

# EENG 426/CPSC 459/ENAS 876

## Silicon Compilation

### Syntax-directed translation

Computer Systems Lab

<http://csl.yale.edu/~rajit>

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# Syntax-directed translation

## Goal:

- Convert CHP program into production rules
- Translation will be
  - Correct
  - Inefficient except for the simplest examples

## Syntax-directed:

- Construction is by *structural induction* on the syntax of the CHP program

$x := E, \text{ skip}$

$S_1; S_2$

$[G_1 \longrightarrow S_1 \parallel \dots \parallel G_n \longrightarrow S_n]$

$[G_1 \longrightarrow S_1 \mid \dots \mid G_n \longrightarrow S_n]$

$*[G_1 \longrightarrow S_1 \parallel \dots \parallel G_n \longrightarrow S_n]$

$*[G_1 \longrightarrow S_1 \mid \dots \mid G_n \longrightarrow S_n]$

$S_1 \parallel S_2$

$X!e \quad X?v$

# Implementing communication

Synchronization with **handshaking expansions**.

Four-phase handshaking:

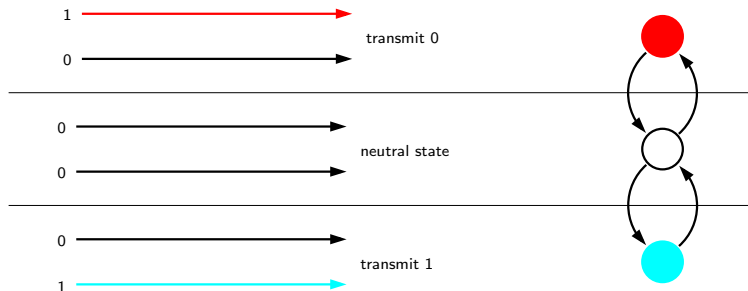
$$X : xo\uparrow; [xi]; xo\downarrow; [\neg xi]$$
$$Y : [yi]; yo\uparrow; [\neg yi]; yo\downarrow$$

$X$ : *active* communication protocol

$Y$ : *passive* communication protocol

# Implementing communication

Dual-rail encoding for data: a standard delay-insensitive (DI) code



To run a statement  $S$ , we will assume:

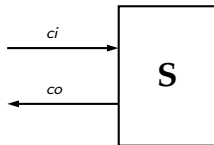
- Input *control* channel  $C$
- Channel consists of two wires ( $ci$ ,  $co$ )
  - When  $ci$  goes high,  $S$  can start
  - When  $S$  is finished,  $co$  goes high
  - ... and the four phase handshake is finished

To evaluate a one-bit expression, we assume:

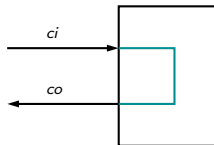
- Input *control* wire
- A dual-rail output that specifies the value
- Variables will have a dual-rail value
- Expressions will be built using structural induction

(Primitives: AND, OR, NOT, variable)

# Translating skip

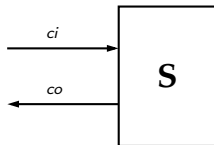


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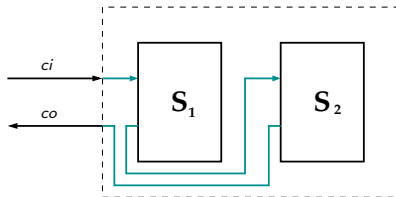




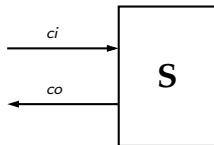
# Translating $S_1; S_2$



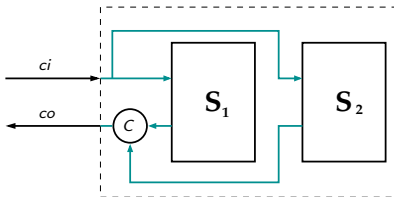
$\equiv$



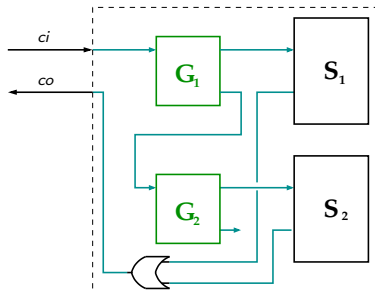
# Translating $S_1 \parallel S_2$



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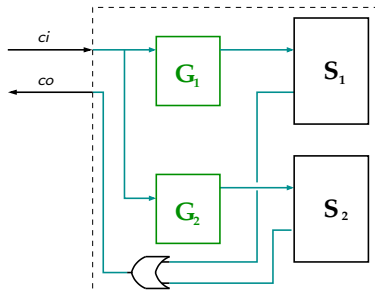


## Deterministic selection statements



(In this version, only local variables are used)

# Deterministic selection statements



(In this version, only local variables are used)