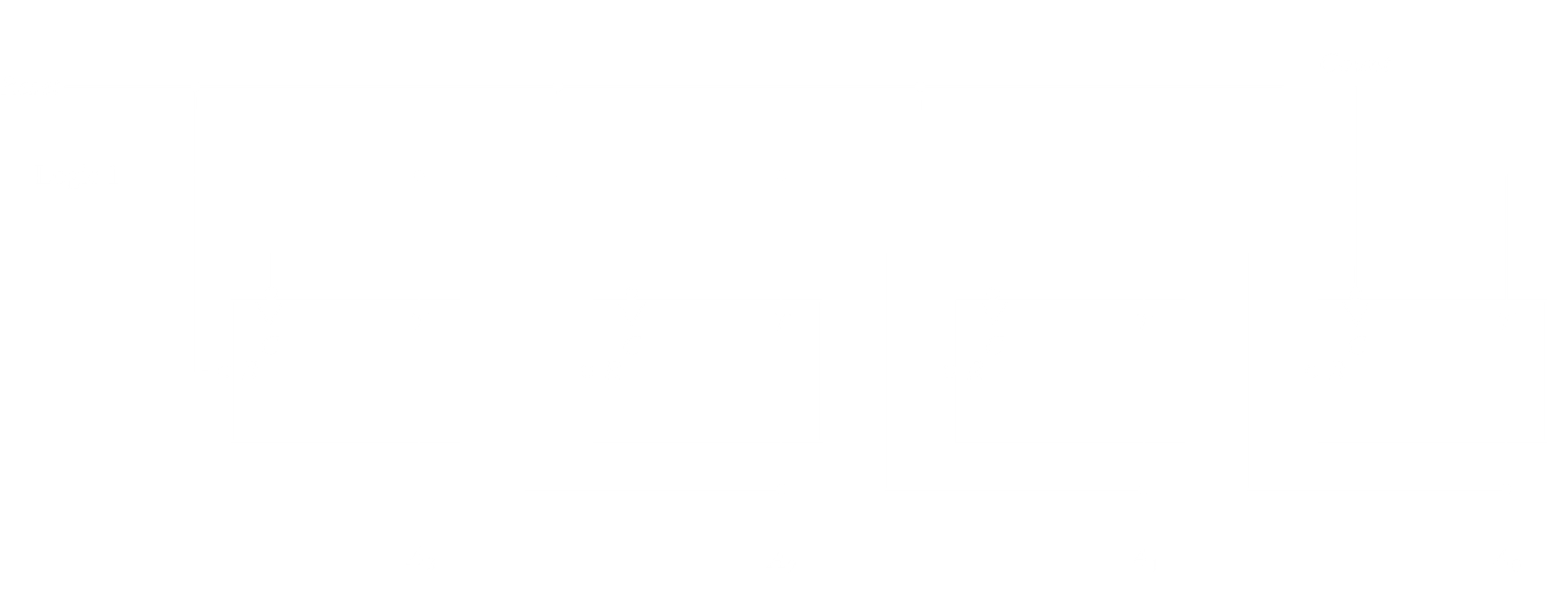
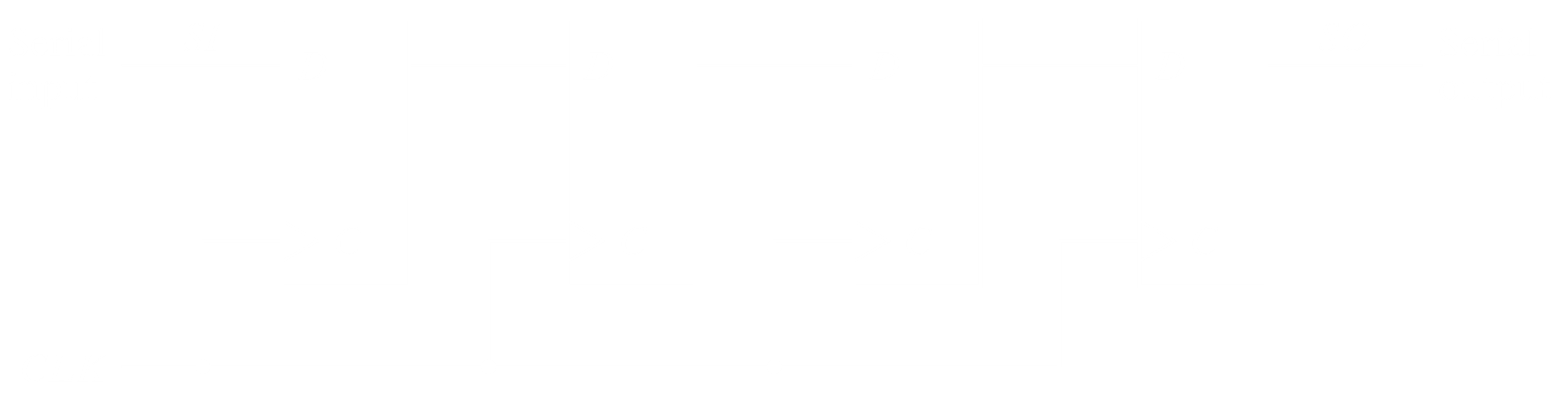
Binary Ripple Counter

* Follows binary sequence
* Consists of a series of flip flops, with the output of each flip flop connected to the clock pulse input of the next flip flop
* Flip flop of least significant bit receives main clock pulse
* Uses negative edge triggers
* Frequency of clock pulse input for each flip flop is half the frequency of the clock pulse input of the previous flip flop
* Signal propagates through the counter in a ripple fashion
* For flip flops, the counter counts from to , in binary
* Flip flops are not clocked simultaneously, so the counter is asynchronous
* Delay of each flip flop comes into account, making the counter slow



Shift Register

* Register consists of group of flip flops in series to store bits of data
* Shift registers are capable of shifting information in one cell to its neighbour by applying clock pulses
* Output of each flip flop acts as the input to the next
* Data can be shifted left to right or right to left or both ways, depending on whether the register is unidirectional or bidirectional
* Multiple forms of shift registers exist, like serial input serial output (SISO), serial input parallel output (SIPO), parallel input serial output (PISO) and parallel input parallel output (PIPO)
* Universal shift registers combine all the different forms of shift registers



Hamming Code

* Block code capable of detecting up to two simultaneous bit errors and correcting single-bit errors
* Source encodes message by inserting parity bits at the positions in the message which are powers of , i.e. at , , , etc.
* The parity bits have a value of or depending on whether the number of ’s in the variables it considers is odd, giving the parity bit a value of , or even, giving the parity bit a value of
* Destination receives message and performs recalculations to detect errors and find the bit position of the error

Encoding Process

* Calculation of the number of parity bits.
* Positioning the parity bits.
* Calculating the values of each parity bit.

Decoding Process

* Calculation of the number of check bits.
* Evaluating the check bits.
* Error detection and correction