	MSG Content
960	MM_WIM_DATA	Audio buffer Full
959	MM_WIM_CLOSE	Close WAVE device
958	MM_WIM_OPEN	Open WAVE device

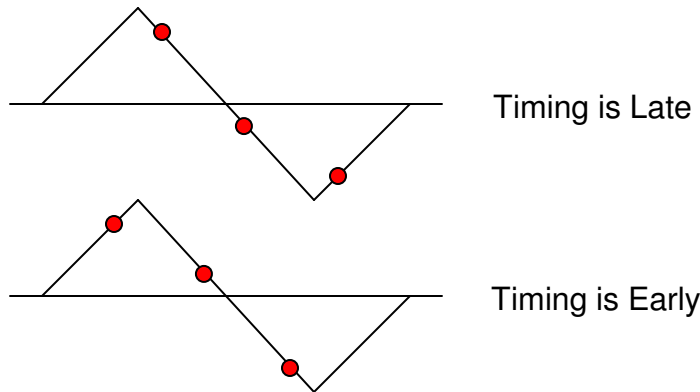
Software Functionality: Spectrum Analyzer



Software Functionality: Baseband Receiver



Synchronization



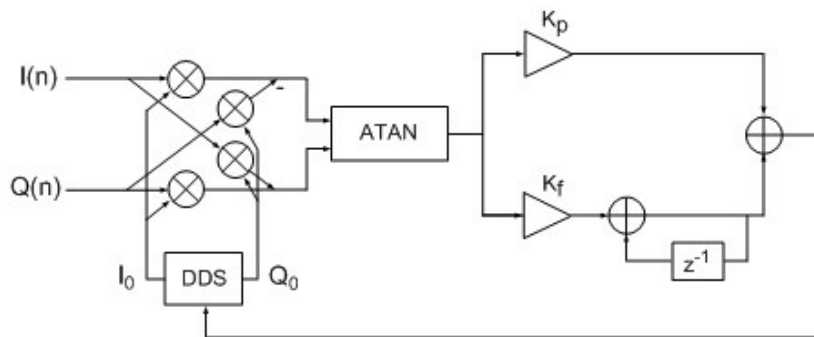
Frame Structure:

Barker	ID	Data
13 bits	3 bits	384 bits

Barker-13 code is used for frame synchronization and recovering the phase ambiguity of detection.
Data traffic is allocated at the 384 data bits.
The 3-bit ID defines the application identity:

Bit Sync: Gardner Algorithm

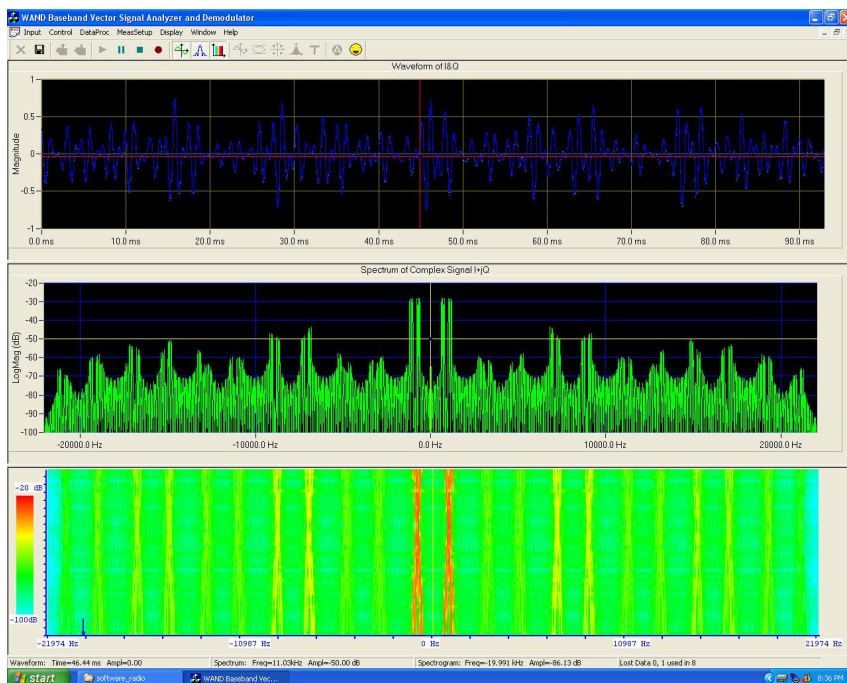
$$e(n) = x(n-1/2) [x(n) - x(n-1)]$$



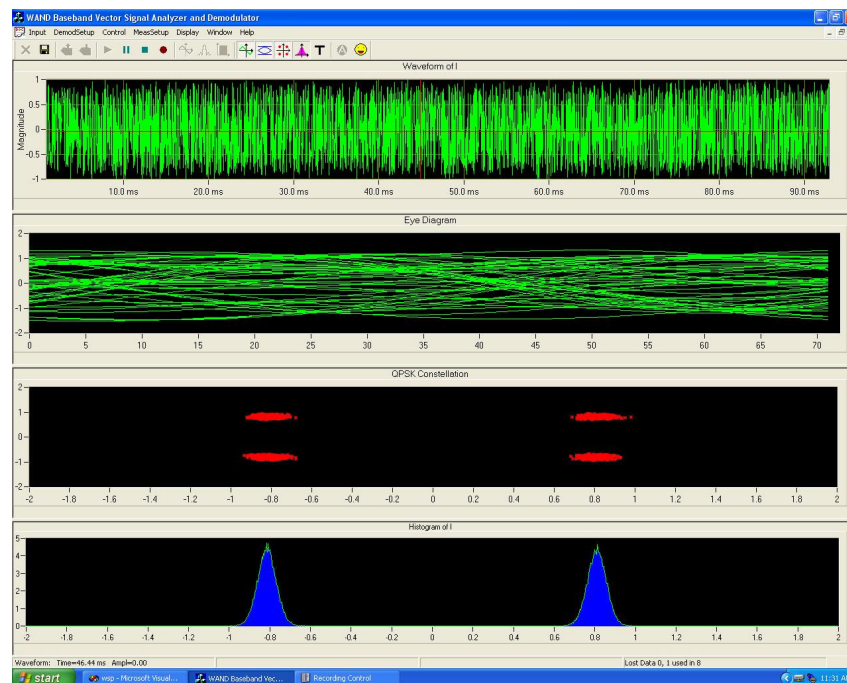
Carrier Sync: Digital Phase-Locked Loop

000	Idle State
001	Reserved
010	Text Messaging
011	Reserved
100	File Transfer
101	Reserved
110	Voice Communication
111	PN Acquisition

User Interface

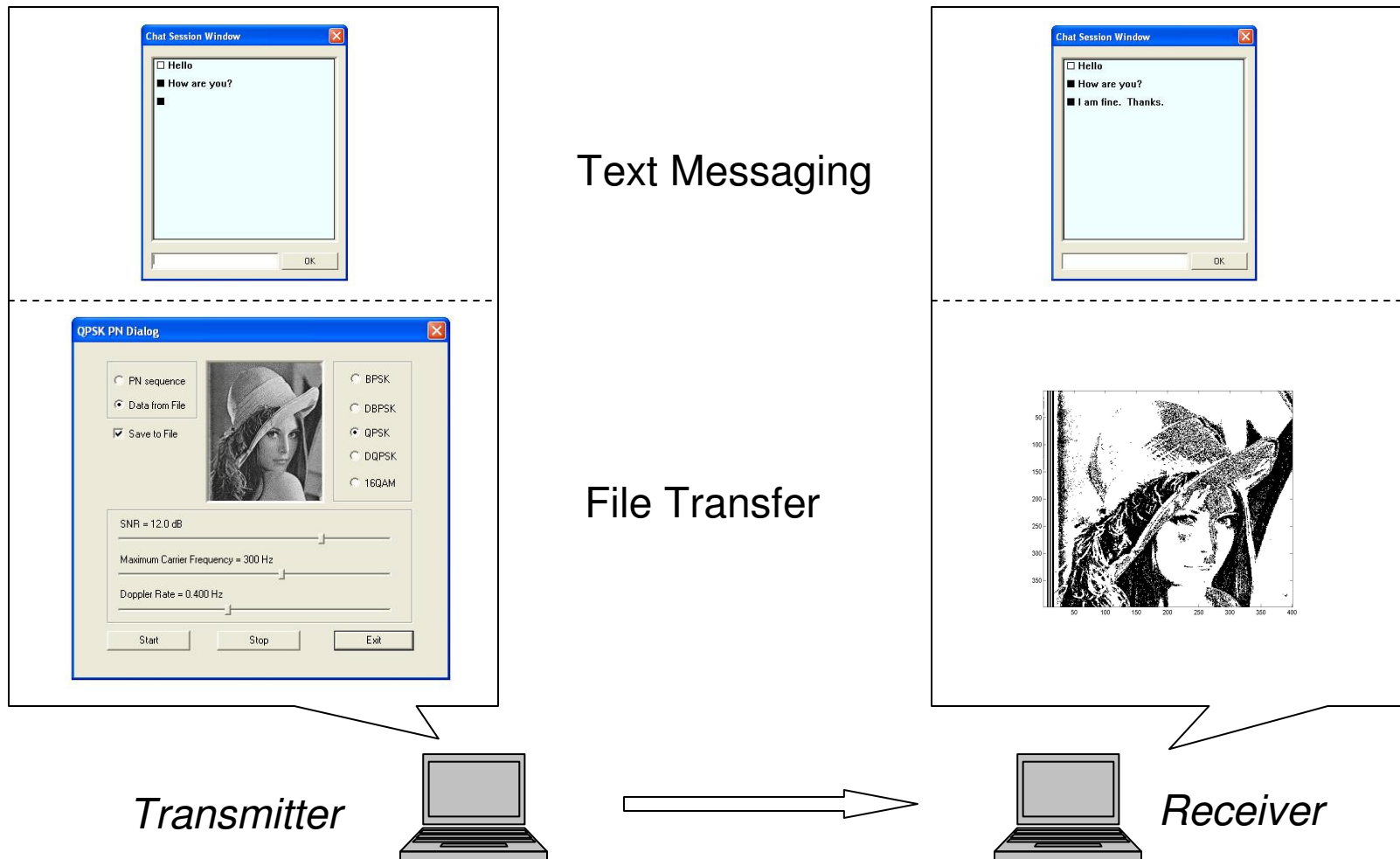


Vector Signal Analyzer



Digital Demodulator (QPSK)

Application Layer Demonstrations



Research and Education Applications

Research:

- Characterization of *220 MHz* mobile channel – delay spread, Doppler, etc.
- “Real world” testbed for advanced error control, coded modulation, and adaptive equalization techniques.
 - Compare simulation trends with those obtained in actual channel.
 - Use the results to improve simulation model.

Education:

- Demonstrate basic communication functions.
- Implement classic modulation and coding techniques.
 - For instance:

