Kinds of Circuits

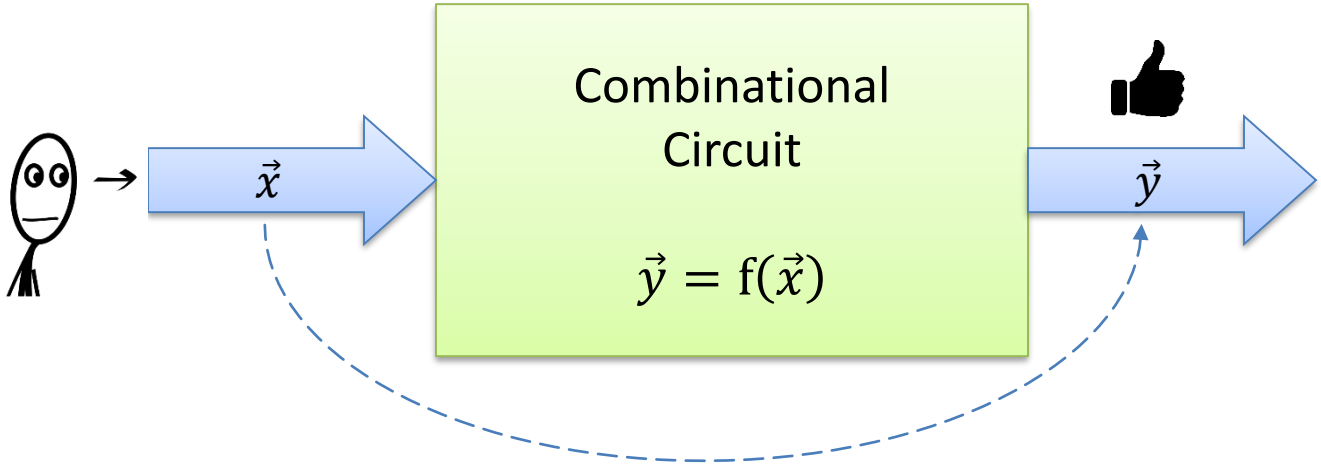
Networks and Embedded Software

First Grade Level

by Wolfgang Neff

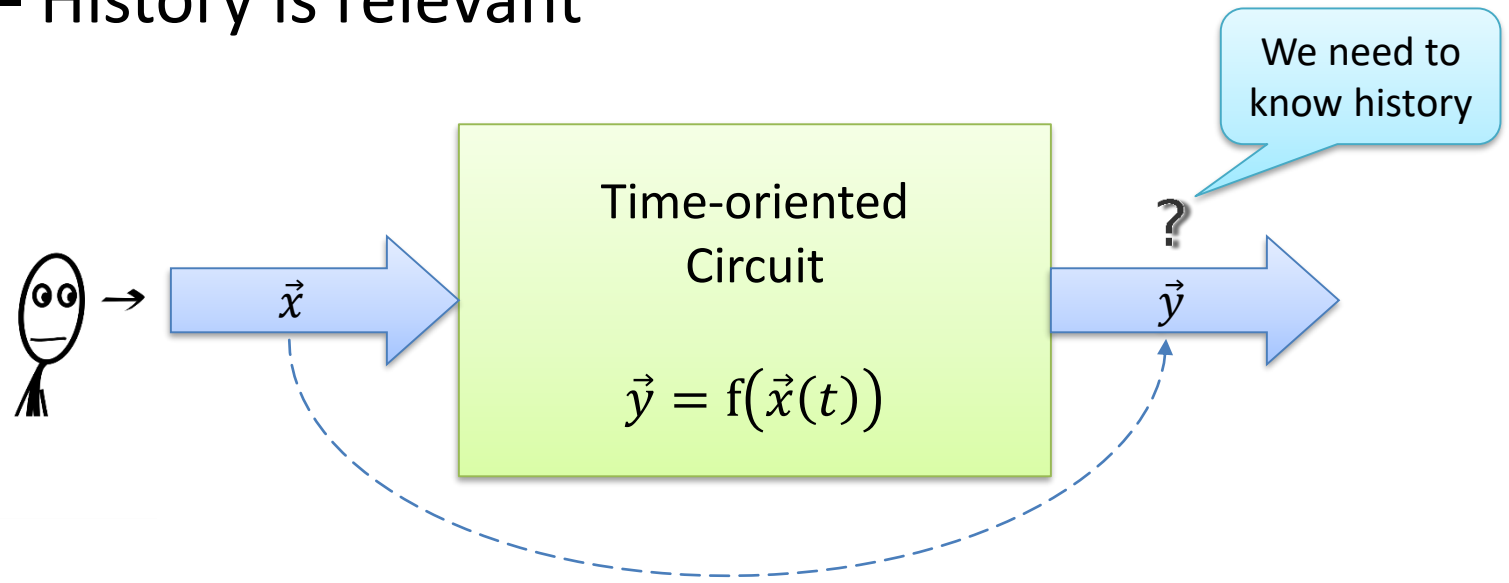
Combinational Circuits

- Output depends on current input, only
  - Output is a function of input
  - Time is of no importance
  - System does not remember



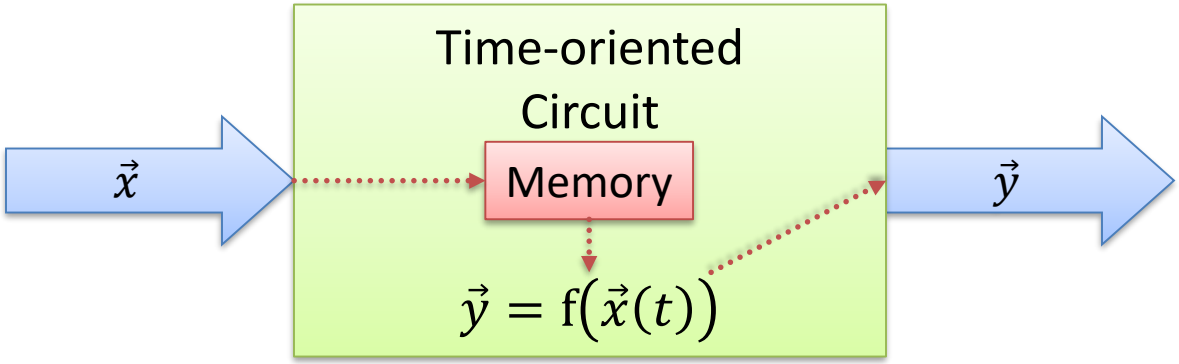
Sequential Circuits (1)

- Output depends on previous inputs
  - Output is a function of input and time
  - History is relevant



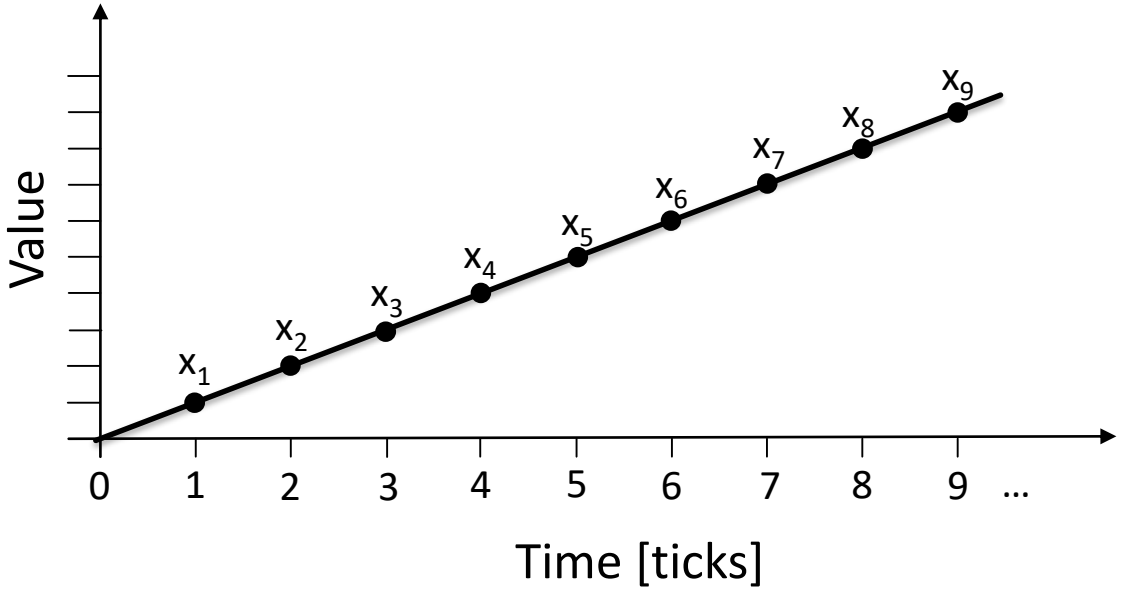
Sequential Circuits (2)

- Output depends on previous inputs (continued)
  - A memory is required



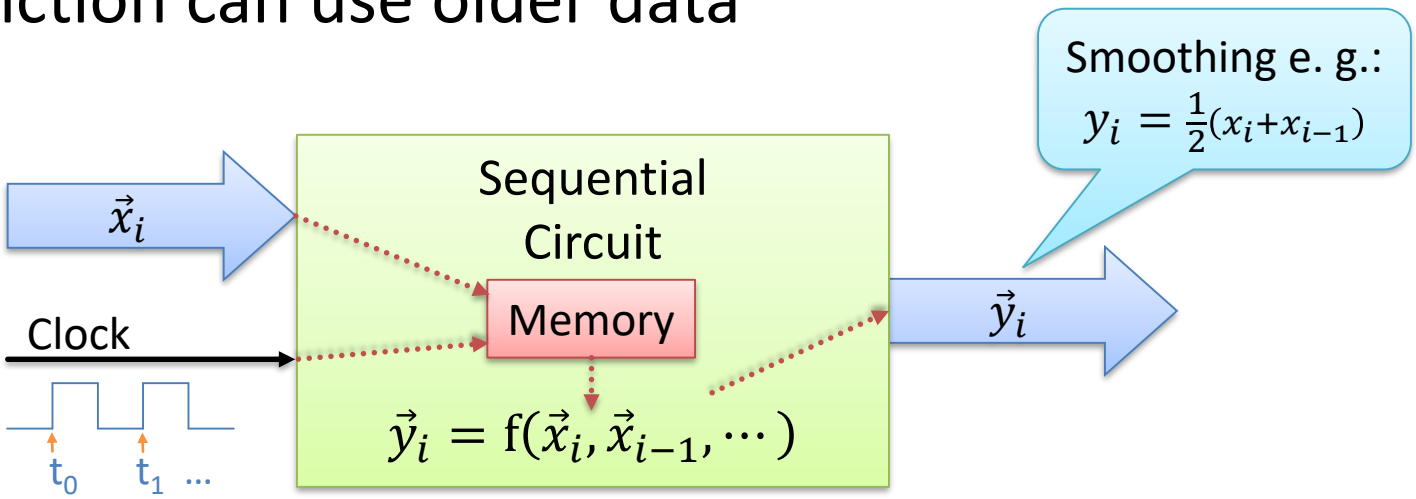
Sequential Circuits (3)

- How to handle history
  - Time gets discretized
  - Time becomes a sequence



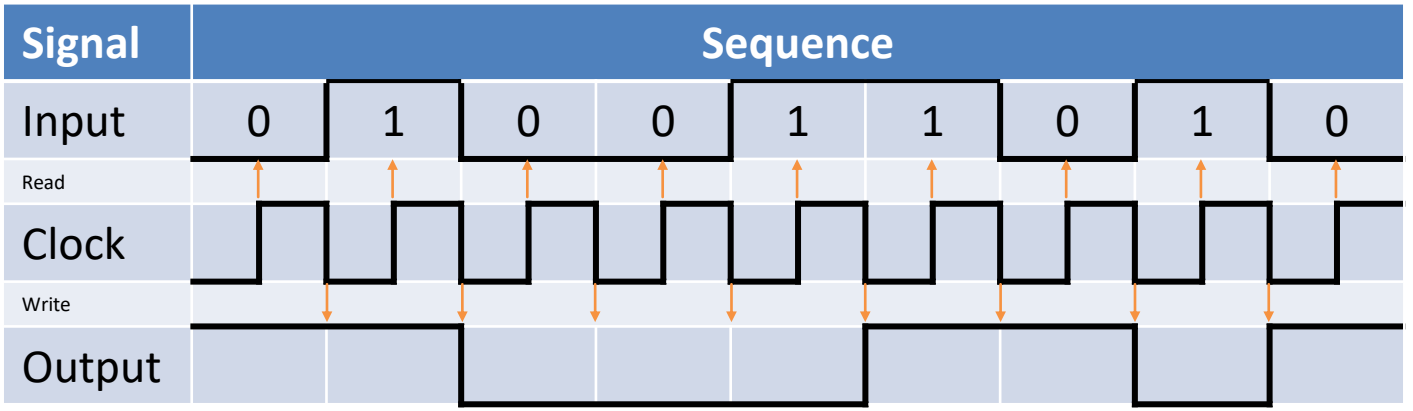
Sequential Circuits (4)

- Time is provided by a clock
  - Input becomes a sequence of data
  - Function can use older data



Sequential Circuits (5)

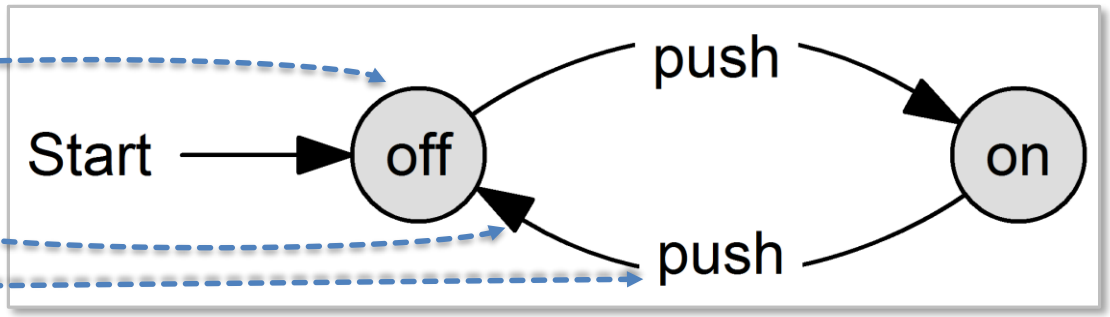
- Taking processing time into account
  - Input and output are separated
    - Circuit reads input on rising edge
    - Circuit writes output on falling edge



Pulse Diagram

Sequential Circuits (6)

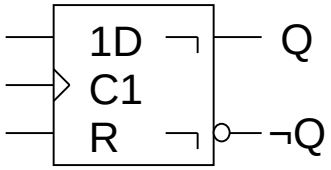
- Sequential circuits often just store states
  - States are handled by state machines (FSM)
  - They are represented by state diagrams
  - They have
    - States
    - Transitions
    - Conditions



State Diagram of a Switch

Sequential Circuits (7)

- States are stored by D flip-flops



D	Q^+
0	0
1	1

  - *1D*: Synchronous data line controlled by clock 1
  - *C1*: First clock signal of the circuit
  - *R*: Asynchronous reset line
  - *Q*: Stored state