EE4800-03
Embedded Systems Design

Lessons 13-14

Logic Analyzers

Overview

- Sampling and Digitizing a Signal
- Logic Analyzer vs. Oscilloscope
- Logic Analyzer Operation

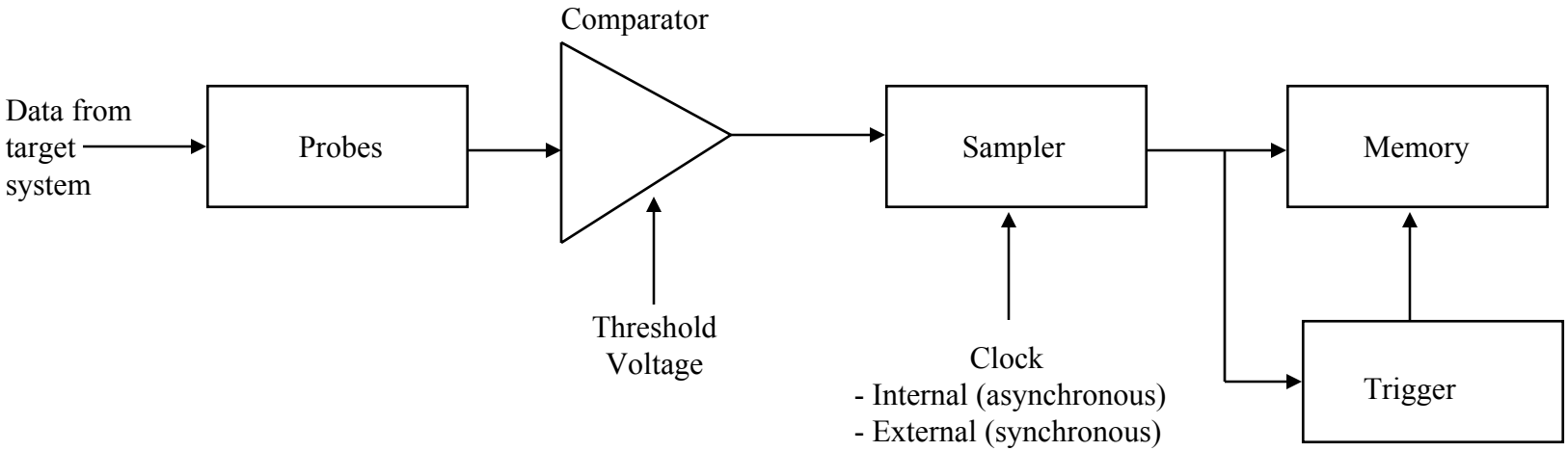
Sampling and Digitizing a Signal

- Signal acquisition:
  - Sampling input signal
  - Digitizing it to convert to digital data
  - Assembling it into a waveform record
- Logic analyzer converts incoming data into ones and zeros
  - Uses comparator with user-selectable threshold
  - Samples data at regular time intervals
  - Reference: Figure 2-1, Tektronix extract

Logic Analyzer vs. Oscilloscope

- Oscilloscope samples incoming signal at regular time intervals.
  - Stores sample amplitude into 8-bit digital value.
  - Preserves amplitude information
  - Signal is analog in nature
- LA monitors multiple channels simultaneously
  - Signal is digital in nature
  - Provides timing relationship information
- Both are powerful analysis, troubleshooting tools

Logic Analyzer Operation



Logic Analyzer Operation

- Clocks control when data is sampled
- Types of clocking
  - External (synchronous) - listing data
    - clock source external to LA
    - useful for obtaing state aspects of data
  - Internal (asynchronous) waveform data
    - data may be lost between clocks
    - asychronous provides all data
    - useful for obtaining timing aspects of data

Logic Analyzer Operation

- Acquiring data
  - Logic analyzer samples data from probes
  - Sample taken when clock occurs
- Triggering
  - Trigger program looks at sampled data for specific events and then takes specified action
  - Also provides storage qualification conditions.
    - If met, allows data to be stored in memory

Waveform Data Concepts

- Use LA to observe timing relationship between signals
- All waveforms are time-aligned horizontally and displayed in same time per division
- Can display waveforms or magnitude mode.
  - Provides hexadecimal value of multi-channel bus

Waveform Data Concepts

- Sampling resolution
  - Waveform accuracy depends on sample clock rate used to record incoming signals (remember Nyquist Criteria !?)
  - If sampled too slow, aliasing will occur (Ref: 2-13)
- LA has fixed memory
  - Trade-off between resolution of recorded signal and its duration
  - A faster sample clock will record a smaller portion of the signal