Embedded Systems

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Embedded systems

- Embedded systems are computer systems that are encapsulated into larger products, and that are normally not directly visible to the user

- Applications:
  - transportation systems (e.g., airplanes, trains, cars)
  - telecommunication equipment (e.g., mobile phones)
  - consumer electronics products (e.g., TVs, DVD-players)

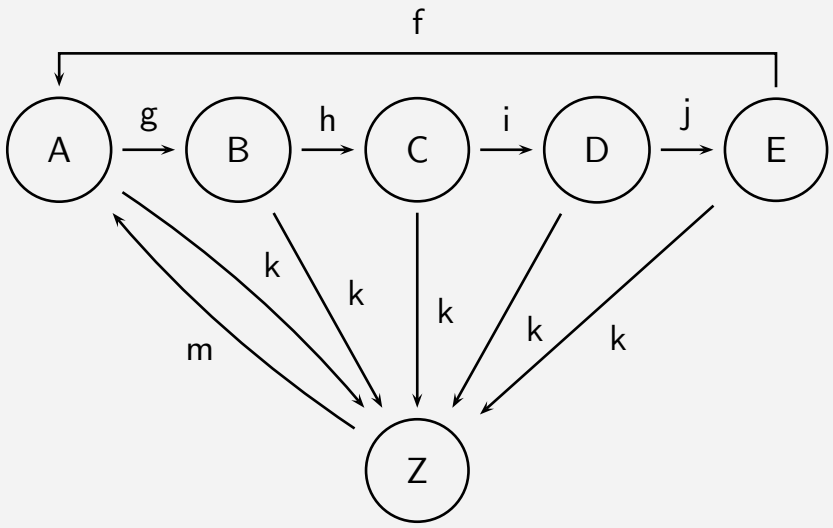
Characteristics of embedded systems

- Dependable
  - Reliability
  - Mantenaibility
  - Availability
  - Safety
  - Security
- Efficient
  - Energy
  - Code-size
  - Run-time
  - Weight
  - Cost
- Specificity
- Real-time
- Hybrid
- Reactive

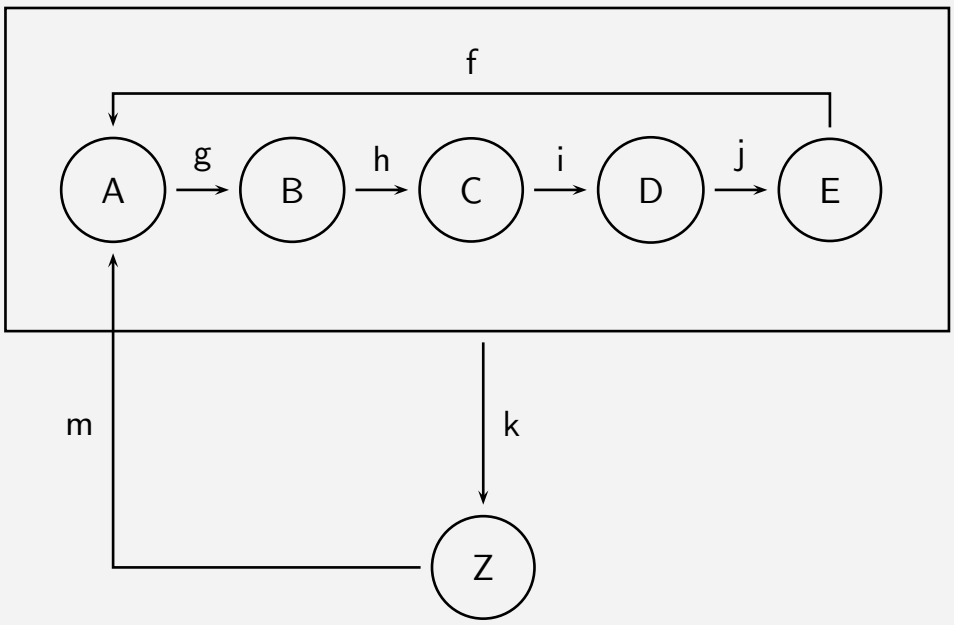
StateCharts

- Introduced by [Harel, 1987]
- Extend finite state machines with
  1. Hierarchy
  2. Concurrency
  3. Time
- Memory is shared, i.e., parallel processes see changes to variables immediately
- Applications: local, control dominated systems; not suited for distributed systems.

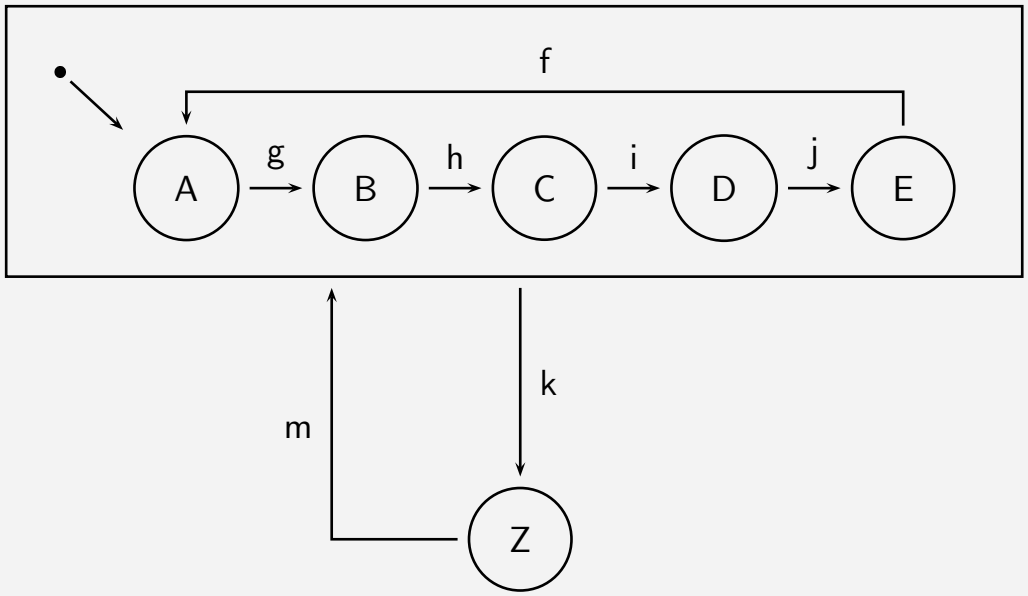
StateCharts: Hierarchy



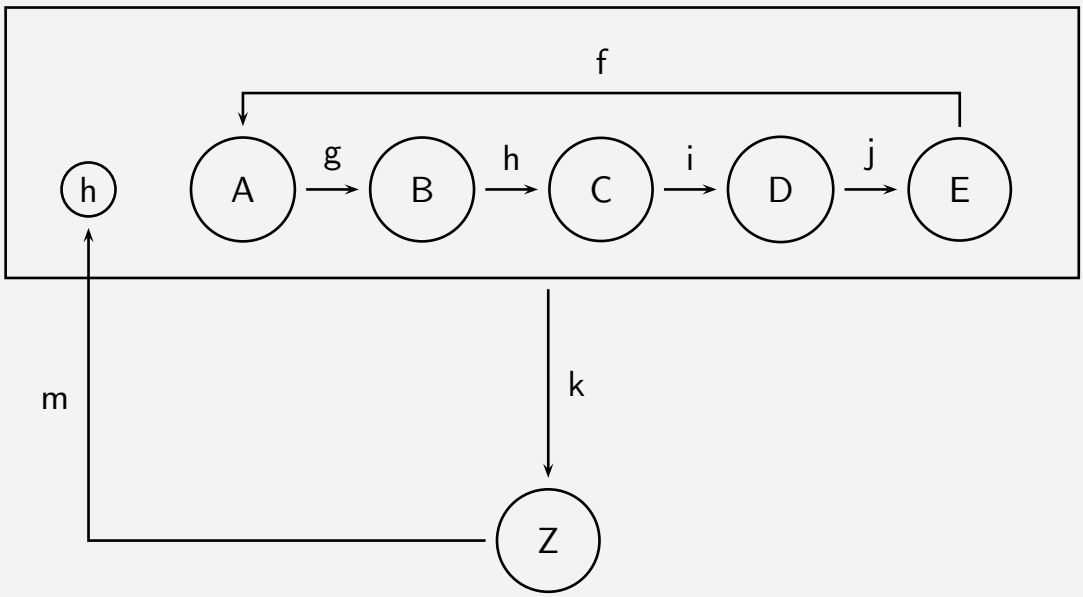
StateCharts: Hierarchy



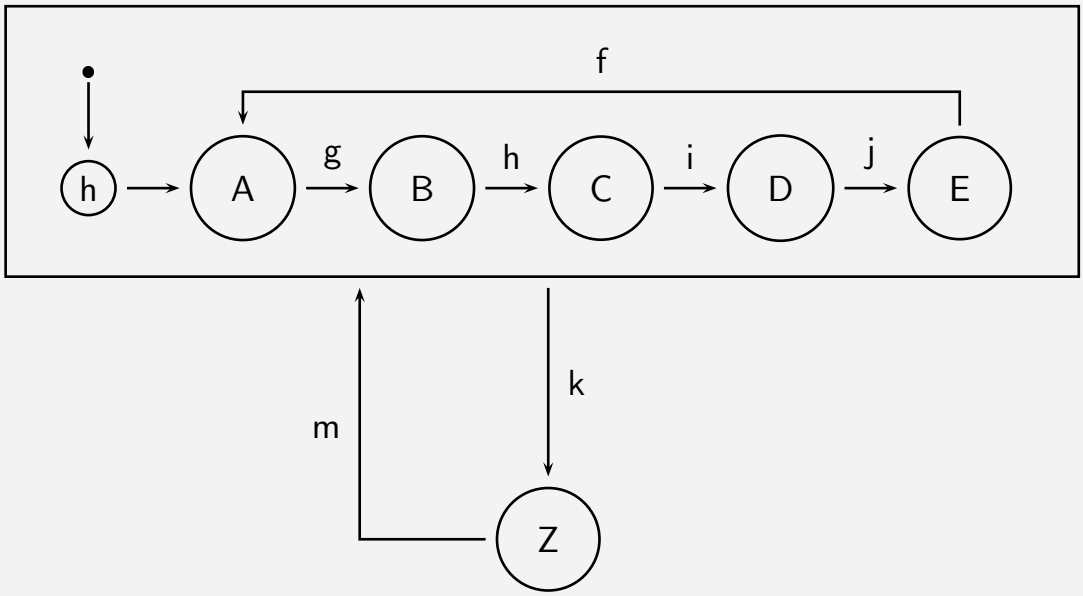
StateCharts: Default state mechanism



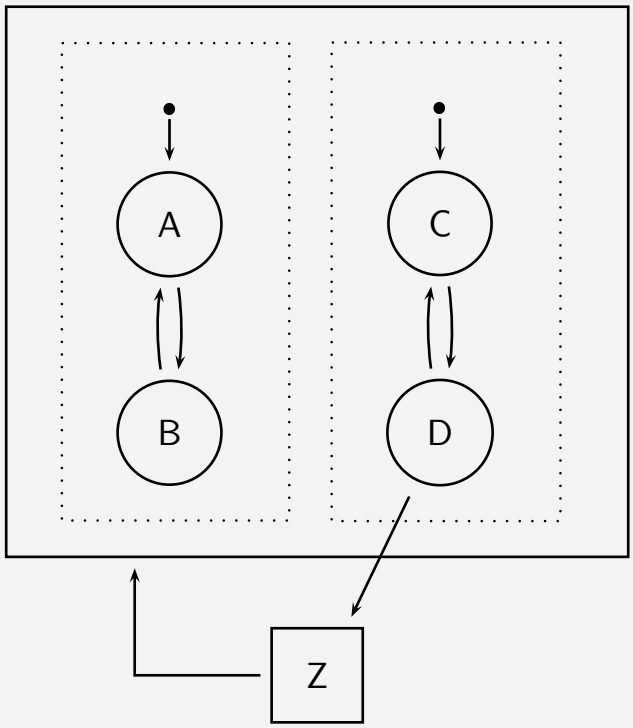
StateCharts: History



StateCharts: Default state plus history

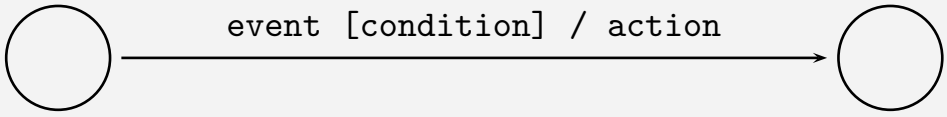


StateCharts: Concurrency



StateCharts: Timers

StateCharts: Edge labels



- Transition may be taken if event occurred in the last step and condition is true
- If transition is taken then action is carried out
- Condititions refer to values of variables
- Action performs assignments to variables and generation of events
- Example: `tick [x = 1023] / overflow; x := 0`