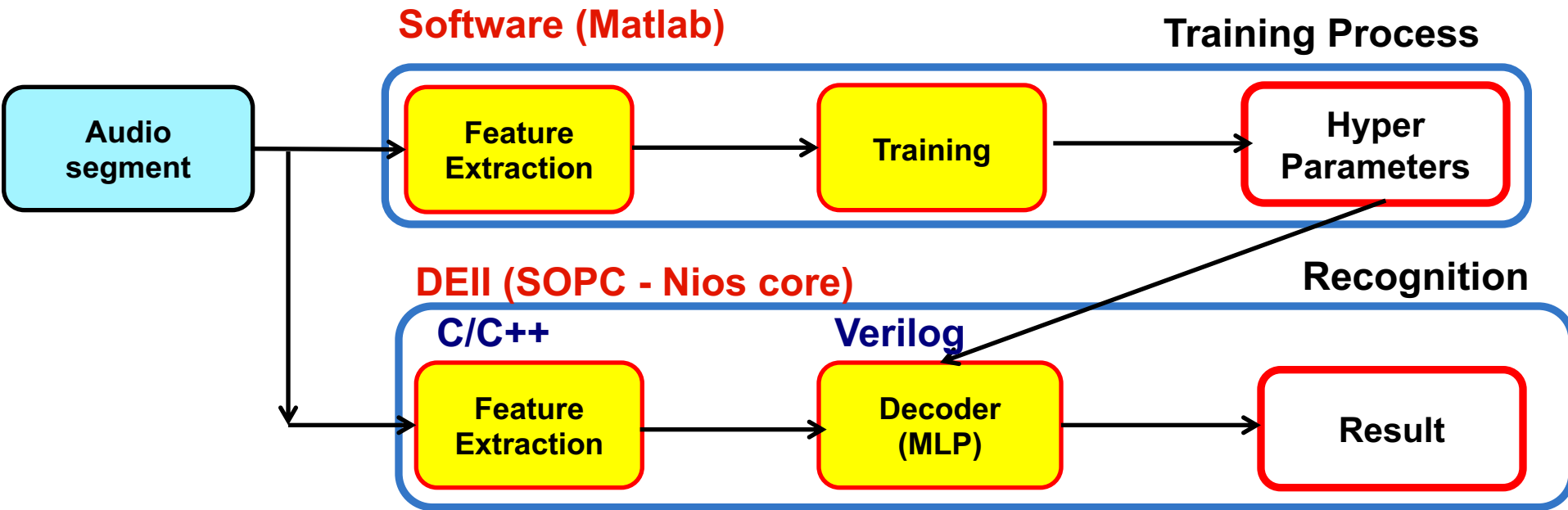


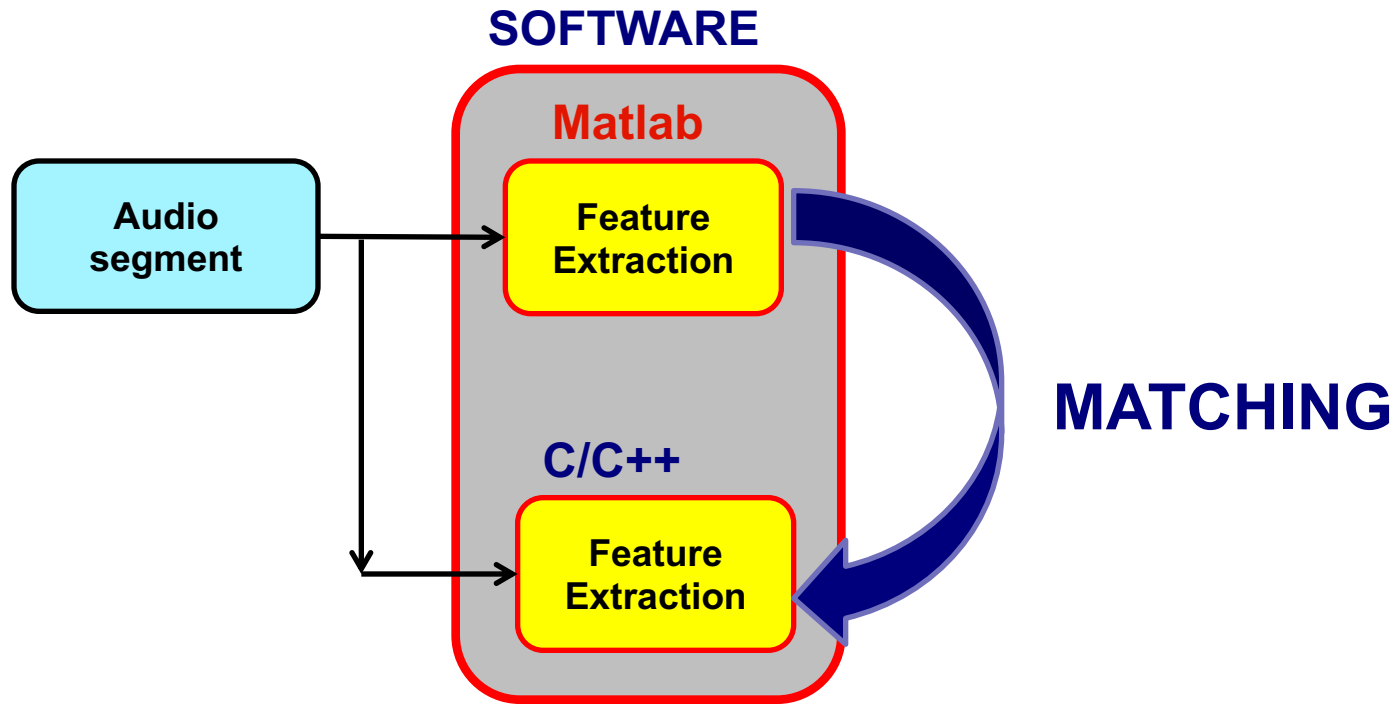
ASR system integrated Neural Network



Feature Extraction: Mel-Frequency Cepstral Coefficients (software approach)

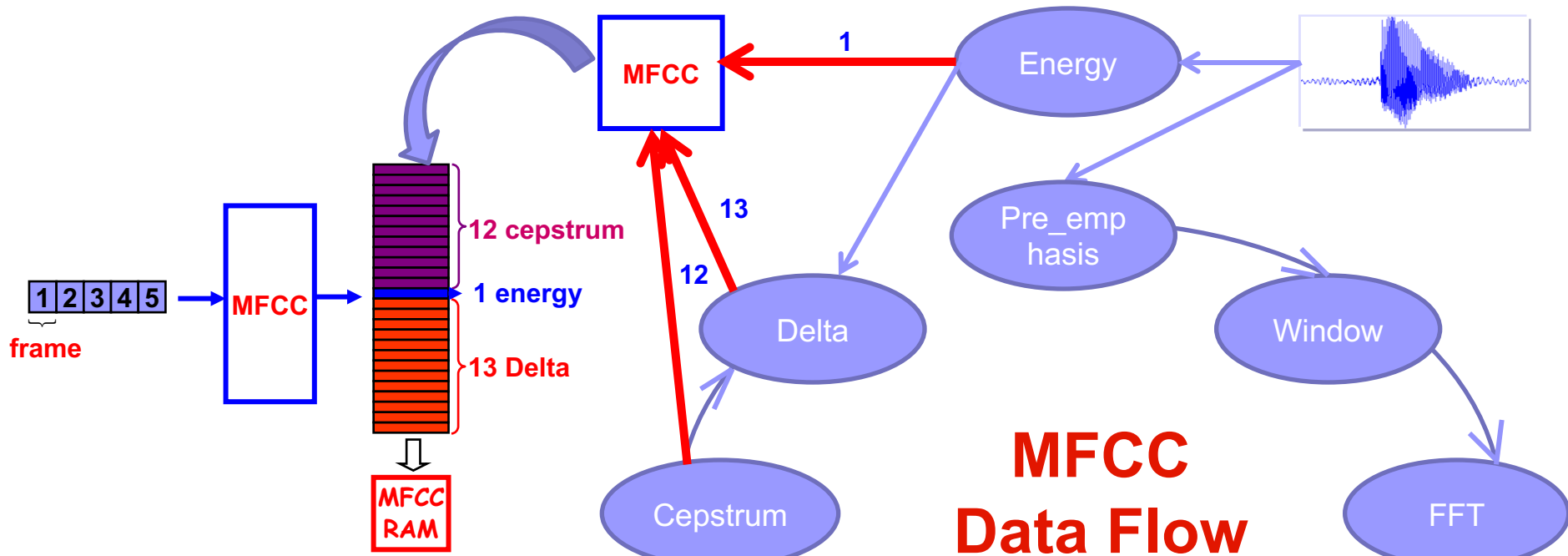
Classifier : Multi-Layer Perceptron Model (hardware approach)

MFCC – Feature Extraction



Software Approach

MFCC – Feature Extraction

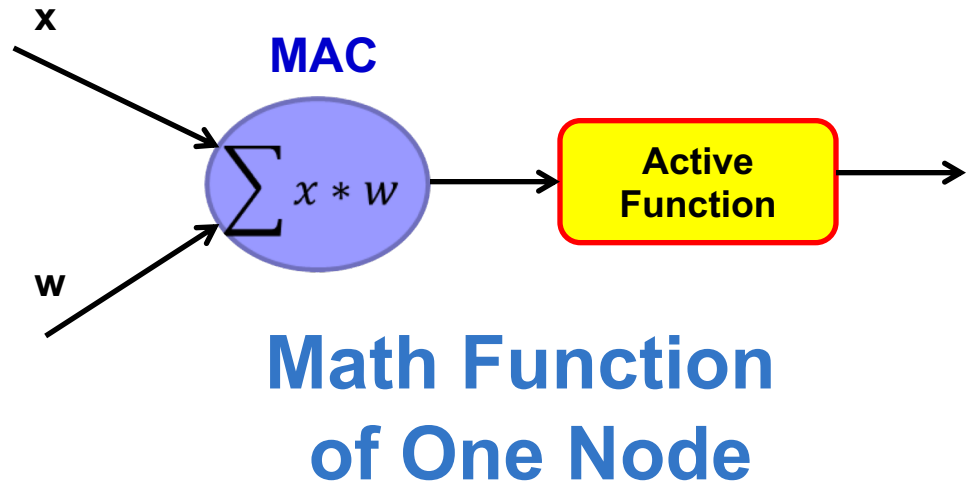
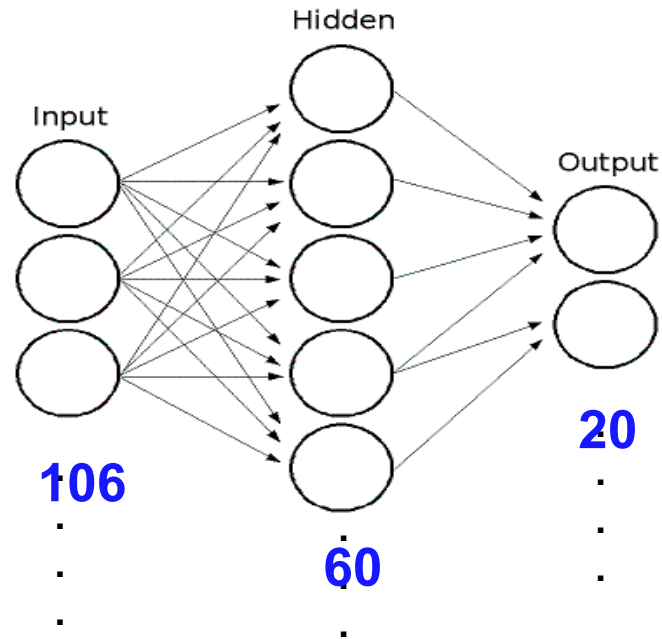


Pre_em	$a = 31/32$
Window/hop	160/50%
FFT	256
Lọc Mel	27
Cepstrum	12
Delta	13
Energy	1

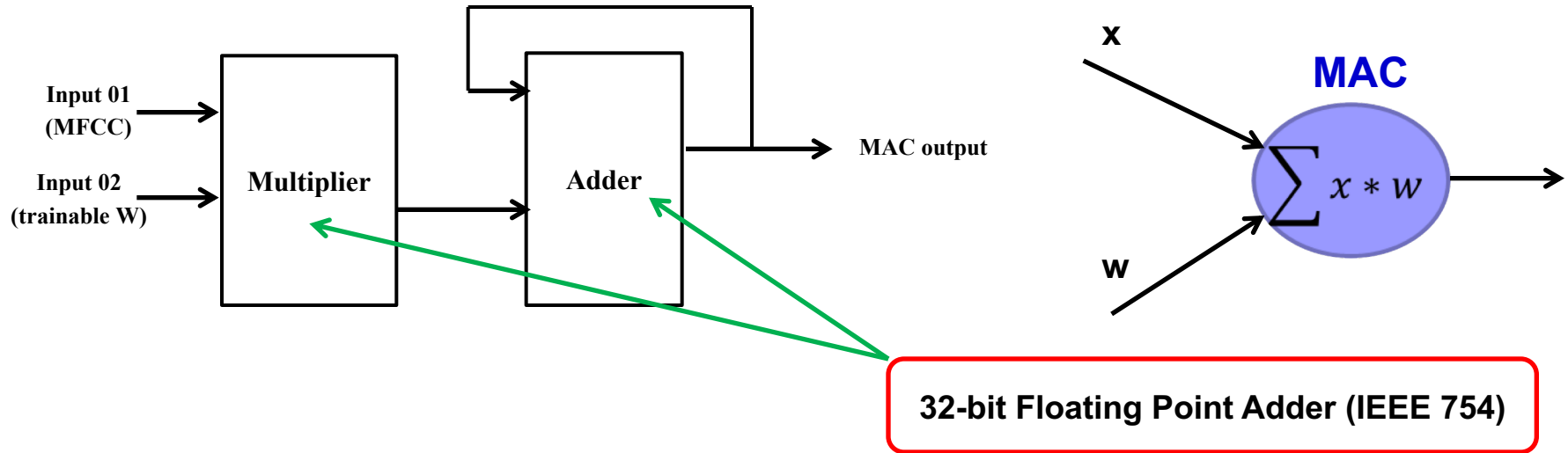
Software Approach

❖ Multi-layer Perceptron Model

- ✓ Three layers
- ✓ 106-60-20

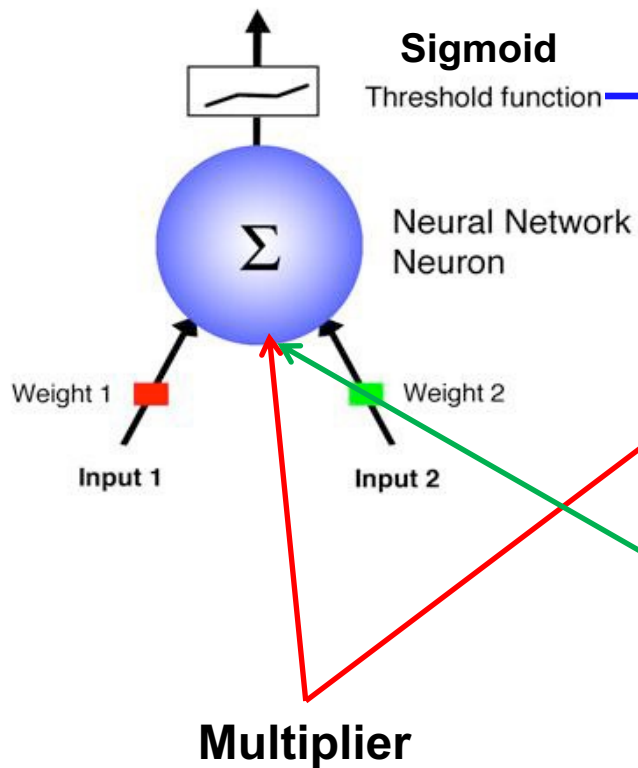


Neural Network - MAC



Neural Network – Active Function

Active Function Approximately

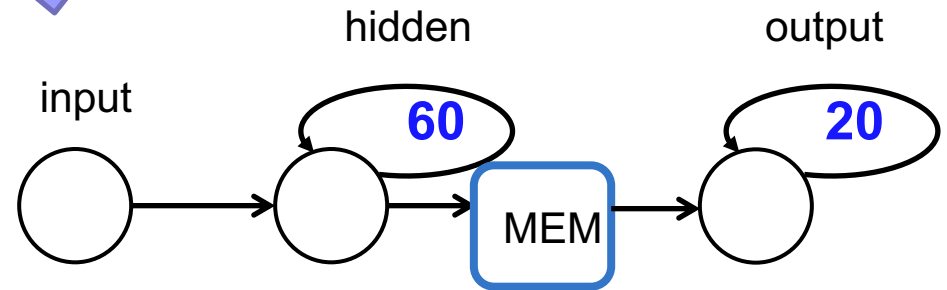
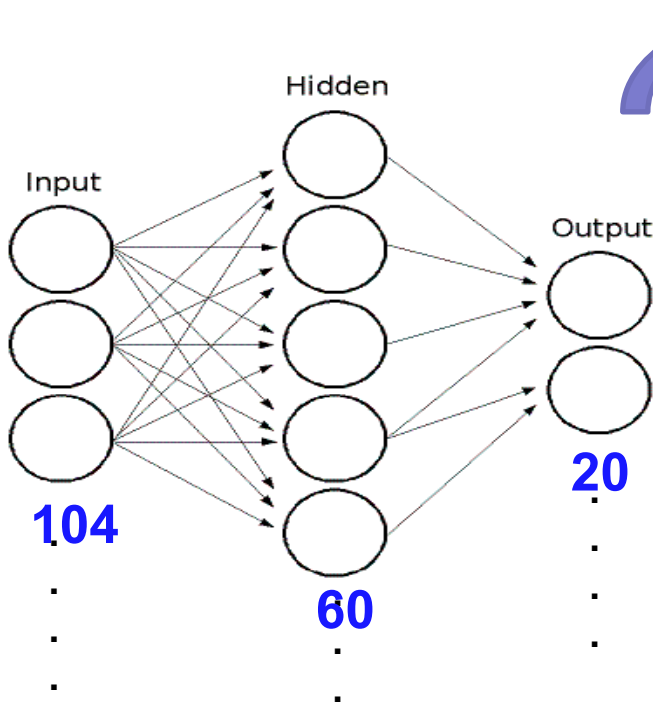


$$y = \begin{cases} 1 & |x| \geq 5 \\ 0.03125 * |x| + 0.84375 & 2.375 \leq |x| < 5 \\ 0.0125 * |x| + 0.625 & 1 \leq |x| < 2.375 \\ 0.25 * |x| + 0.5 & 0 \leq |x| < 1 \end{cases} \quad (2.32)$$

Multiplier

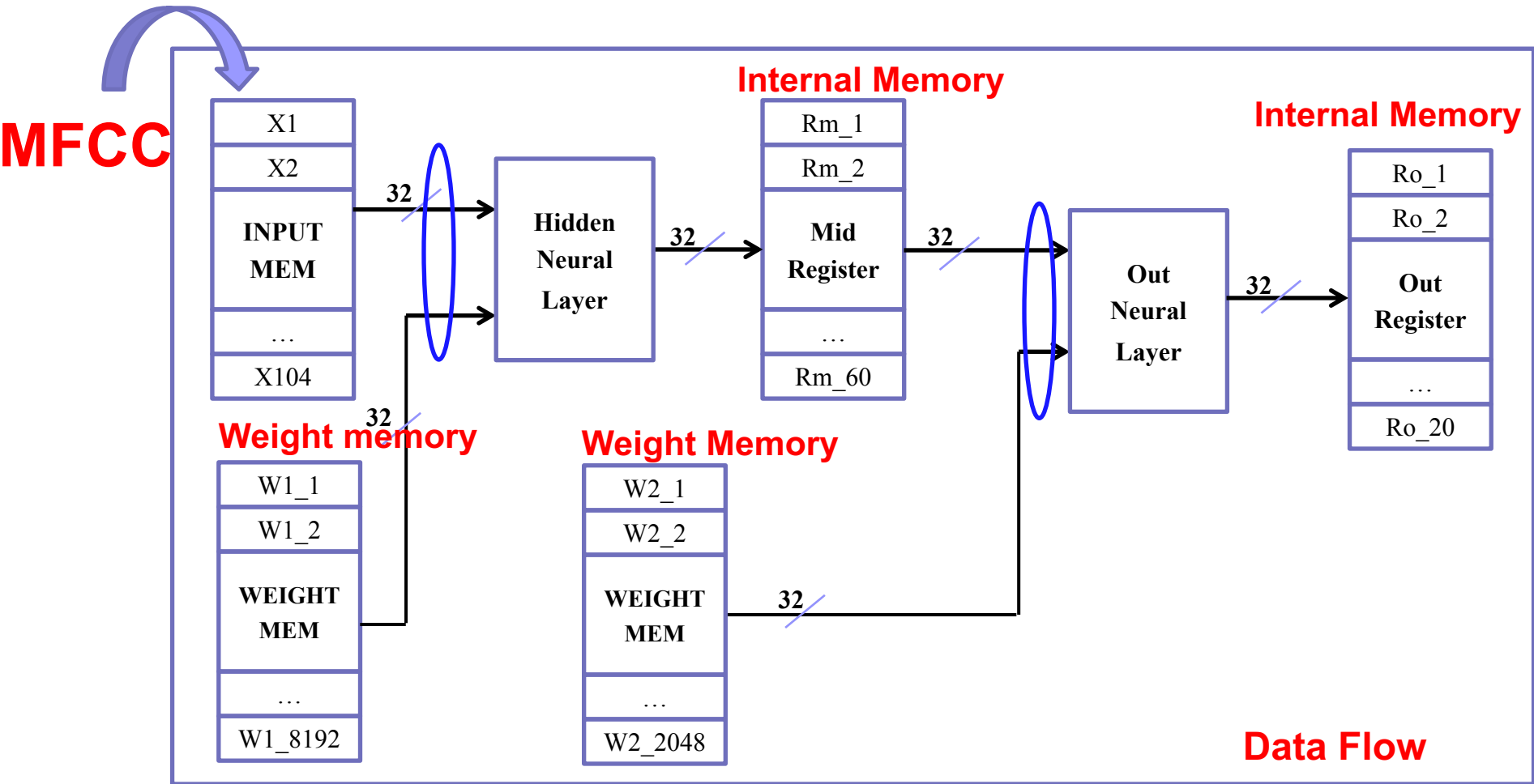
Adder

Neural Network

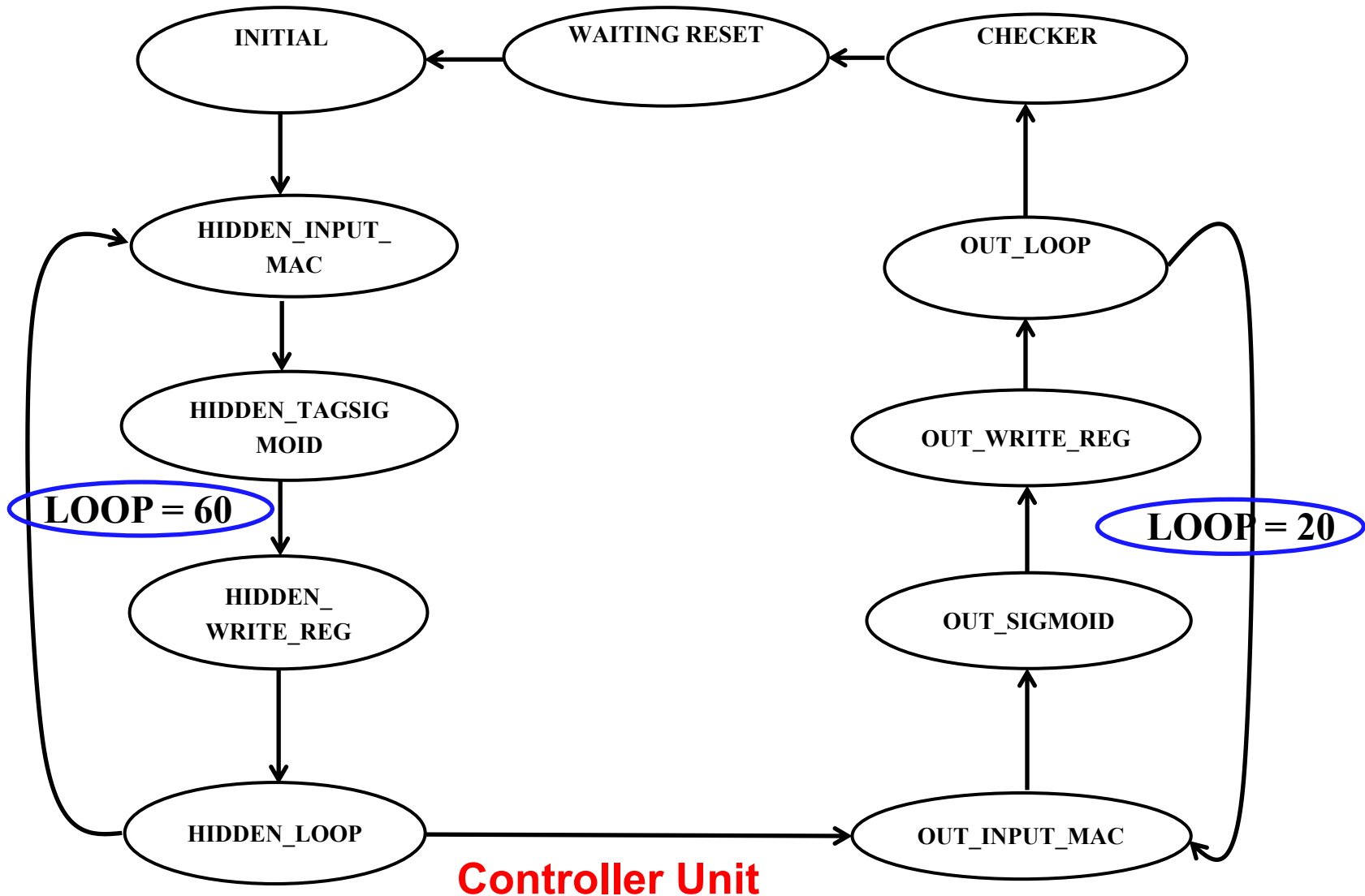


**Function of one node
is repeated**

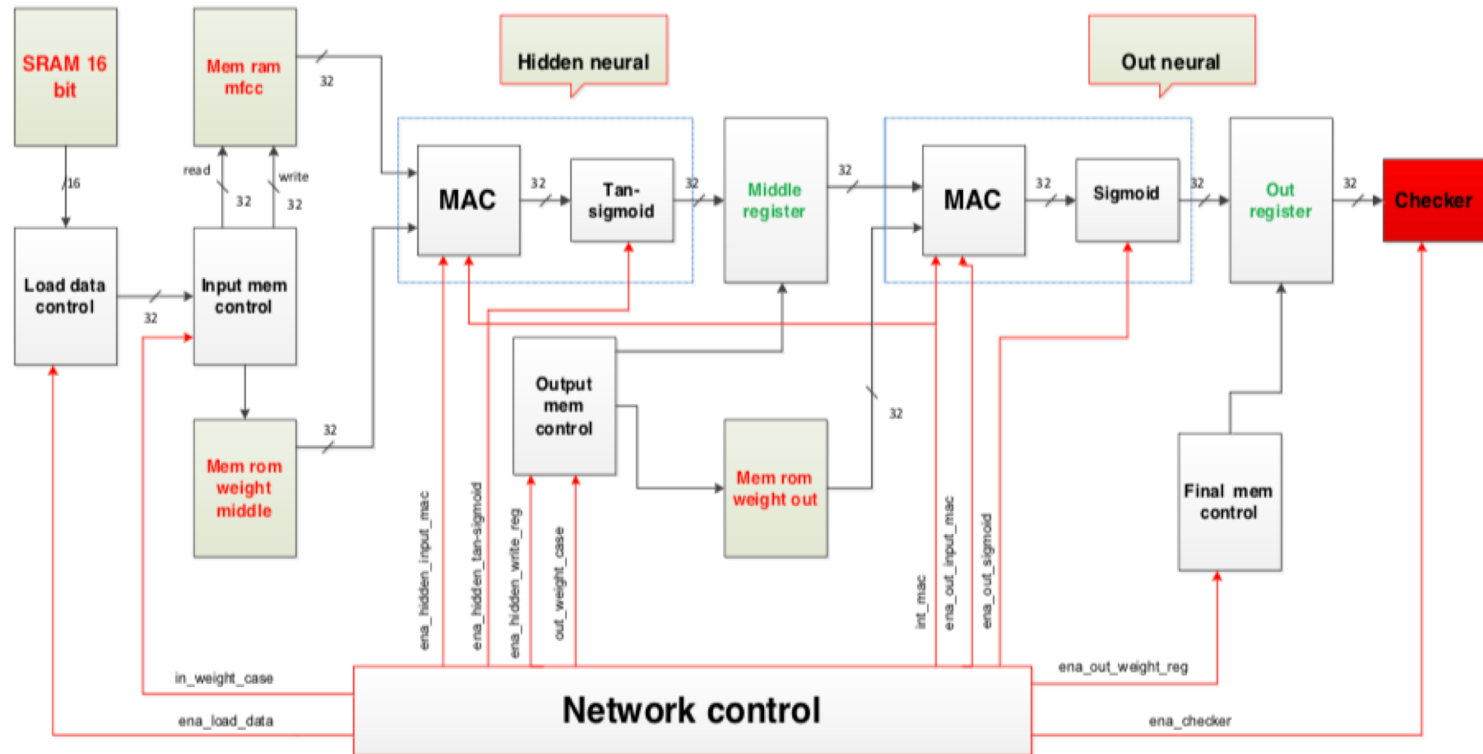
Neural Network – Data Flow



Neural Network – Controller Unit



ASR system intergated Neural Network



**Main componentes for ASR demo on
DEII kit (Altera)**