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## Using Simulation to Derive Activity-Based Costing Estimates

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# Using Simulation to Derive Activity-Based Costing Estimates



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# Objective

Demonstrate how activity-based costing (ABC) concepts can be integrated into a discrete-event simulation model and used to evaluate manufacturing cell configurations

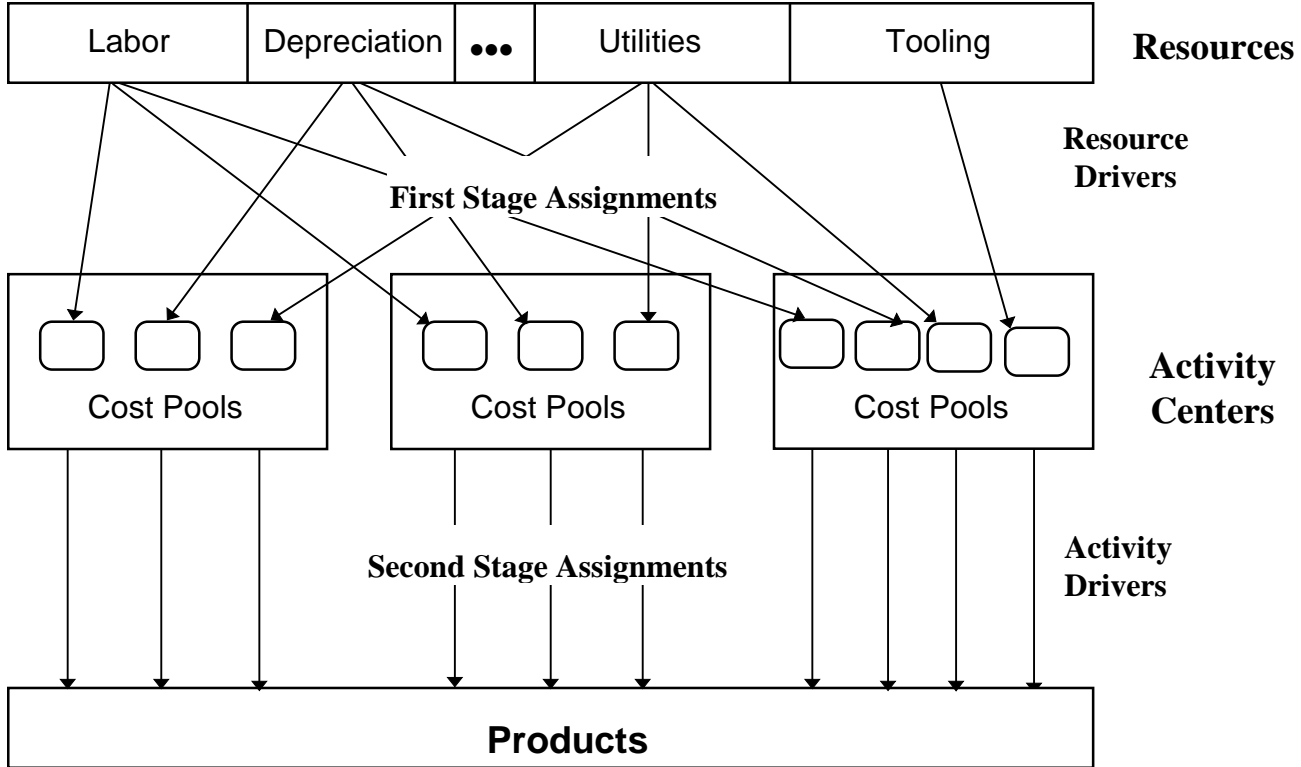
# Cost/Benefit Analysis Using Simulation

- Collect data *off-line* using data generated by the simulation
  - Moore (1990); Krishnamurthi et al. (1994)
    - Based on premise that model exists
- Collect data *on-line* during the execution of the simulation
  - Christy and Kleindorfer (1990) and McLanahan and Ketcham (1990)
  - Savory et al. (1996); Rasmussen et al. (1996)
    - Add cost collecting routines during model development

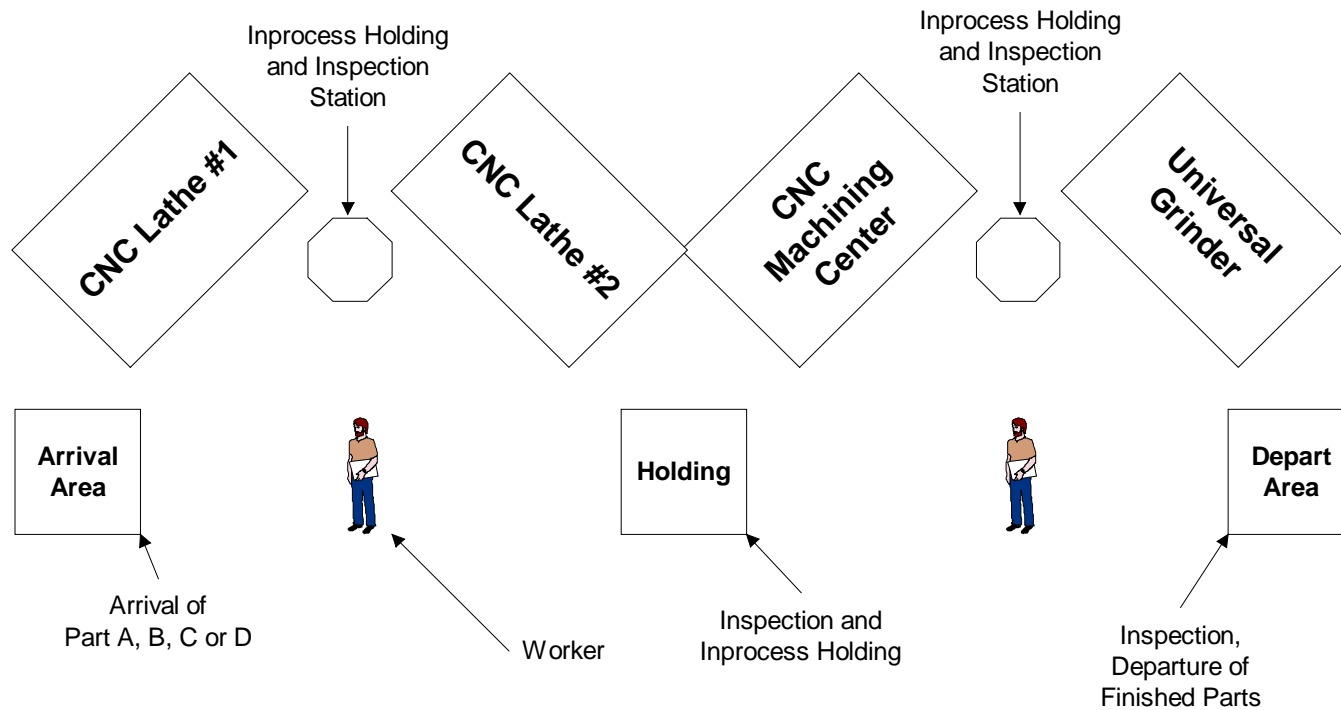
# Activity-Based Costing (ABC)

- Emphasizes activities rather than departments to isolate factors most likely to contribute towards costs
- Focuses on the causes behind indirect costs
- Traces the causal relationship between different cost-incurring activities and final products produced
- A procedure that often makes it possible to estimate product costs more accurately than using traditional costing systems

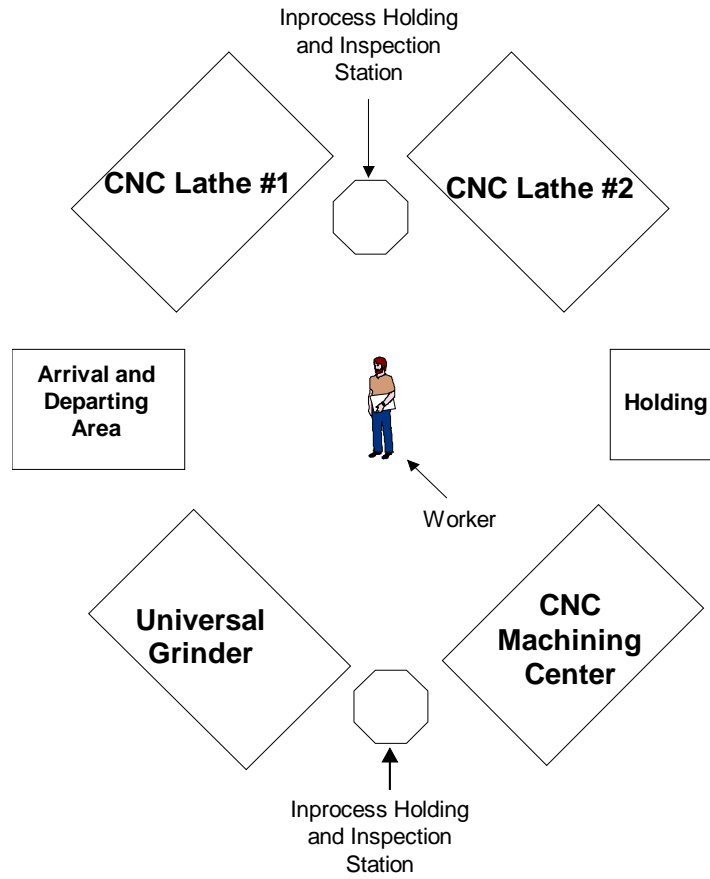
# A Simple ABC Example



# Linear Cell Configuration



# U-Shaped Cell Configuration





# Part Family Characteristics

## Processing Sequence

Part Type	Batch Size	CNC Lathe #1	CNC Lathe #2	CNC Machining	Universal Grinder
A	4	1	2	3	4
B	3	1	2	N/A	3
C	6	1	2	3	N/A
D	2	1	2	N/A	N/A

## Batch Setup Distributions

Setup	CNC Lathe #1	CNC Lathe #2	CNC Machining	Universal Grinder
Short	Triangular (30,60,90)/4	Triangular (30,60,90)/4	Triangular (30,45,60)/4	Triangular (20,40,60)/4
Long	Triangular (30,60,90)	Triangular (30,60,90)	Triangular (30,45,60)	Triangular (20,40,60)

# Part Family Characteristics

## Part Processing Distributions

<b>Part Type</b>	<b>CNC Lathe #1</b>	<b>CNC Lathe #2</b>	<b>CNC Machining</b>	<b>Universal Grinder</b>
<b>A</b>	Triangular (10, 15, 20)	Triangular (10, 15, 20)	Triangular (10, 20, 30)	Triangular (10, 20, 30)
<b>B</b>	Triangular (10, 15, 20)	Triangular (10, 15, 20)	N/A	Triangular (10, 20, 30)
<b>C</b>	Triangular (10, 15, 20)	Triangular (10, 15, 20)	Triangular (10, 15, 20)	N/A
<b>D</b>	Triangular (10, 15, 20)	Triangular (10, 15, 20)	N/A	N/A

# Costing Information

**Direct and indirect labor = \$12/hour plus a 30% benefit rate**

**Hourly preventative and repair mainenance rates = \$50 and \$200**

## Equipment Prices

	<b>Purchase Price</b>	<b>Life</b>	<b>Power Consumption</b>	<b>Utilities</b>	<b>Consumables</b>
CNC Lathe #1	\$120,000	10 years	20 kilowatts	\$0.04/hour	\$2.00/hour
CNC Lathe #2	\$120,000	10 years	20 kilowatts	\$0.04/hour	\$2.00/hour
CNC Machining Center	\$100,000	10 years	25 kilowatts	\$0.04/hour	\$2.50/hour
Universal Grinder	\$80,000	10 years	15 kilowatts	\$0.04/hour	\$1.75/hour

# Simulation Design

- All configurations modeled in SIMAN V
- Data collected and stored primarily in part attributes
- Information accumulated as parts exit the system
- Results for each replication are saved to a file
- After last replication, overall estimates are calculated
- Bills of Activity are generated by the simulation

# Summary of Results

- Results are for 52 week period

	<b>Linear Cell Two Operators</b>	<b>Linear Cell One Operator</b>	<b>U-Shaped Cell One Operator</b>
<b>Manufacturing Cost per Unit</b>	\$35.48	\$35.41	\$35.38
<b>Non-allocated Cost for Operator Idle Time</b>	\$84,346.26 (42,047.73 + 42,298.55)	\$16,872.26	\$17,383.73

# Summary of Results

- The linear cell with 1 operator is better than 2 operators due to reduced idle time and costs
- The linear cell with 1 operator has a lower non-allocated cost for operator idle time as compared to the U-shaped cell

*Which is best?*

# Conclusions

The integration of activity-based costing with a discrete-event simulation model can provide a cell designer with useful costing information for determining the best cell configuration

- decisions can be made in terms of costs/expenses
- ability to break out non-allocated costs for operator idle time