Welcome and Recap of Models

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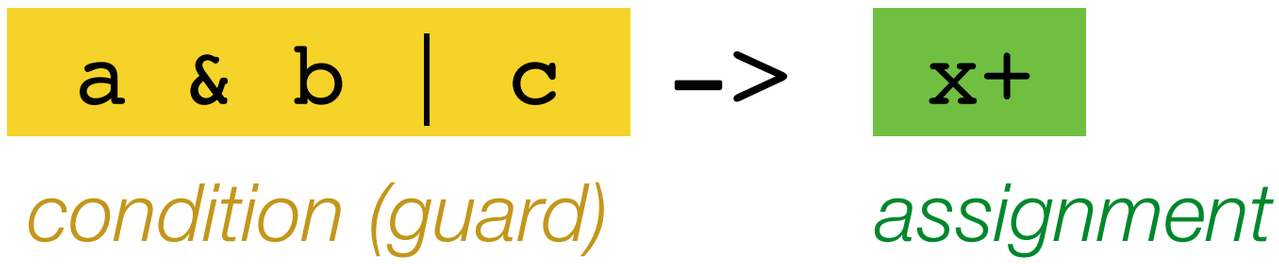
Abstractions for behavioral level modeling

- Message-passing programming in CHP
  - ❖ Parallel collection of sequential programs
  - ❖ Communication channels for information exchange
- Dataflow graphs
  - ❖ Fine-grained parallel components
    - ‣ Can be viewed as “simple subset of CHP”
    - ‣ Easy to think about pipelines
  - ❖ Communication channels for information exchange
- Links and joints
  - ❖ Separation of state and actions
  - ❖ Information exchanged via links
    - ‣ Abstraction that captures common features of different ways to implement communication between two components

Gate-level modeling

- Digital logic
  - ❖ All variables must be mapped into Booleans (0/1)
    - ▸ If we already have a Boolean variable, direct mapping
    - ▸ N-bit integers : use N one-bit variables
  - ❖ Circuit often includes signal + complement
    - ▸ Sometimes made *explicit* by having two variables for a Boolean

- Gates manipulate Boolean values



production rule

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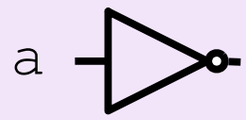
Syntax for gates in ACT

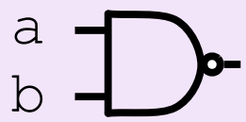
short cuts

combinational




```
a -> x-
~a -> x+
```

```
a => x-
```

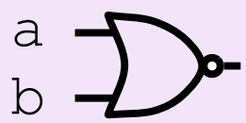



```
a & b -> x-
~a | ~b -> x+
```

```
a & b => x-
```

=>

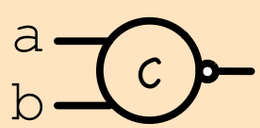
combinational gate




```
a | b -> x-
~a & ~b -> x+
```

```
a | b => x-
```

state-holding




```
~a & ~b -> x+
a & b -> x-
```

```
a & b #> x-
```

#>

C-element gate

```
~a & ~b -> x+
a -> x-
```

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Going from channels to signals/Booleans

- Two parts of a channel
  - ❖ Synchronization [blocking send and receive]
  - ❖ Data transfer from sender to receiver
- Basic idea
  - ❖ Two signals : request and acknowledge
    - ▸ One end asserts request
    - ▸ Other end asserts acknowledge
  - ❖ It is possible to have one signal
    - ▸ One end asserts the signal
    - ▸ The other end de-asserts the signal
- Many variations of this idea in the literature
  - ❖ We will describe some popular approaches today