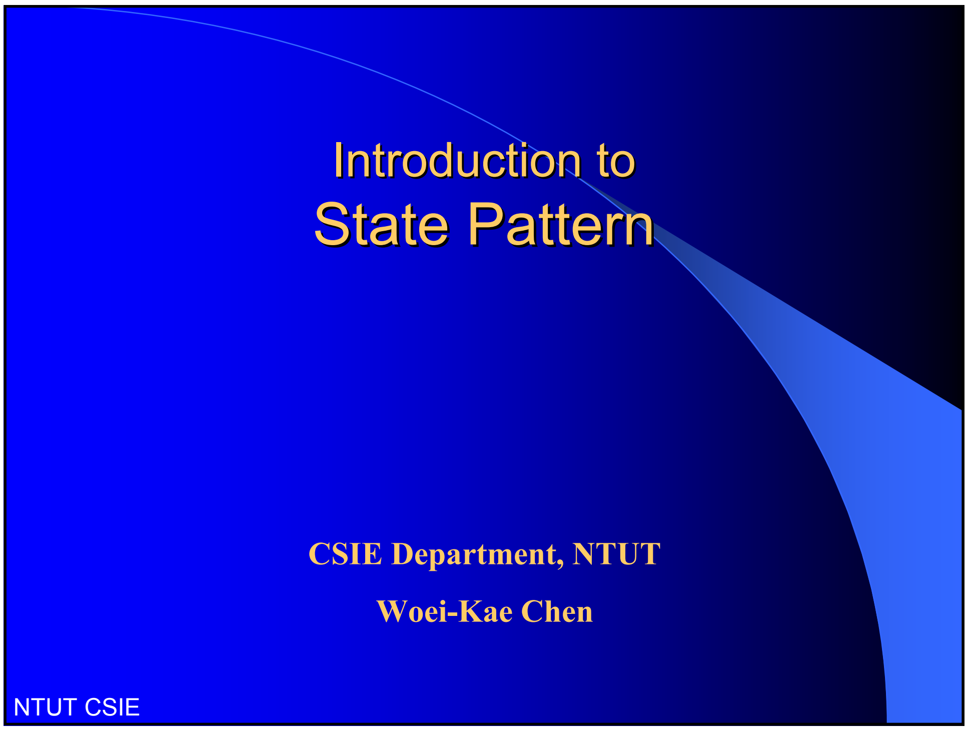

Introduction to State Pattern

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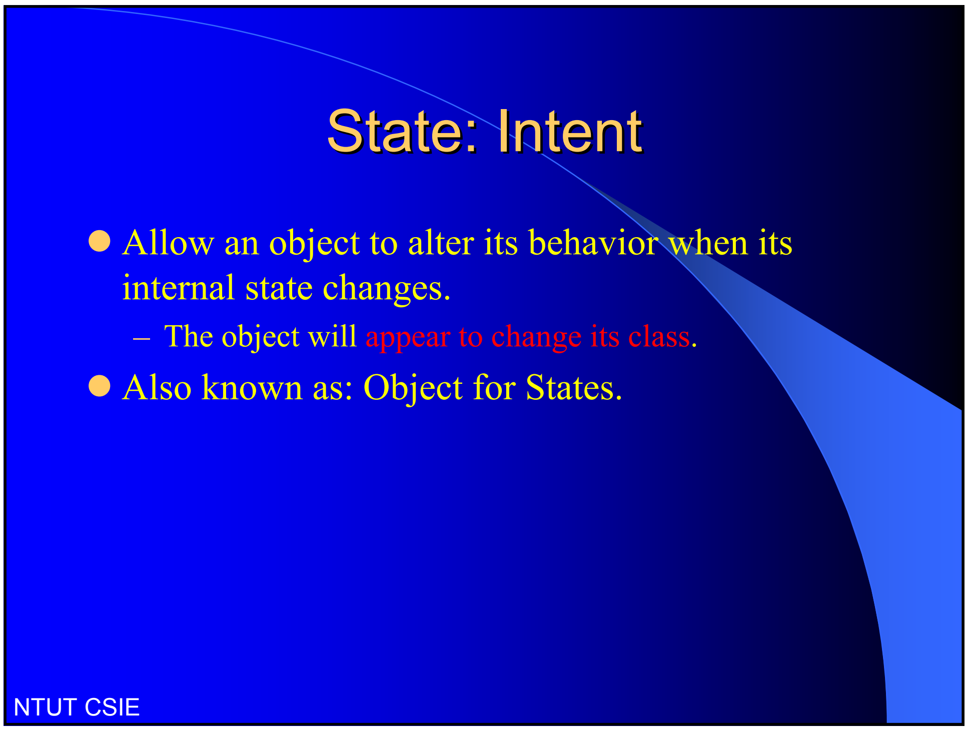
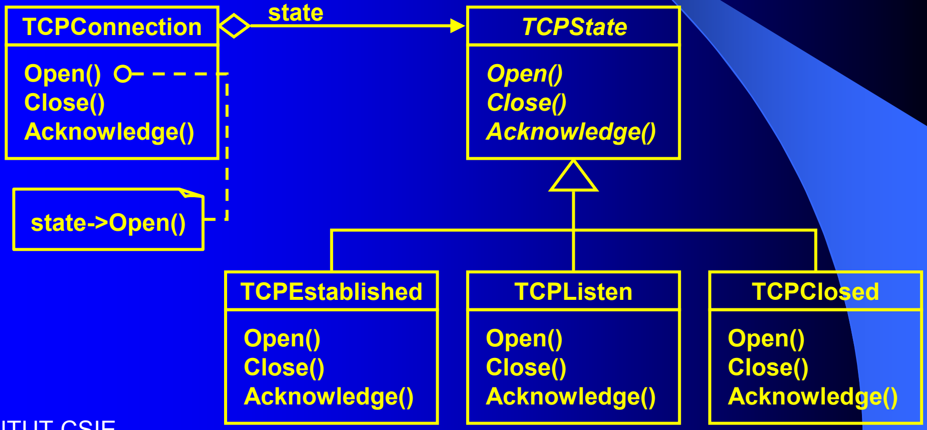


State: Intent

- Allow an object to alter its behavior when its internal state changes.
  - The object will appear to change its class.
- Also known as: Object for States.

State: Motivation (1)

- An object can be in one of several different states.



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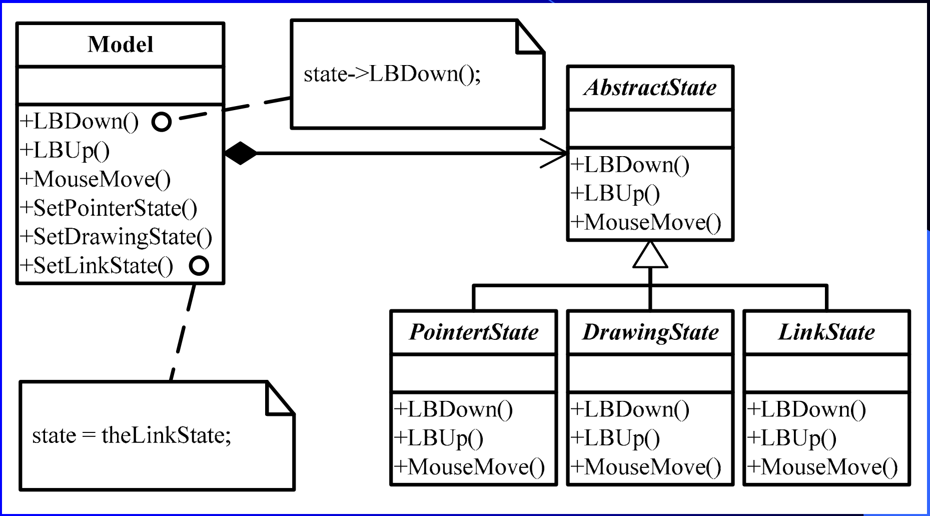
State: Motivation (2)



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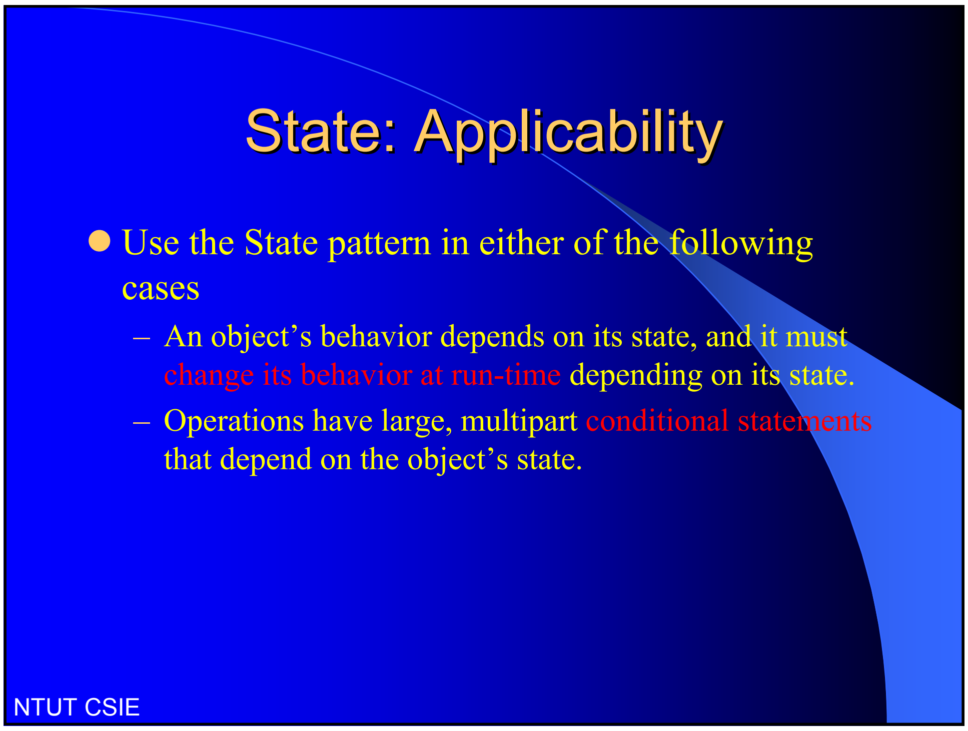

State: Applicability

- Use the State pattern in either of the following cases
  - An object’s behavior depends on its state, and it must change its behavior at run-time depending on its state.
  - Operations have large, multipart conditional statements that depend on the object’s state.

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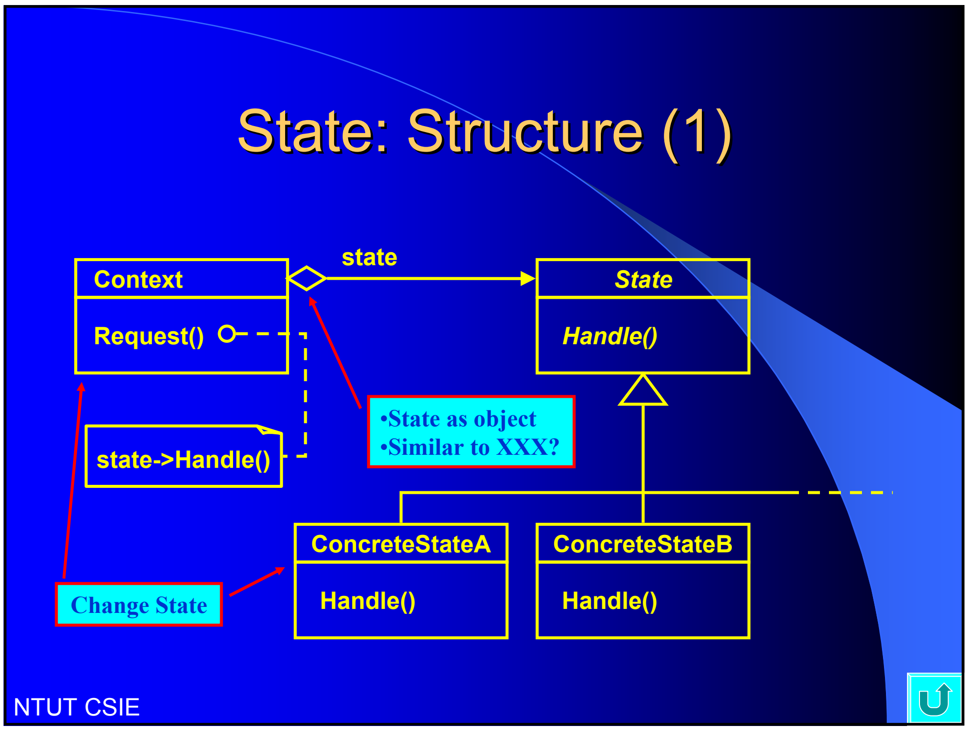

State: Structure (1)

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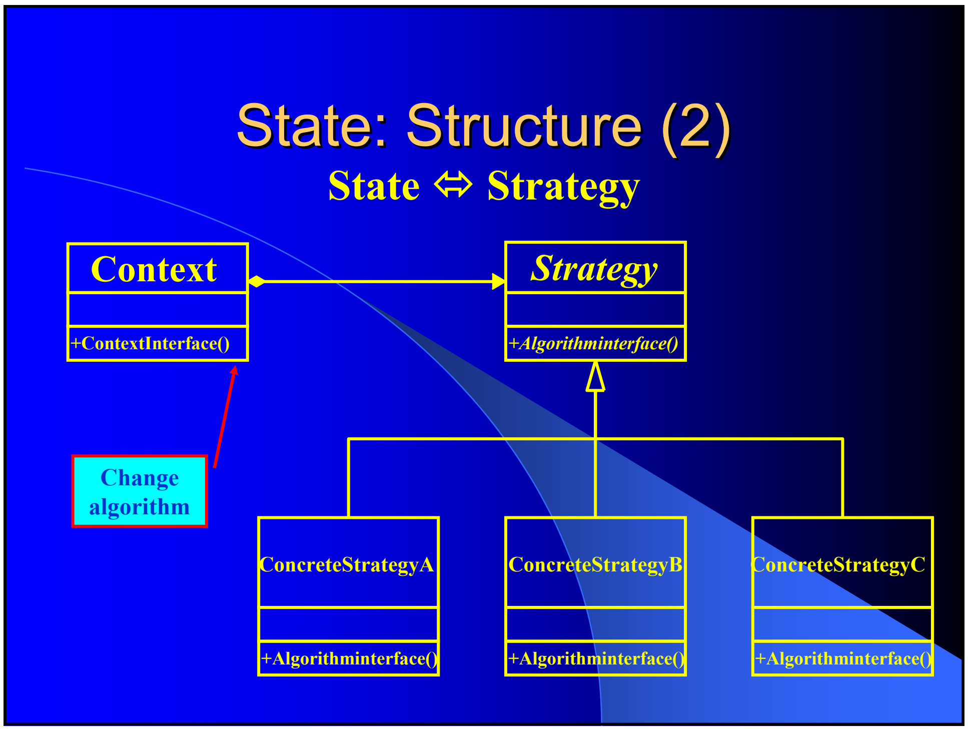
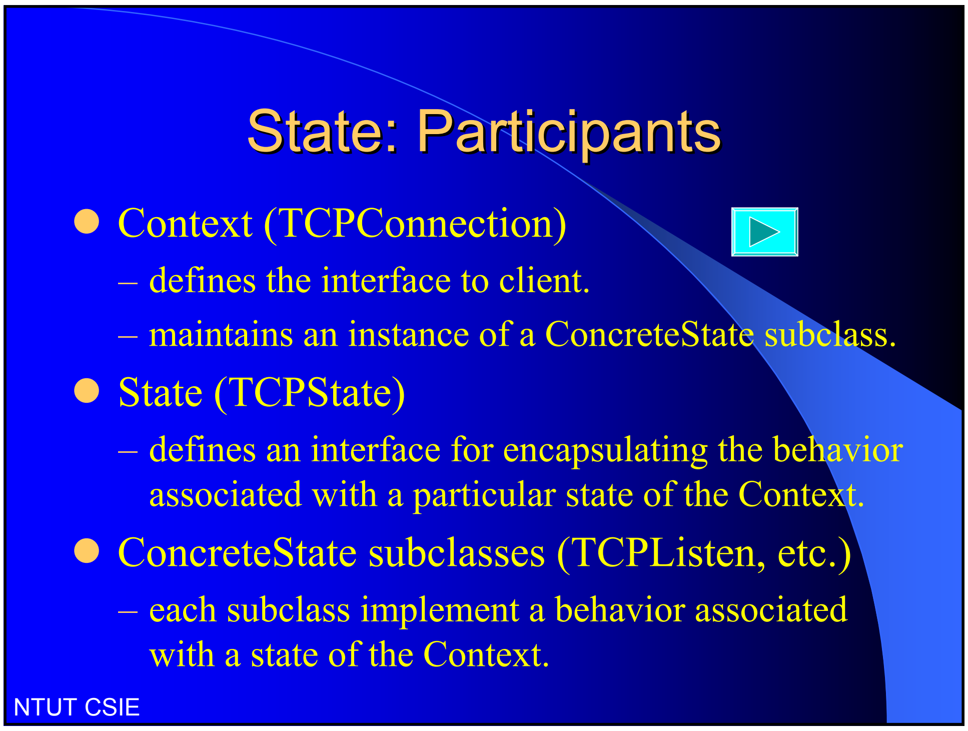


State: Structure (2)

State ⇔ Strategy



State: Participants

- Context (TCPConnection)
  - defines the interface to client.
  - maintains an instance of a ConcreteState subclass.
- State (TCPState)
  - defines an interface for encapsulating the behavior associated with a particular state of the Context.
- ConcreteState subclasses (TCPListen, etc.)
  - each subclass implement a behavior associated with a state of the Context.

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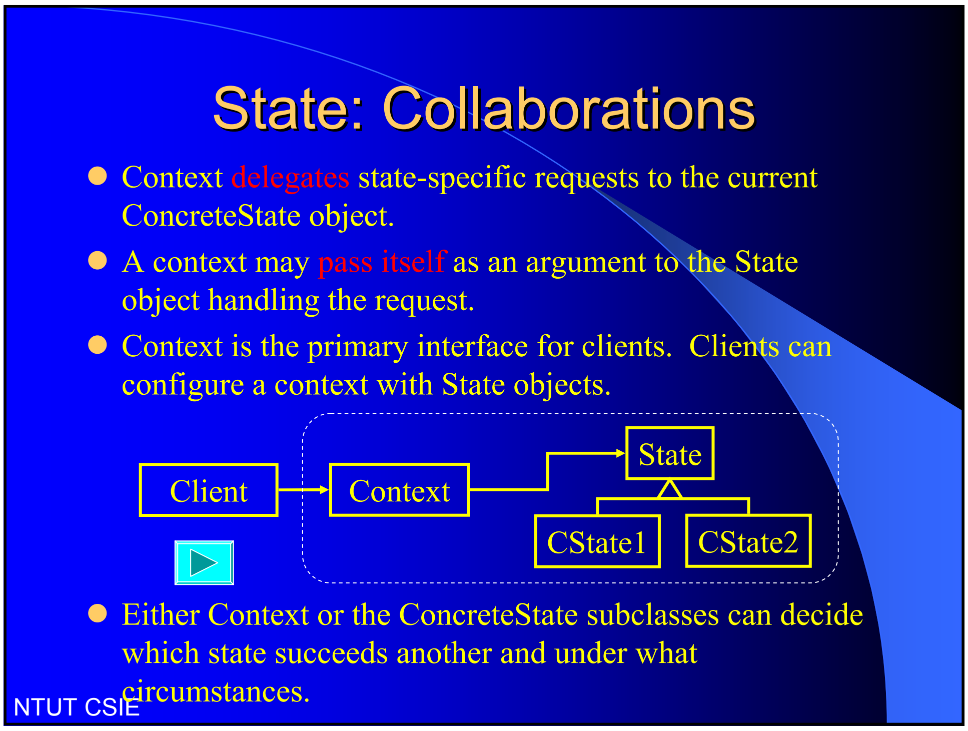
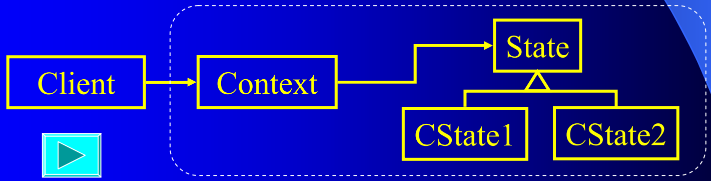


State: Collaborations

- Context delegates state-specific requests to the current ConcreteState object.
- A context may pass itself as an argument to the State object handling the request.
- Context is the primary interface for clients. Clients can configure a context with State objects.



- Either Context or the ConcreteState subclasses can decide which state succeeds another and under what circumstances.

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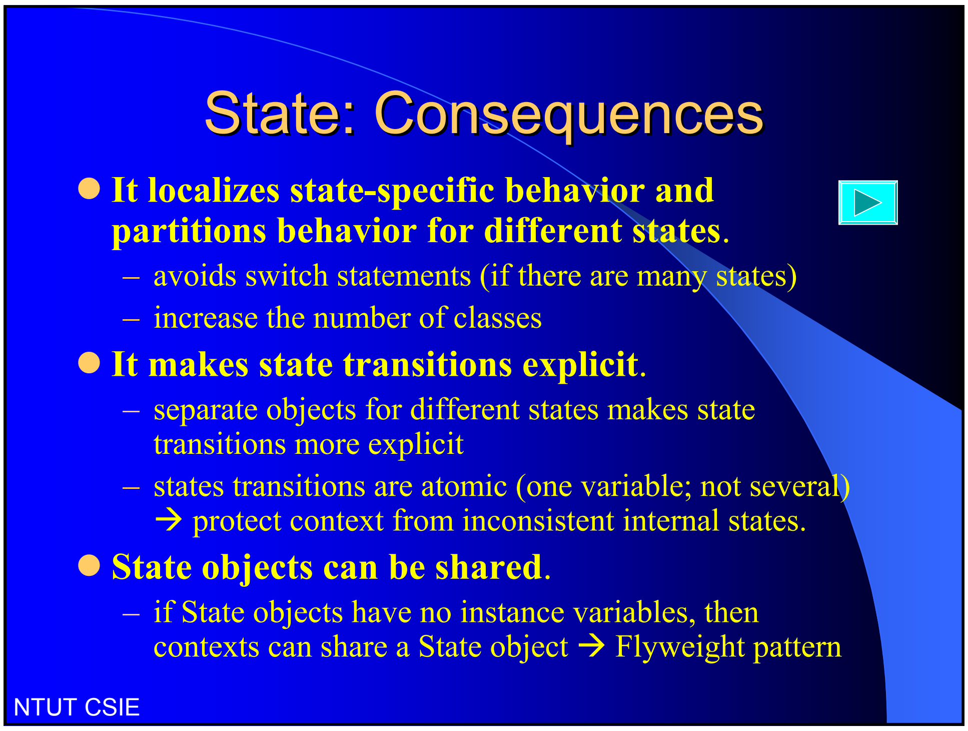

State: Consequences

- **It localizes state-specific behavior and partitions behavior for different states.**
  - avoids switch statements (if there are many states)
  - increase the number of classes
- **It makes state transitions explicit.**
  - separate objects for different states makes state transitions more explicit
  - states transitions are atomic (one variable; not several) → protect context from inconsistent internal states.
- **State objects can be shared.**
  - if State objects have no instance variables, then contexts can share a State object → Flyweight pattern

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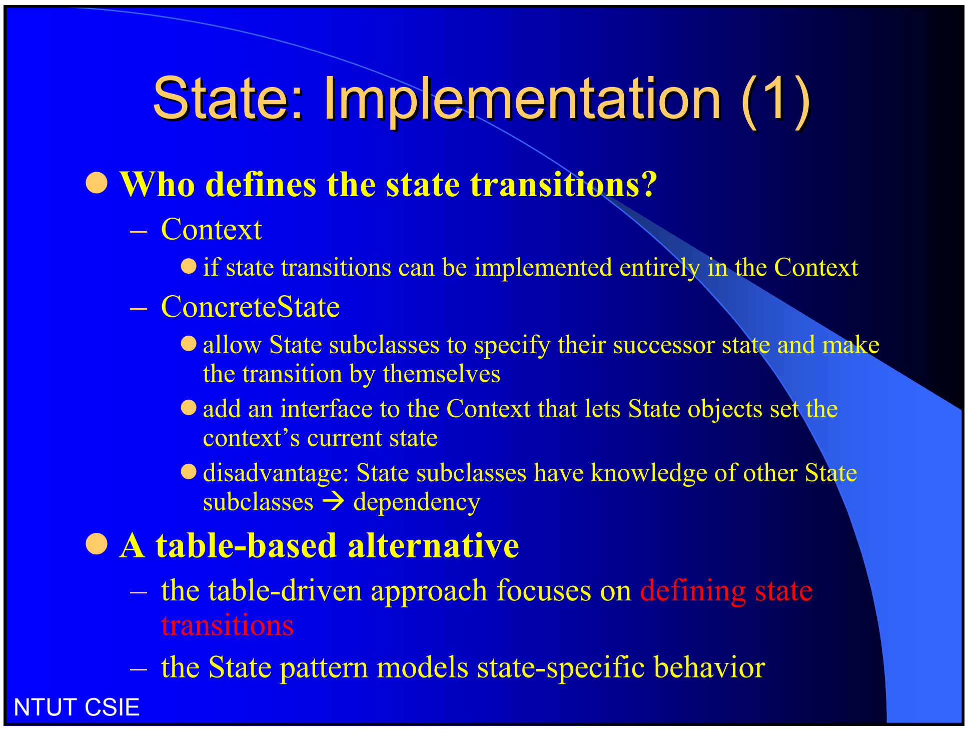
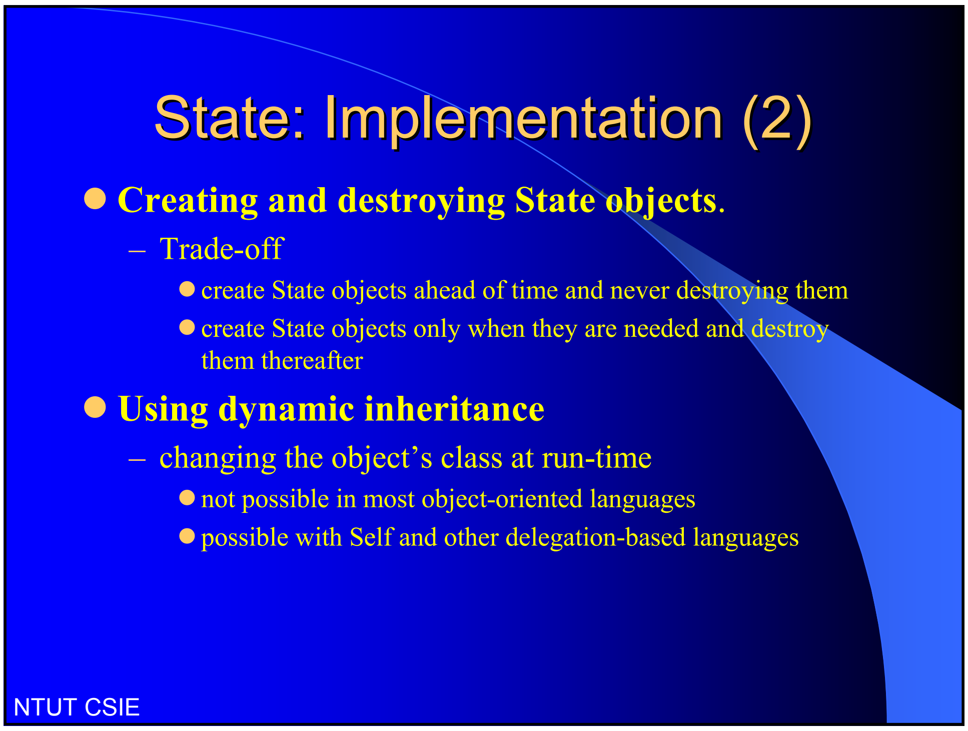


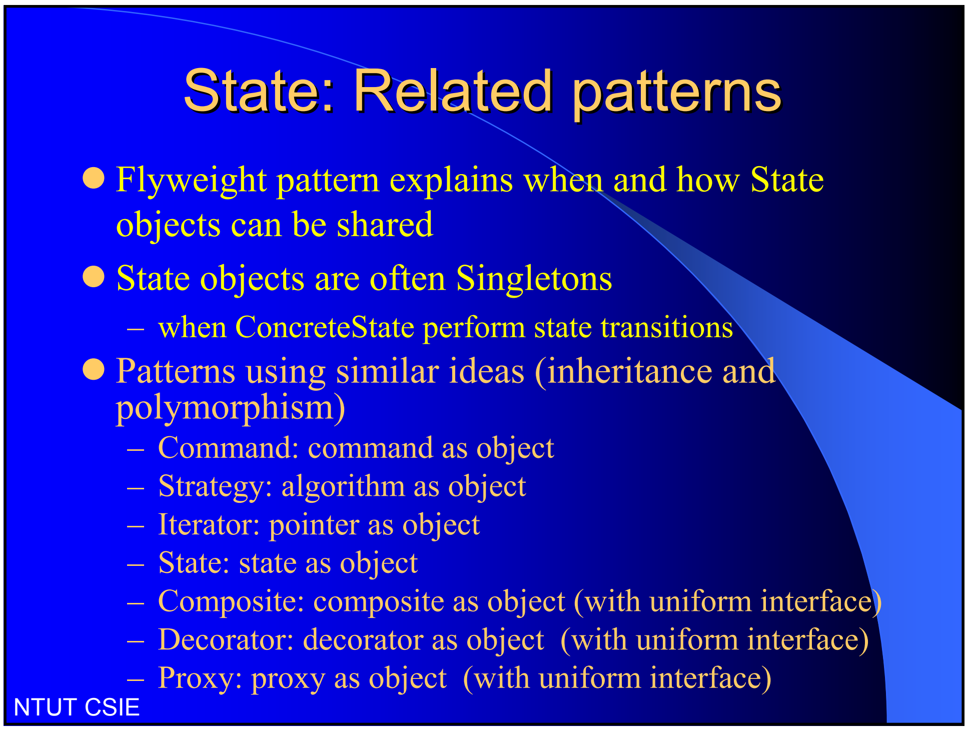
State: Implementation (1)

- **Who defines the state transitions?**
  - Context
    - if state transitions can be implemented entirely in the Context
  - ConcreteState
    - allow State subclasses to specify their successor state and make the transition by themselves
    - add an interface to the Context that lets State objects set the context’s current state
    - disadvantage: State subclasses have knowledge of other State subclasses → dependency
- **A table-based alternative**
  - the table-driven approach focuses on defining state transitions
  - the State pattern models state-specific behavior



State: Implementation (2)

- **Creating and destroying State objects**.
  - Trade-off
    - create State objects ahead of time and never destroying them
    - create State objects only when they are needed and destroy them thereafter
- **Using dynamic inheritance**
  - changing the object’s class at run-time
    - not possible in most object-oriented languages
    - possible with Self and other delegation-based languages



State: Related patterns

- Flyweight pattern explains when and how State objects can be shared
- State objects are often Singletons
  - when ConcreteState perform state transitions
- Patterns using similar ideas (inheritance and polymorphism)
  - Command: command as object
  - Strategy: algorithm as object
  - Iterator: pointer as object
  - State: state as object
  - Composite: composite as object (with uniform interface)
  - Decorator: decorator as object (with uniform interface)
  - Proxy: proxy as object (with uniform interface)

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