Statechart Diagram

PMCA504L – Software Engineering

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Statechart Diagram

- Also called *state diagram*.
- Shows the sequence of states that an object goes through during its life in response to outside stimuli and messages.
  - ✓ During analysis, we use state transition diagrams to indicate the dynamic behavior of the system.
  - ✓ During design, we use state transition diagrams to capture the dynamic behavior of individual classes or of collaborations of classes.

Statechart Diagram

- Use Statechart diagram if you are interested in one object over many use-cases.
- The purpose of state diagram is to understand the algorithm involved in performing a method.

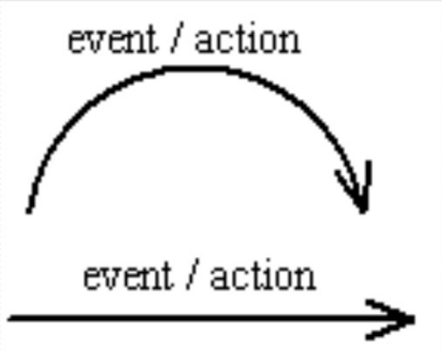
Essential Elements of a Statechart Diagram

- States
  - ✓ The state is the set of values that describes an object at a specific point in time. i.e., the state of an object represents the cumulative results of its behavior.
  - ✓ Example – Telephone call – idle, off hook, dialing, on hook, receiving.
  - ✓ A state is represented with a rounded rectangle, with one or more compartments.

- The name compartment holds the name of the state.
- The internal transition compartment holds a list of actions or activities performed in response to events received while the object is in the state, without changing states.

Essential Elements of a Statechart Diagram

- State Transitions
  - ✓ An event is some occurrence that may cause the state of a system to change. This change of state is called a *state transition.*
  - ✓ An event occurs at the instant in time when the value is changed.
  - ✓ Notation Used



Event Types

- External Event (also known as system event)
  - ✓ is caused by something outside the system boundary
  - ✓ e.g. when a cashier presses the "enter item" button on a POST, an external event has occurred.
- Internal Event
  - ✓ is caused by something inside our system boundary.
  - ✓ In terms of SW, an internal event arises when an operation is invoked via a message sent from another internal object. (The messages in collaboration diagrams suggest internal events)
- Temporal Event
  - ✓ is caused by the occurrence of a specific date and time or passage of time.

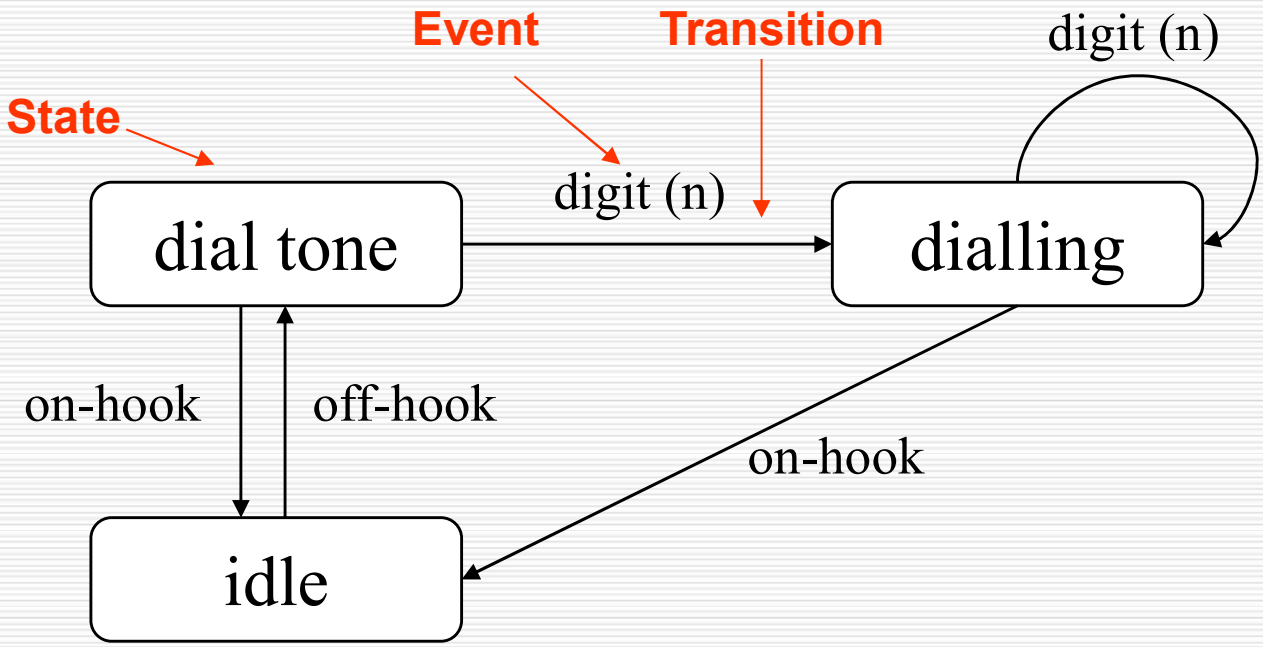
Essential Elements of a Statechart Diagram

- Start State
  - ✓ A filled circle followed by an arrow represents the object's initial state.
  - ✓ Notation used

Essential Elements of a Statechart Diagram

- Final State
  - ✓ An arrow pointing to a filled circle nested inside another circle represents the object's final state.
  - ✓ Notation used

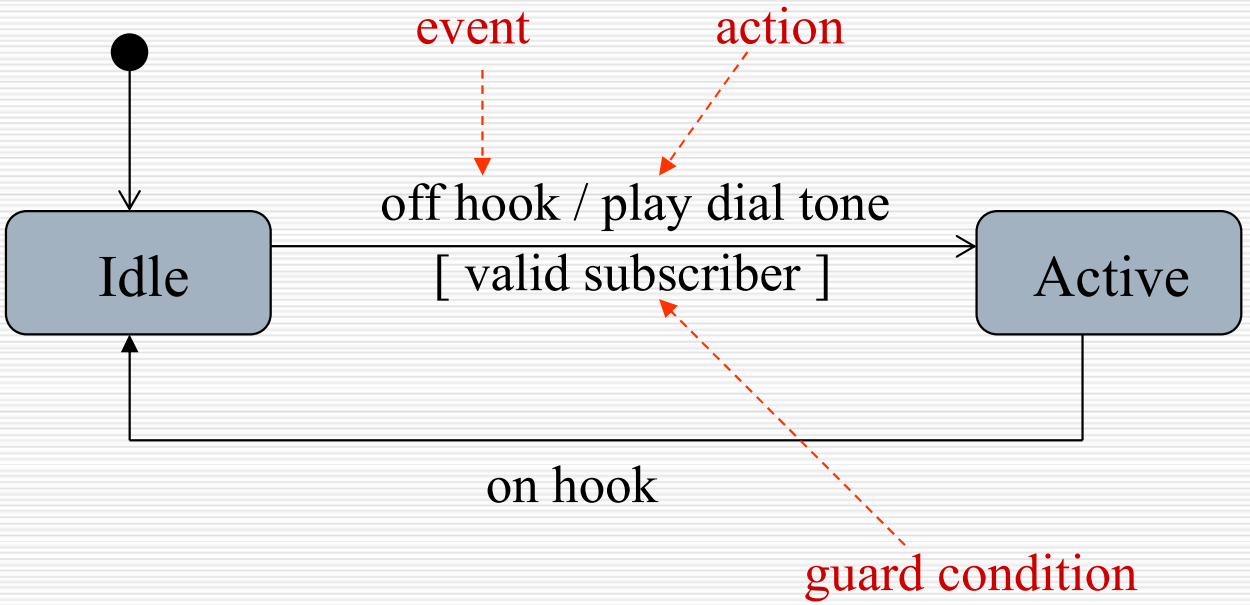
Example


Event
Transition
digit (n)
State
digit (n)
dial tone
dialling
on-hook
off-hook
on-hook
idle

Transition Actions, Guard Conditions

- Transition Actions
  - ✓ a transition can cause an action to fire. In SW, this may represent the invocation of a method of an object
- Transition Guard conditions
  - ✓ a transition may also have a conditional guard -- or boolean test. The transition is only taken if the test passes.
  - ✓ Guard condition is shown in brackets, following event name.

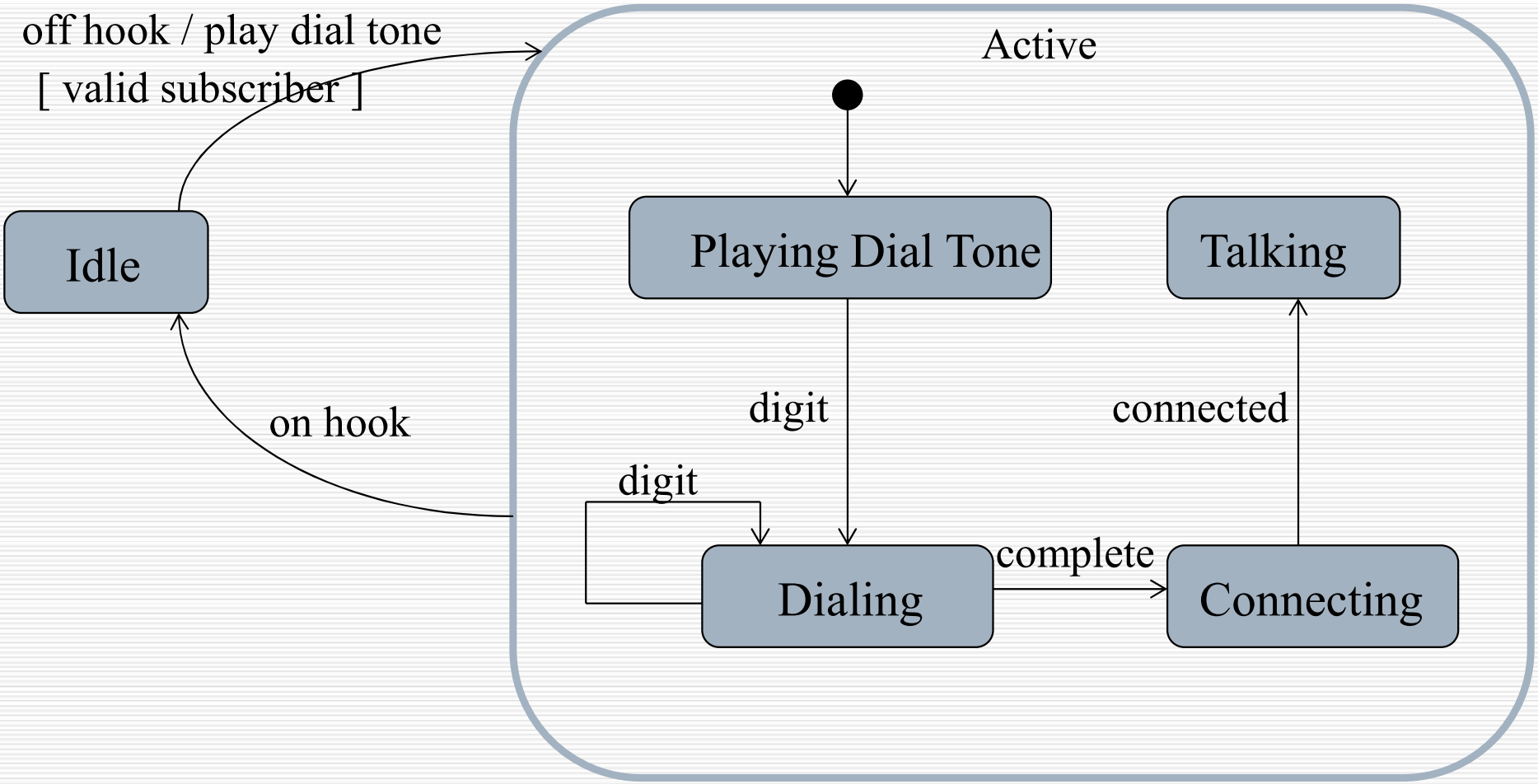
Transition Action and Guards



Nested States

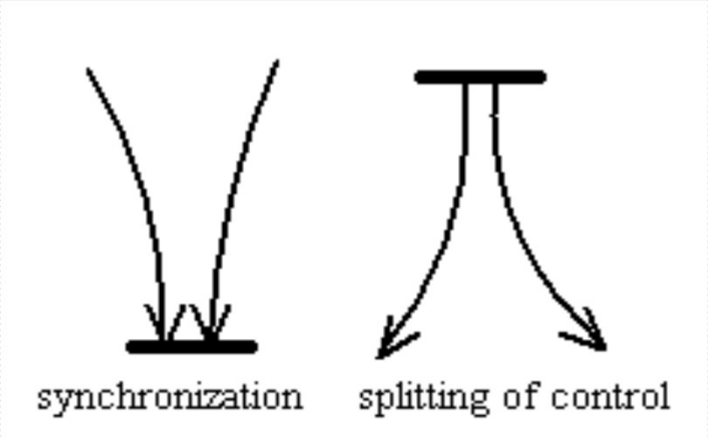
- The ability to nest states gives depth to state transition diagrams.

Example: Nested States



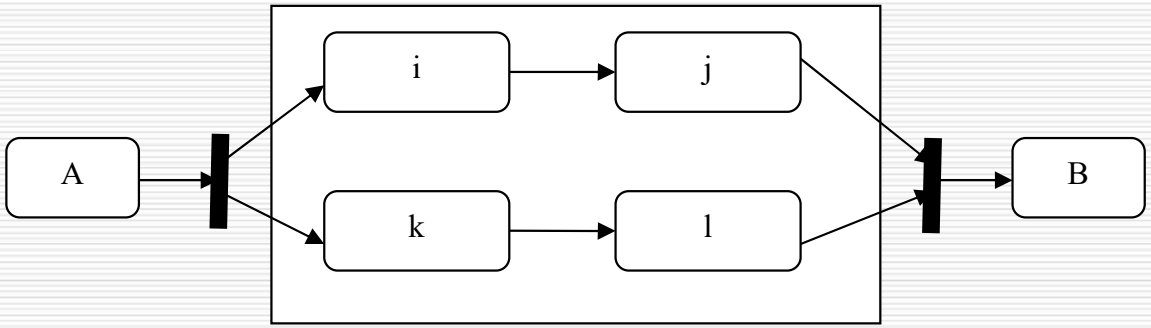
Synchronization and Splitting of Control

- A complex transition may have multiple source and target states. It represents synchronization or a splitting of control into concurrent threads.
- A short heavy bar with *two transitions entering* it *represents* a *synchronization of control*.
- A short heavy bar with *two transitions leaving* it *represents* a *splitting of control* that creates multiple states.



Synchronization and Splitting of Control

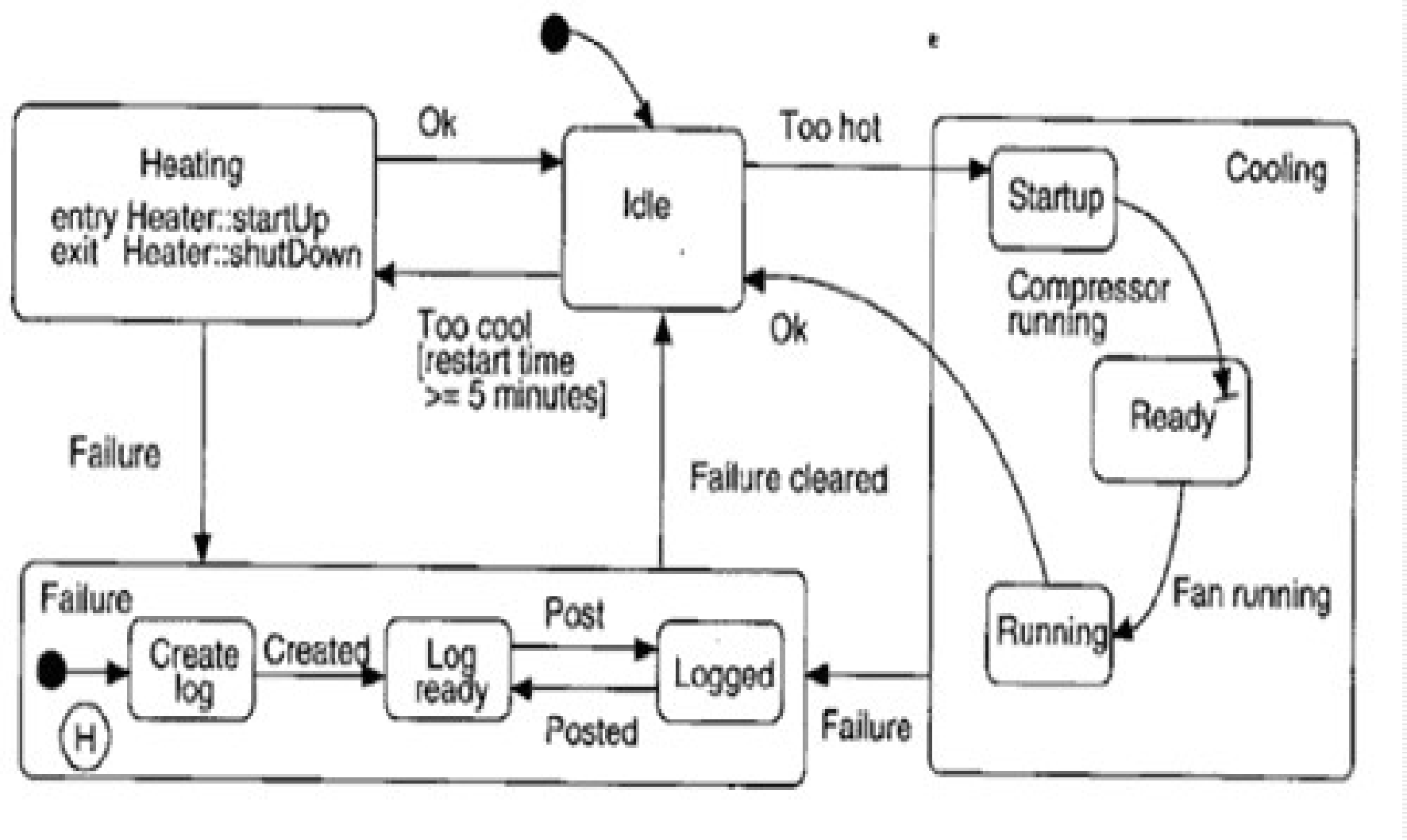
- Example



History

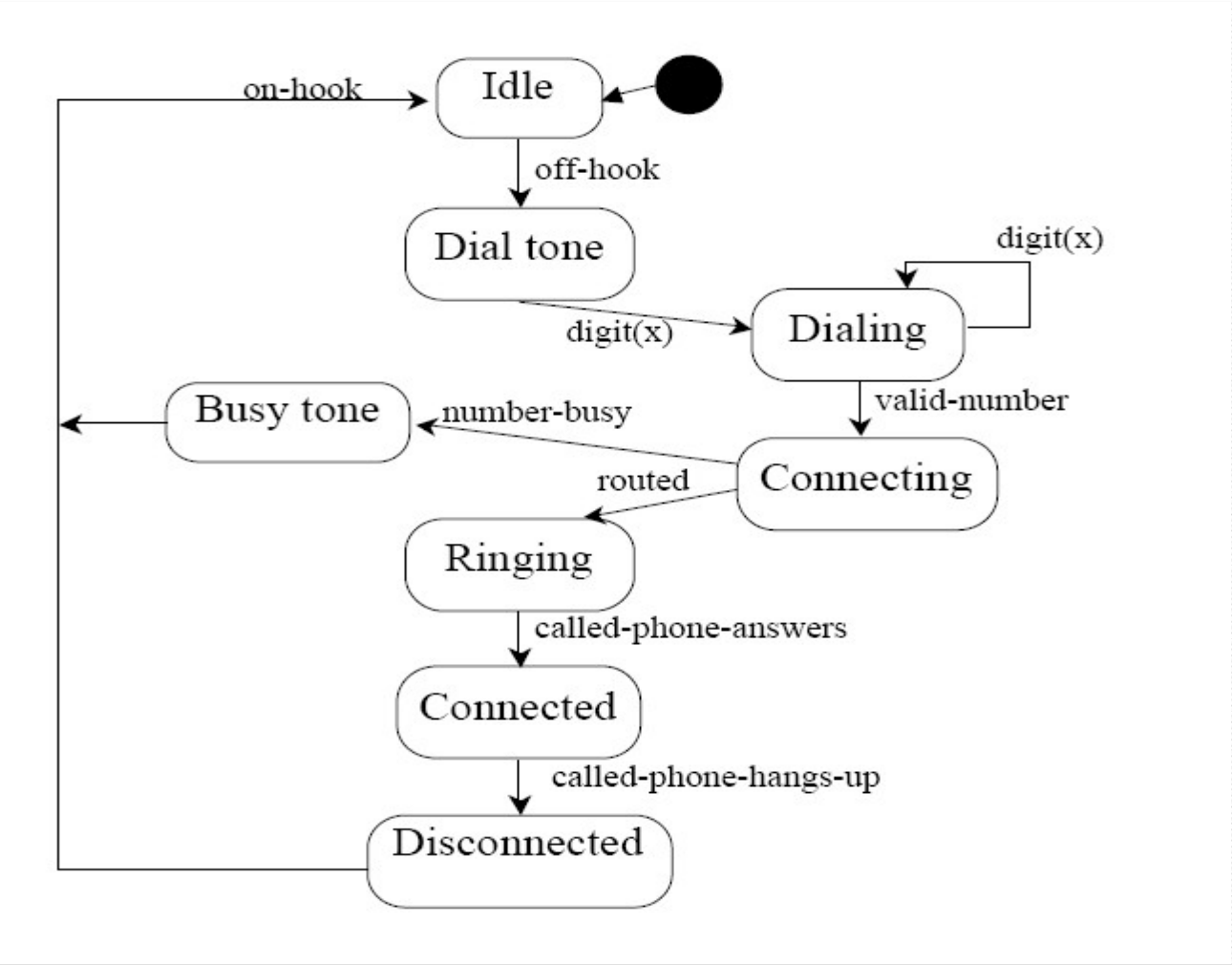
- When transitioning directly to a state with substates, we wish to return to the most recently visited state; these semantics may be indicated by the history icon.
- Shown as the letter H inside a circle and placed anywhere directly inside the state.

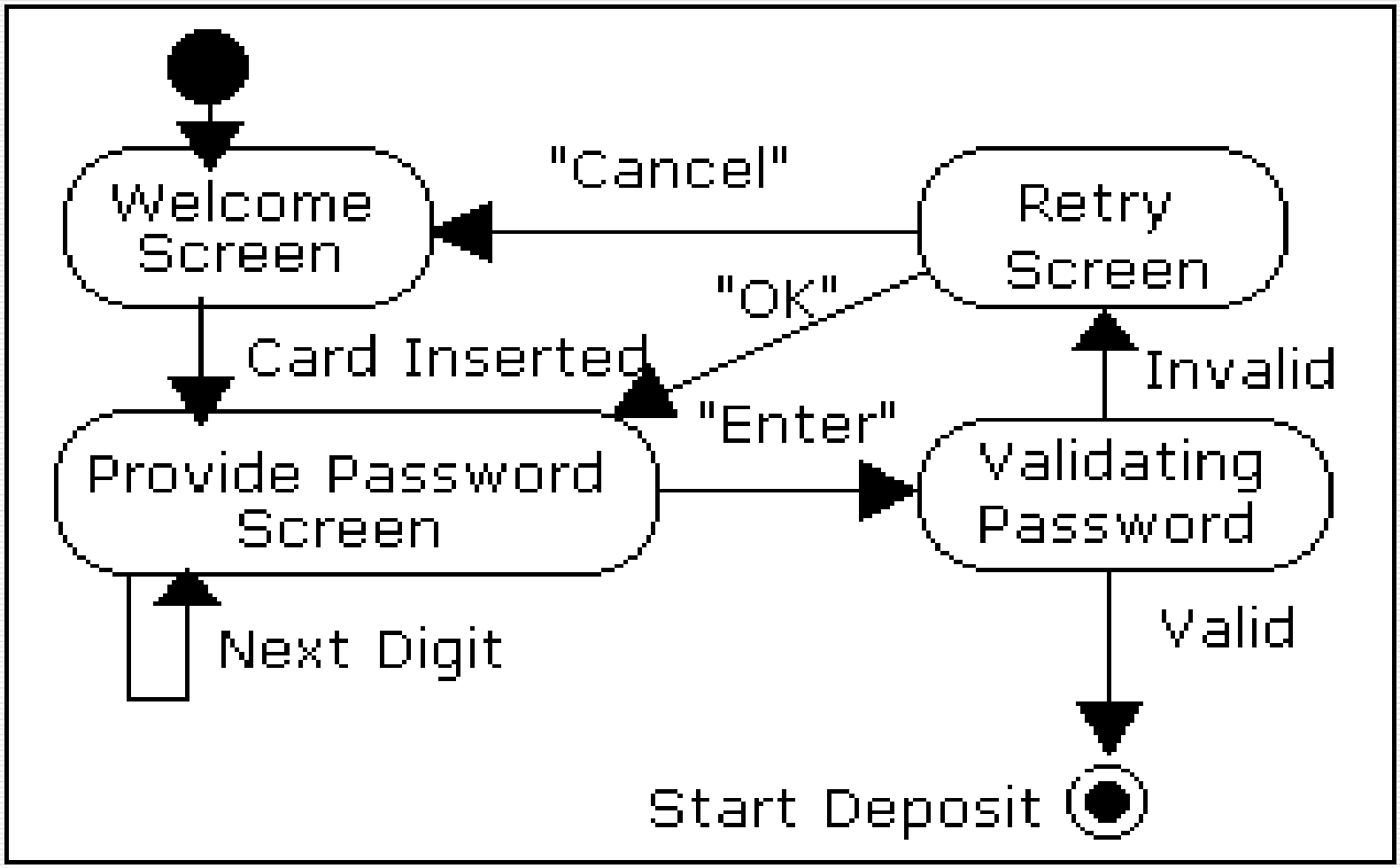
History - Example



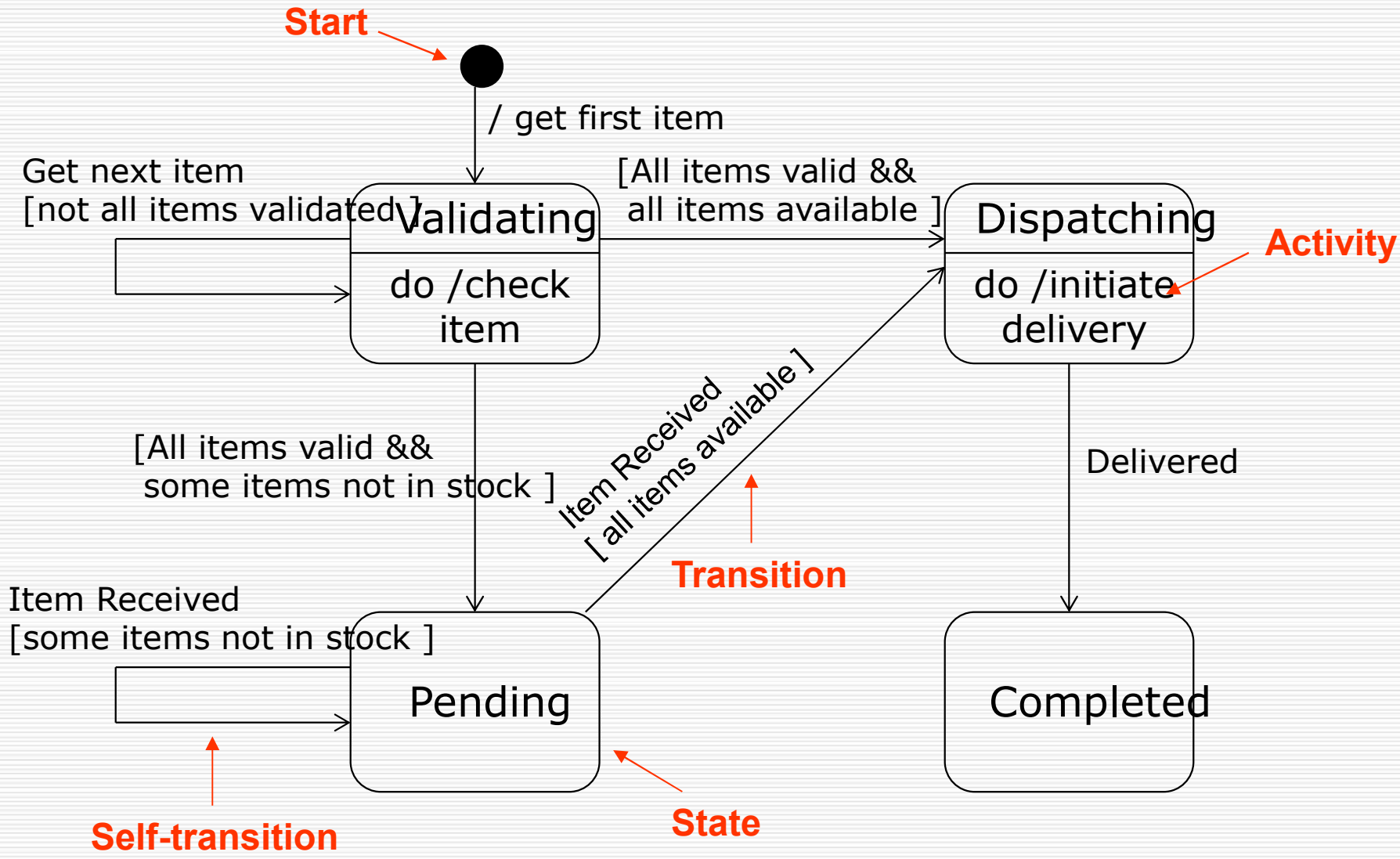
Statechart Diagram Example

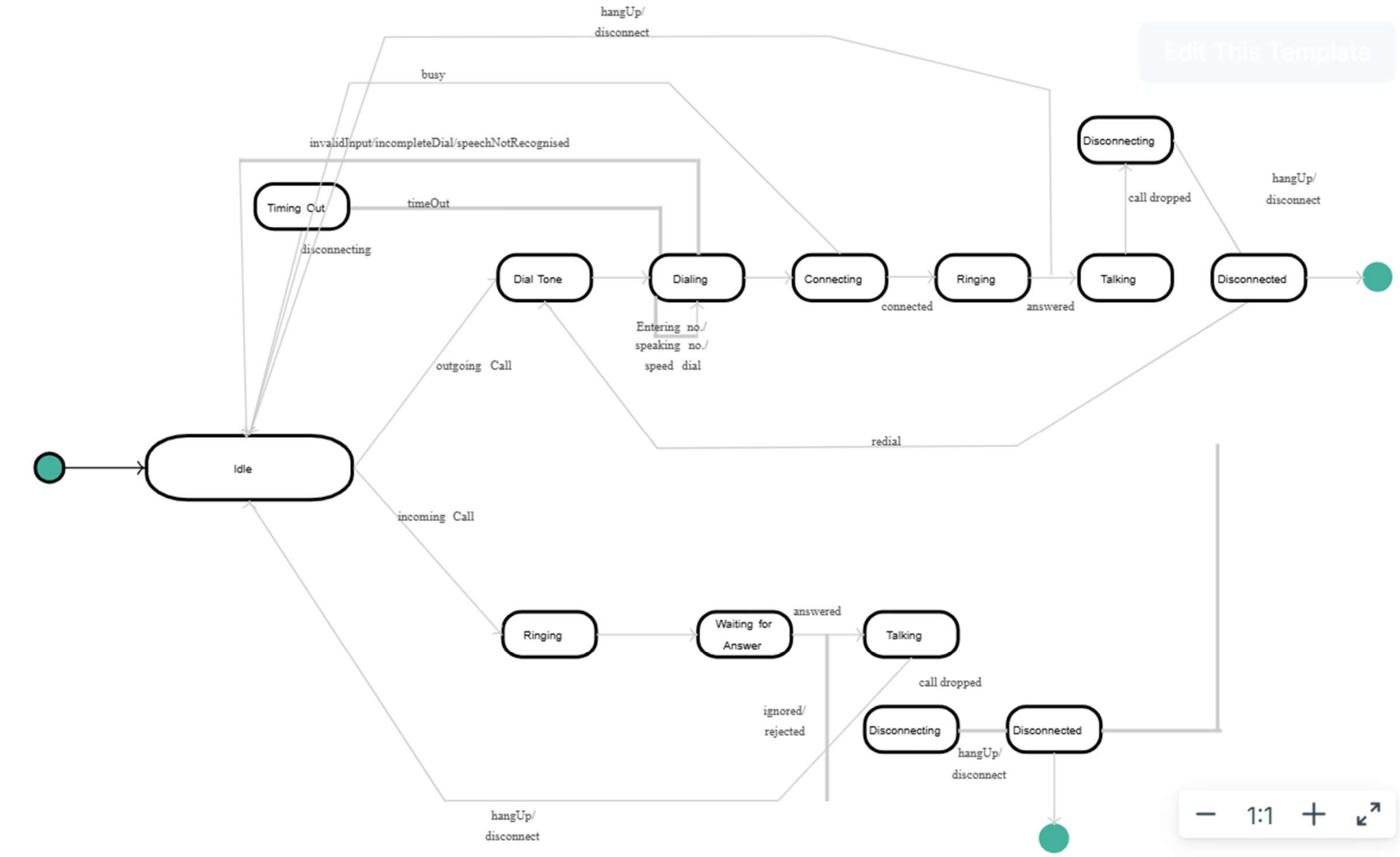
- Statechart Diagram for making a phone call




Welcome Screen
"Cancel"
Retry Screen
"OK"
Card Inserted
Invalid
"Enter"
Provide Password Screen
Validating Password
Next Digit
Valid
Start Deposit

STD Example


Start
/ get first item
Get next item
[not all items validated]
Validating
do /check item
[All items valid &&
all items available]
Dispatching
do /initiate delivery
Activity
[All items valid &&
some items not in stock]
Item Received
[all items available]
Transition
Delivered
Item Received
[some items not in stock]
Pending
Completed
Self-transition
State


hangUp/
disconnect
busy
invalidInput/incompleteDial/speechNotRecognised
Timing Out
timeOut
disconnecting
Dial Tone
Dialing
Entering no./
speaking no./
speed dial
Connecting
connected
Ringing
answered
Talking
Disconnecting
call dropped
hangUp/
disconnect
Disconnected
outgoing Call
redial
Idle
incoming Call
Ringing
Waiting for
Answer
answered
Talking
call dropped
ignored/
rejected
Disconnecting
Disconnected
hangUp/
disconnect
hangUp/
disconnect
1:1