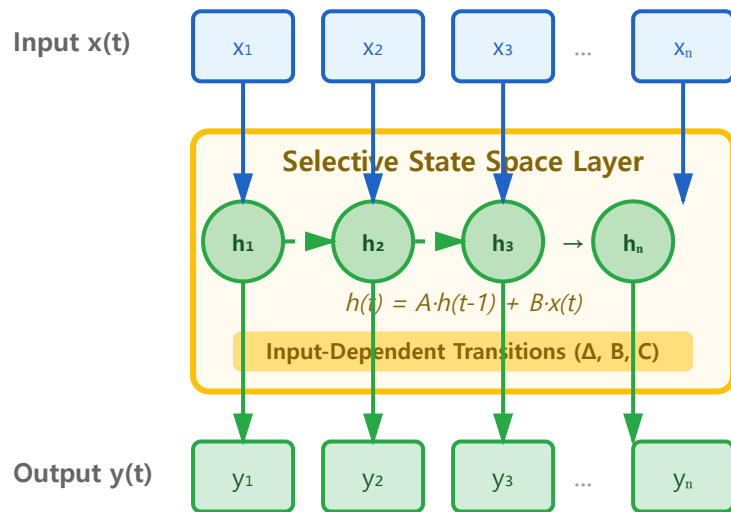


# Mamba: State Space Models with Linear Complexity

## Mamba Architecture: Selective State Space



**Complexity:  $O(n)$  Time & Memory**

Transformer  $O(n^2) \rightarrow$  Mamba  $O(n)$

### State Space Models

- Continuous-time dynamics
- Linear recurrence
- Efficient long sequences

### Selective Mechanism

- Input-dependent  $A, B, C$
- Context-aware filtering
- Mamba's key innovation

### vs Transformers

- Linear scaling with length
- Better for 1M+ tokens
- Faster inference

### Medical Applications

- ICU time-series monitoring
- Continuous glucose tracking
- Long-term EEG analysis

### Next-Gen Efficiency

Mamba achieves Transformer-level performance with  **$O(n)$  complexity instead of  $O(n^2)$** , enabling processing of million-token medical time-series in real-time with selective state updates.