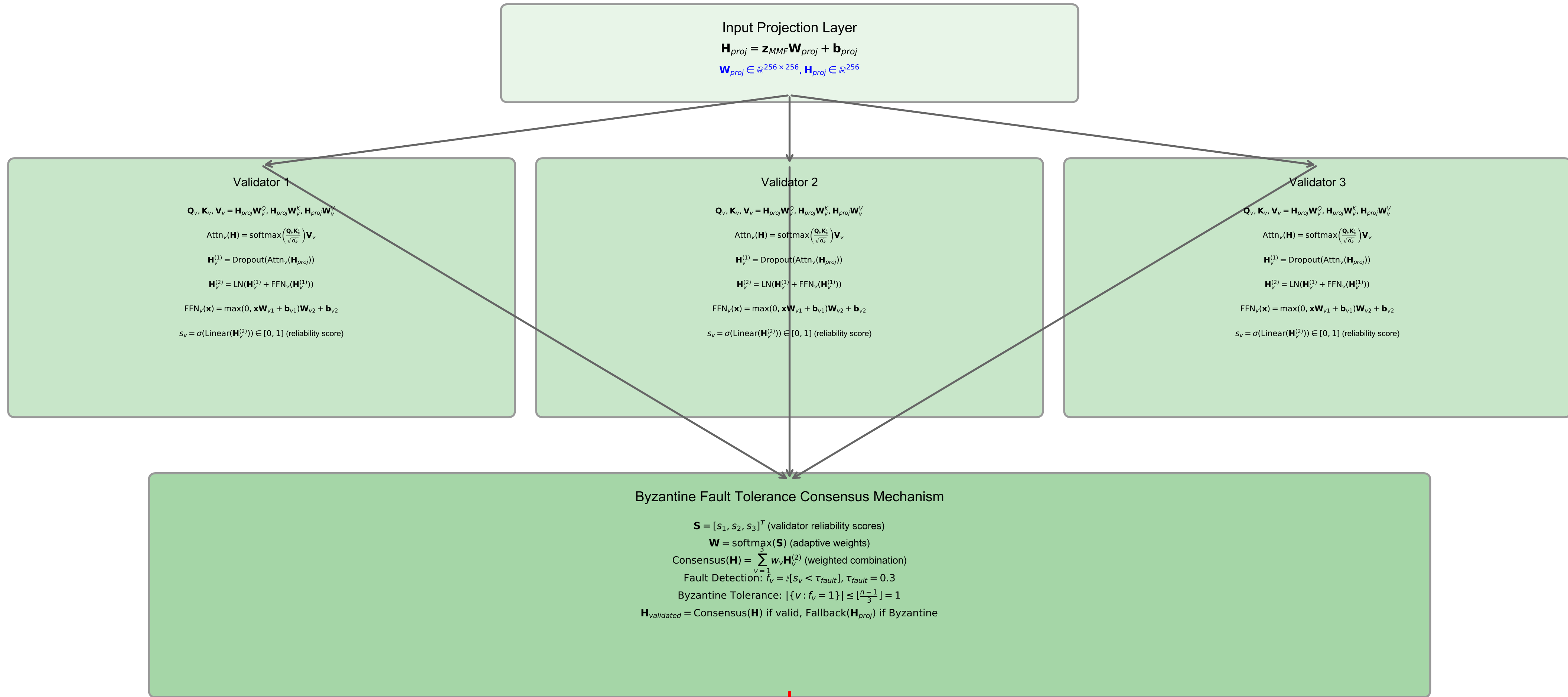


# SA-BFT Detailed Architecture with Mathematical Formulas

## Semantic-Aware Byzantine Fault Tolerance Validator



### SA-BFT Mathematical Specifications:

- Parameters:  $\theta_{SA-BFT} = 2.1M$  (13.4%)
- Input Dimension:  $d_{in} = 256$
- Validators:  $n_v = 3$  (parallel)
- Attention Heads:  $h_v = 8$  per validator
- Dropout Rate:  $p_{drop} = 0.15$
- Fault Threshold:  $\tau_{fault} = 0.3$
- Byzantine Tolerance:  $f \leq 1$  (max faults)
- Consensus Weight:  $w_v \propto s_v$
- Response Time:  $T_{response} < 10ms$
- Detection Accuracy:  $A_{fault} > 95\%$
- Output Dimension:  $d_{out} = 256$
- Reliability Score:  $R \in [0, 1]$

### Validated Features Output

$$\mathbf{Z}_{SA-BFT} = \mathbf{H}_{validated} \in \mathbb{R}^{256}$$

Fault-tolerant, semantically-aware validated features

$$\text{Reliability : } R = \frac{\sum_v s_v \cdot (1 - f_v)}{\sum_v (1 - f_v)} \in [0, 1]$$