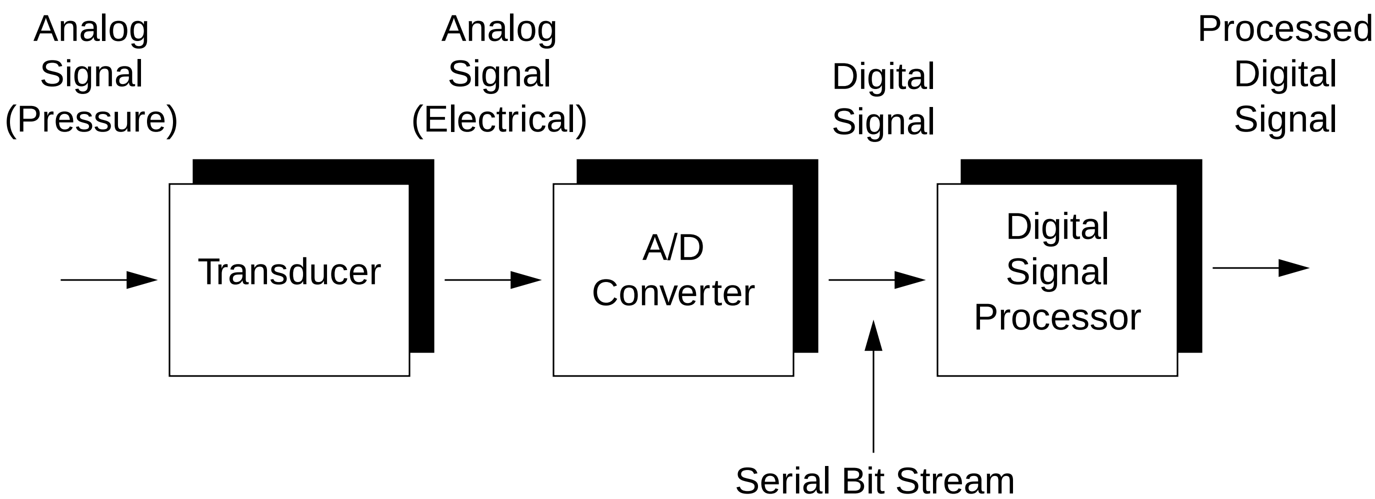
Input / Output (I/O) For DSP Systems

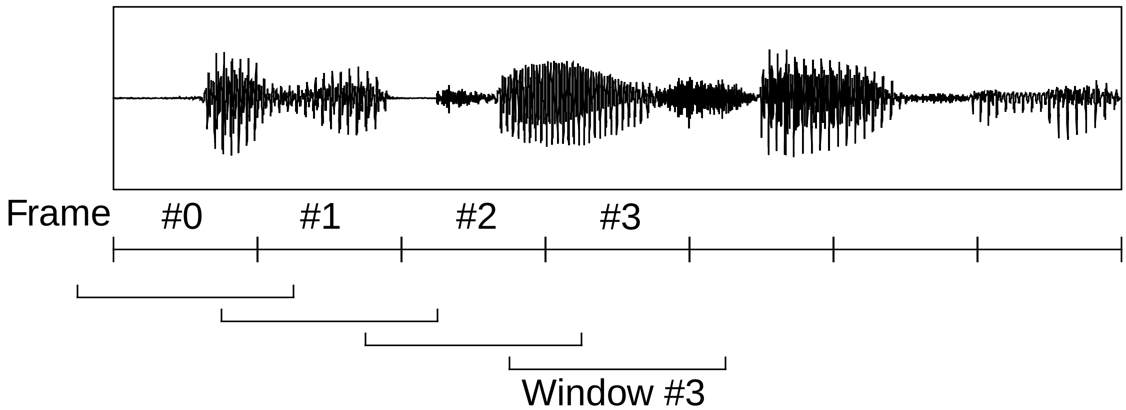
- DSP systems typically operate in real-time. This places unique requirements on I/O software, mainly because it is highly desirable to overlap I/O and processing (you don't want the program waiting on data).



- Issues:
  - — Interconnection of two devices with serial bit streams
  - — Code that requires variable amounts of time to execute
  - — Interrupt servicing
  - — Latency
  - — Buffering
  - — Algorithm performs frame-based analysis
- Solution:
  - — Implement buffering within the DSP chip
- Add useful URLS here...

Why Frame-Based Analysis?

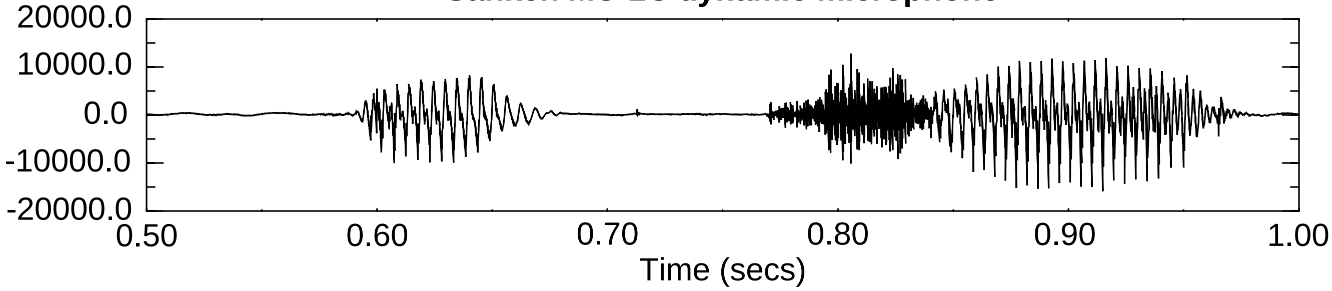
- A one-dimensional signal example: a typical frame overlap is 50%



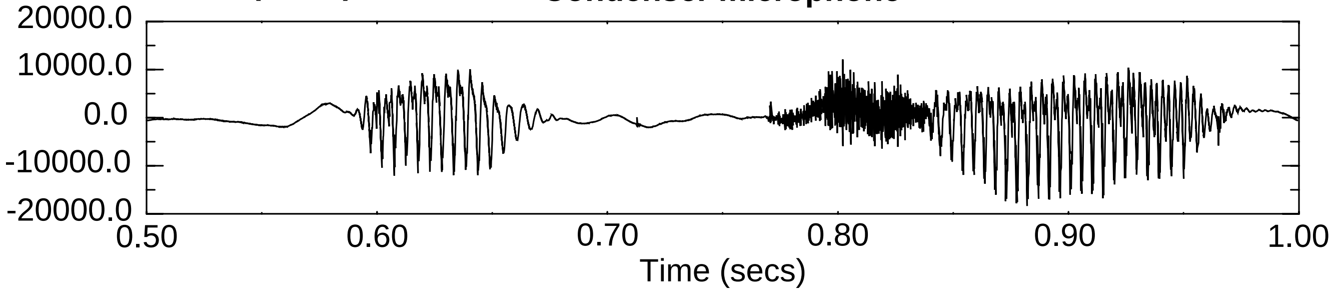
- An image processing example in which the window size might be a power of 2 or 4 to accommodate a Fast Fourier Transform or Discrete Cosine Transform.

What Do Signals Look Like?

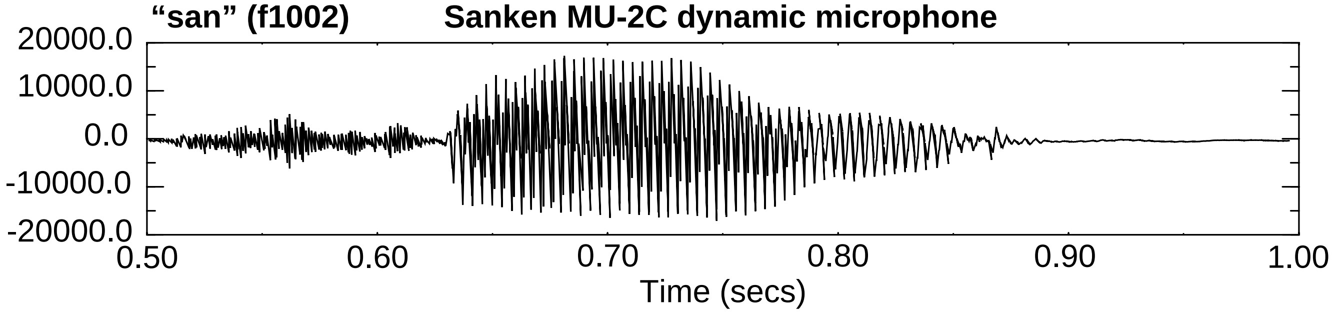
“ichi” (f1001) **Sanken MU-2C dynamic microphone**



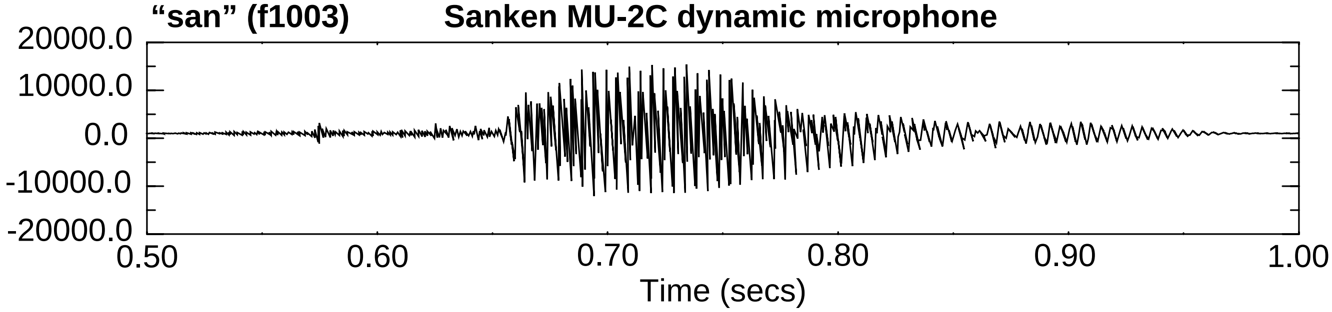
“ichi” (f1001) **Condenser microphone**



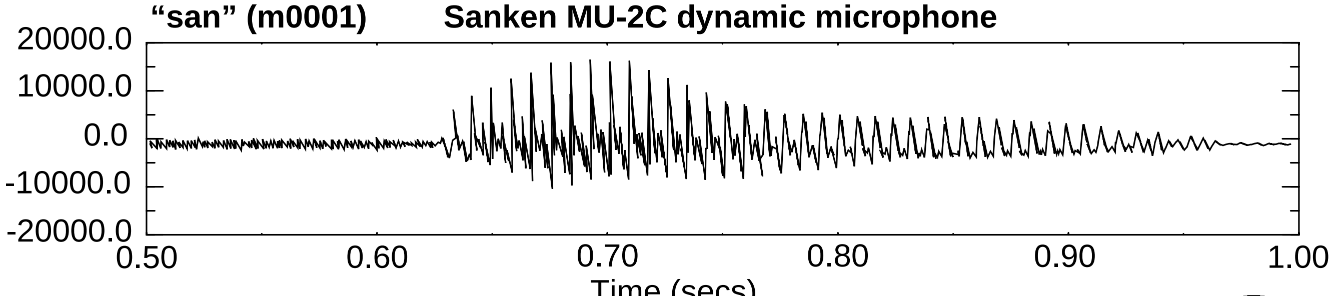
“san” (f1002) **Sanken MU-2C dynamic microphone**



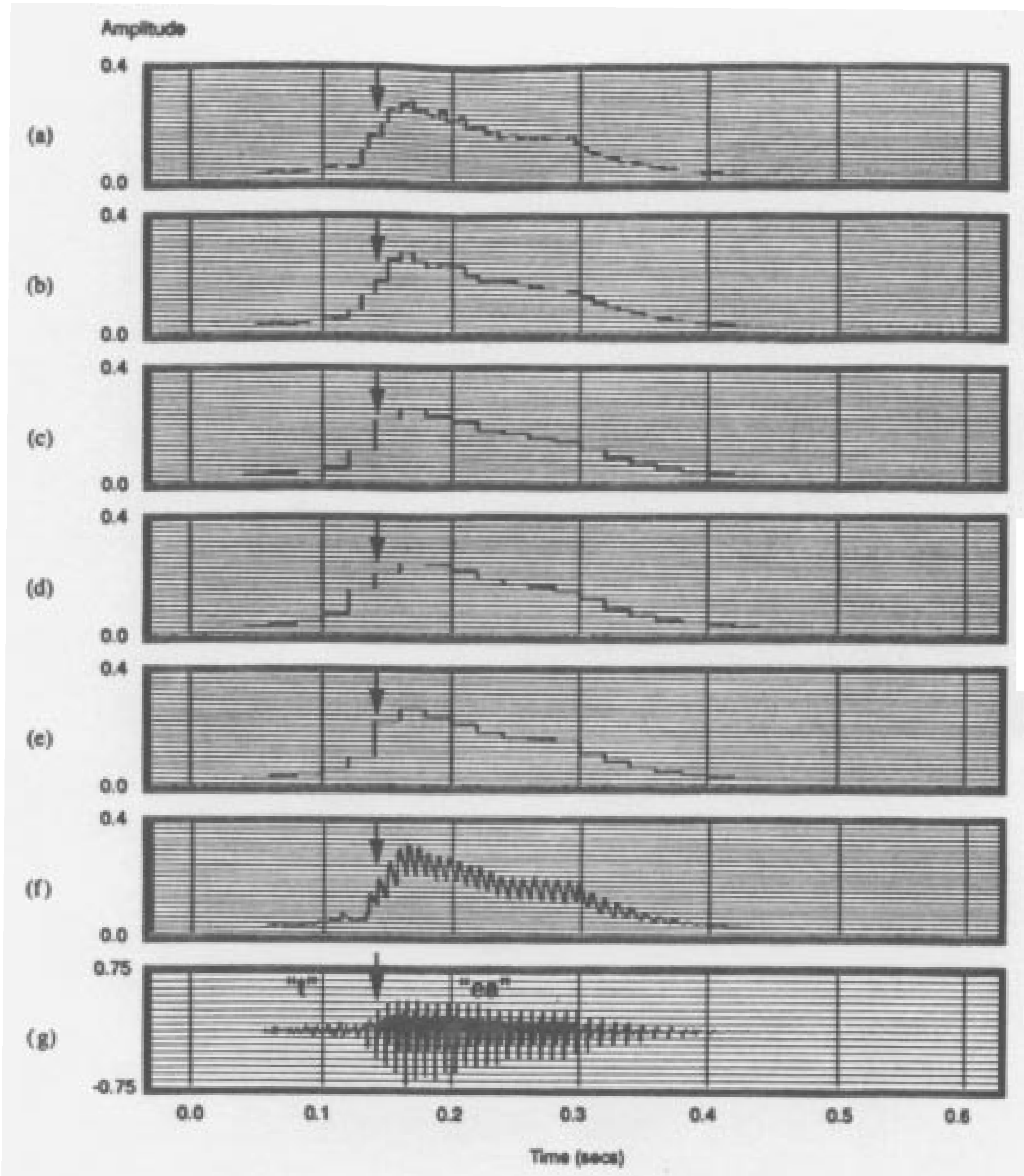
“san” (f1003) **Sanken MU-2C dynamic microphone**



“san” (m0001) **Sanken MU-2C dynamic microphone**



An Example of the Importance of Frame / Window Size



(a) $T_f = 5\ ms$, $T_w = 10\ ms$

(b) $T_f = 10\ ms$, $T_w = 20\ ms$

(c) $T_f = 20\ ms$, $T_w = 30\ ms$

(d) $T_f = 20\ ms$, $T_w = 30\ ms$, $Hamm.\ Win.$

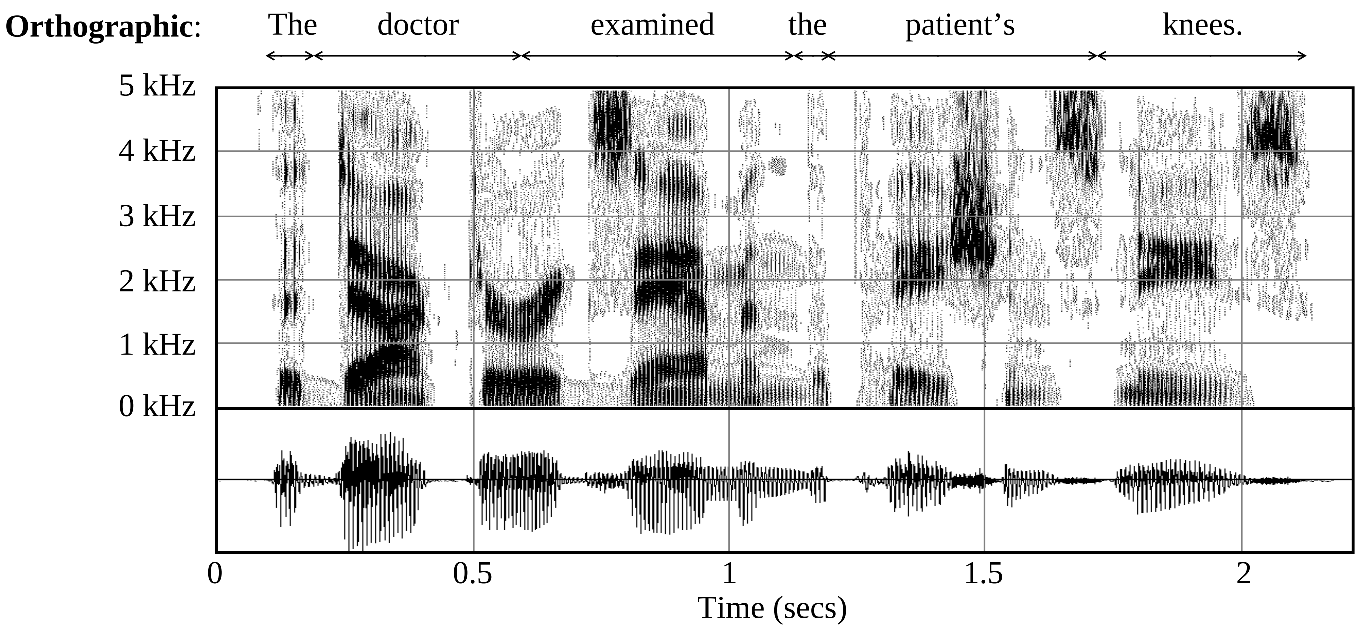
(e) $T_f = 20\ ms$, $T_w = 60\ ms$, $Hamm.\ Win.$

(f) Recursive 50 Hz LPF

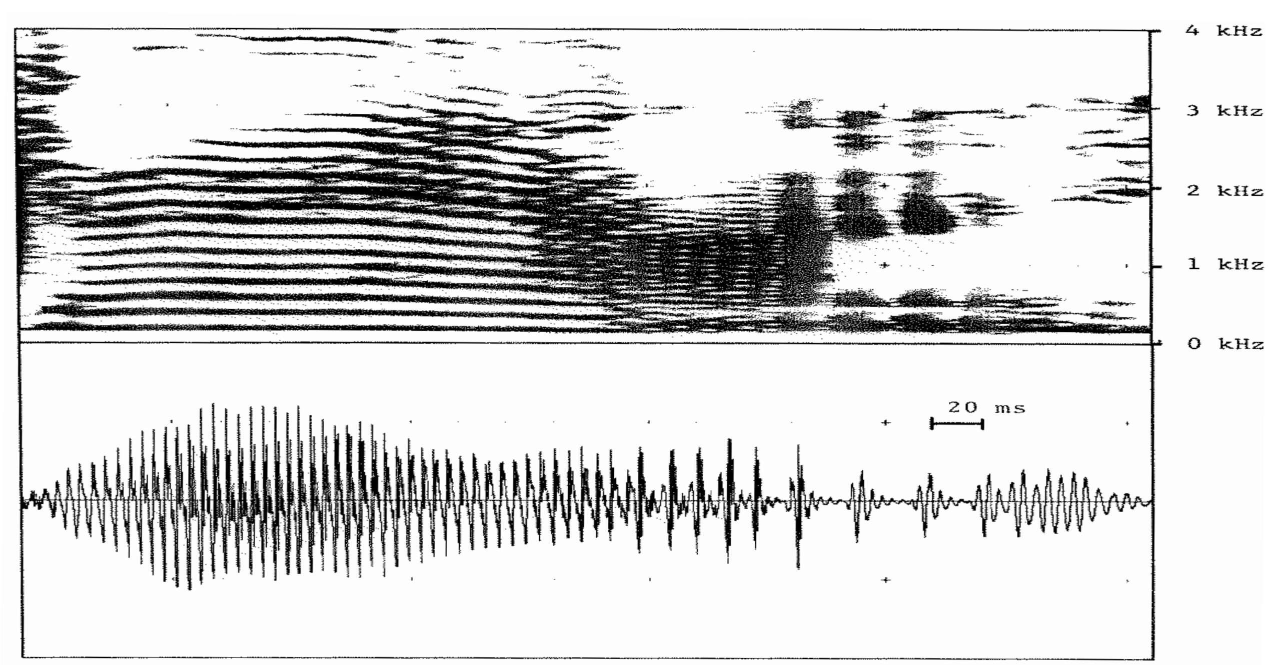
(g) Speech Signal

What Does A Speech Signal Spectrogram Look Like?

Standard wideband spectrogram ($f_s = 10\ kHz$, $T_w = 6\ ms$):



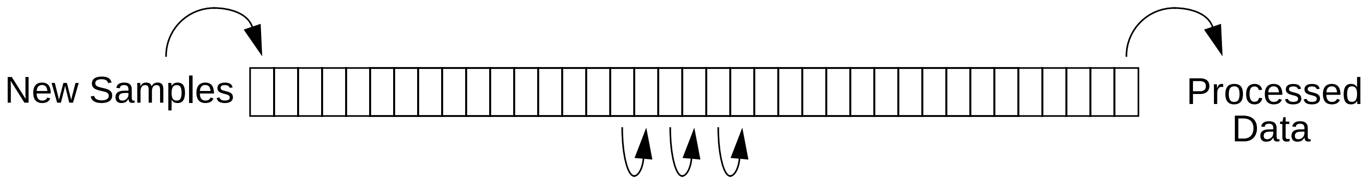
Narrowband Spectrogram ($f_s = 8\ kHz$, $T_w = 30\ ms$):



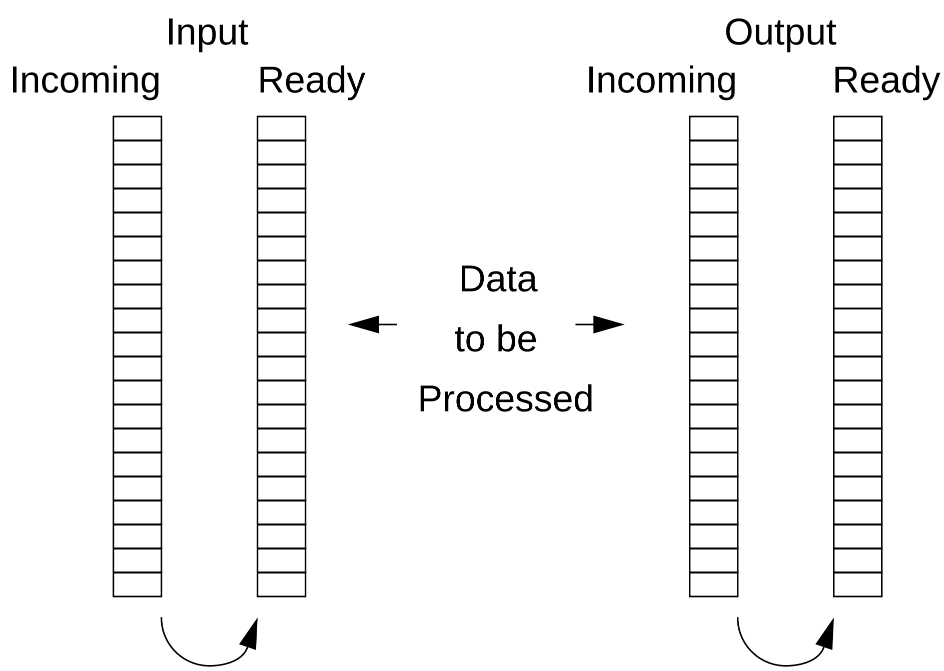
"Drown" (female)

Solutions

- Delay Line (Shift Registers)

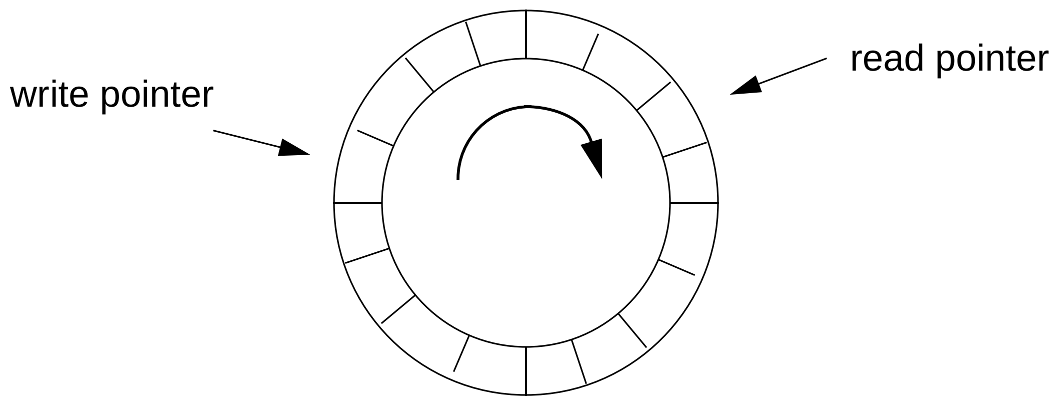


- Ping-Pong Buffer



- What is wrong with these approaches?

Better Solution: Circular Buffer



- Efficient, simple, and typically addressing modes are supported in hardware