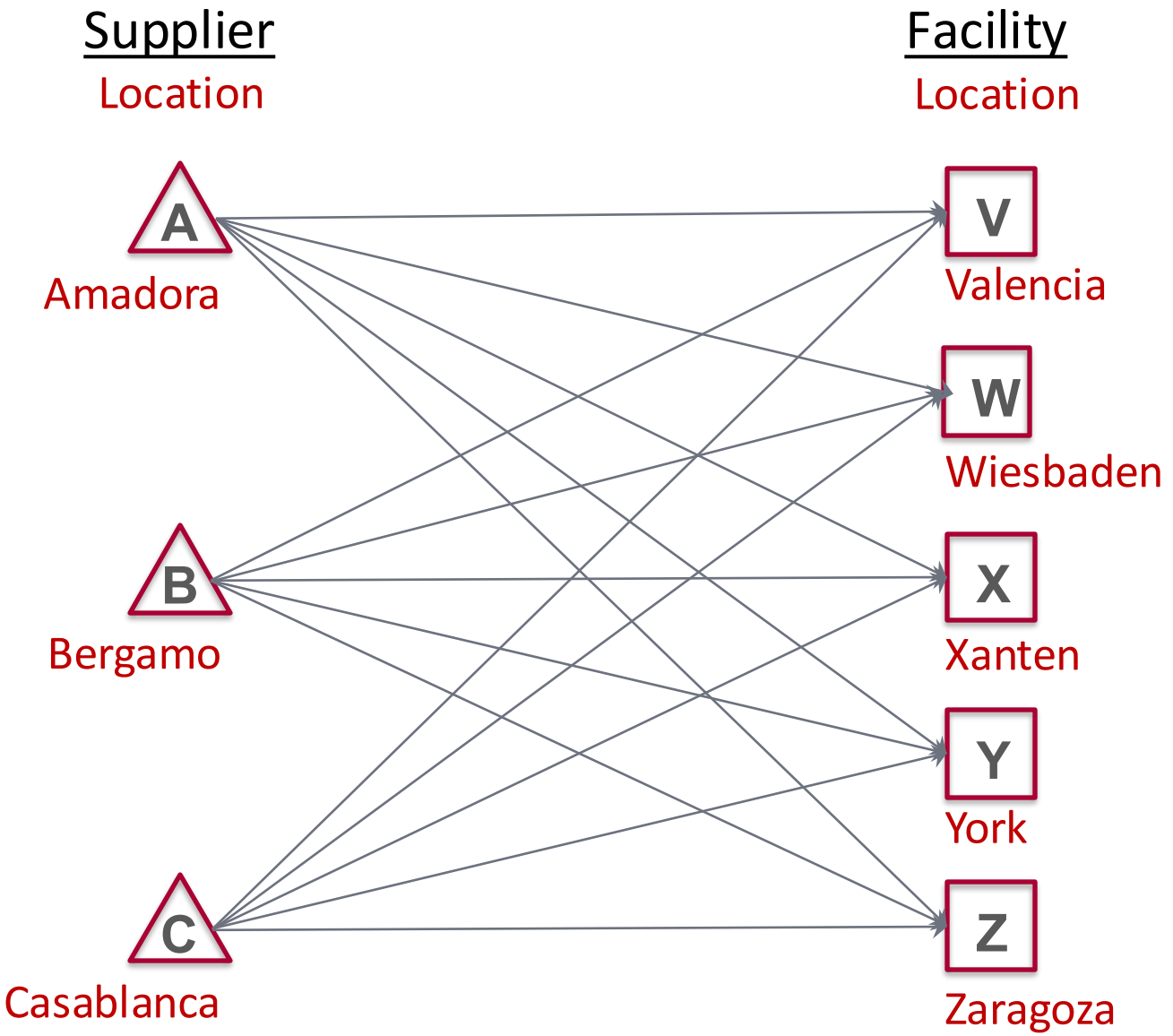
Motivating Example

- Consider a large apparel retailer in Europe with 5 production facilities and 3 fabric suppliers.
  - The suppliers are located in **A**madora (Portugal), **B**ergamo (Italy), and **C**asablanca (Morocco)
  - The production facilities are located in **V**alencia (Spain), **W**iesbaden (Germany), **X**anten (Germany), **Y**ork (England), and **Z**aragoza (Spain)

Supply Network



Motivating Example

- Consider a large apparel retailer in Europe with 5 production facilities and 3 fabric suppliers.
  - The suppliers are located in **A**madora (Portugal), **B**ergamo (Italy), and **C**asablanca (Morocco)
  - The production facilities are located in **V**alencia (Spain), **W**iesbaden (Germany), **X**anten (Germany), **Y**ork (England), and **Z**aragoza (Spain)

- Can we use optimization to minimize supply costs while meeting demand?

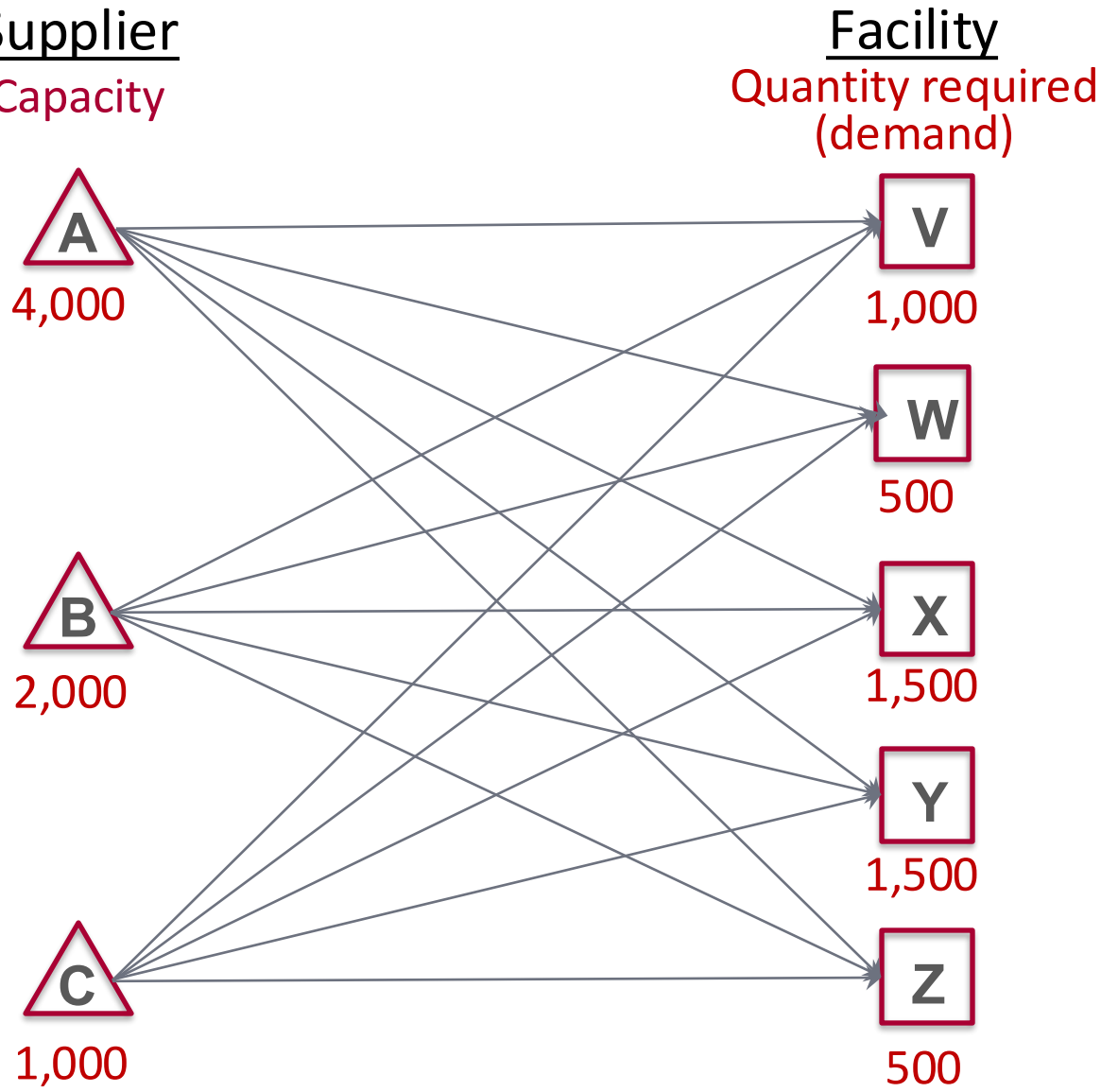
Motivating Example

- Consider a large apparel retailer in Europe with 5 production facilities and 3 fabric suppliers.
  - The suppliers are located in **A**madora (Portugal), **B**ergamo (Italy), and **C**asablanca (Morocco)
  - The production facilities are located in **V**alencia (Spain), **W**iesbaden (Germany), **X**anten (Germany), **Y**ork (England), and **Z**aragoza (Spain)
- Can we use optimization to minimize supply costs while meeting demand?

This example is highly simplified. Supply chains are much more complex (multiple stages, multiple products, multiple time periods, many design decisions at each stage, and complex operational constraints). However, it provides an illustration of how optimization models can capture key design decisions, and practice in modeling using binary variables

What sort of input data we do need to formulate the problem?

Facility Demands and Supply Capacities



Capacity and quantity required figures are in tons of fabric per month

Supply Costs

- Supply Costs in €1,000 per ton of fabric:

Supplier	Cost of supplying 1 ton to Facility				
	Valencia	**Wiesbaden**	**Xanten**	**York**	**Zaragoza**
Amadora	1.78	2.26	2.22	2.30	1.45
Bergamo	1.64	2.70	2.00	2.44	2.30
Casablanca	1.70	2.15	2.58	1.28	1.95

- Supply costs include purchase, transportation, and all other variable costs

Supply Costs

- Supply Costs in €1,000 per ton of fabric:

Supplier	Cost of supplying 1 ton to Facility				
	Valencia	**Wiesbaden**	**Xanten**	**York**	**Zaragoza**
Amadora	1.78	2.26	2.22	2.30	1.45
Bergamo	1.64	2.70	2.00	2.44	2.30
Casablanca	1.70	2.15	2.58	1.28	1.95

- Supply costs include purchase, transportation, and all other variable costs
  - Example: It costs €1,780 to supply 1 ton of fabric from the supplier in Amadora to the production facility in Valencia

Supply Costs

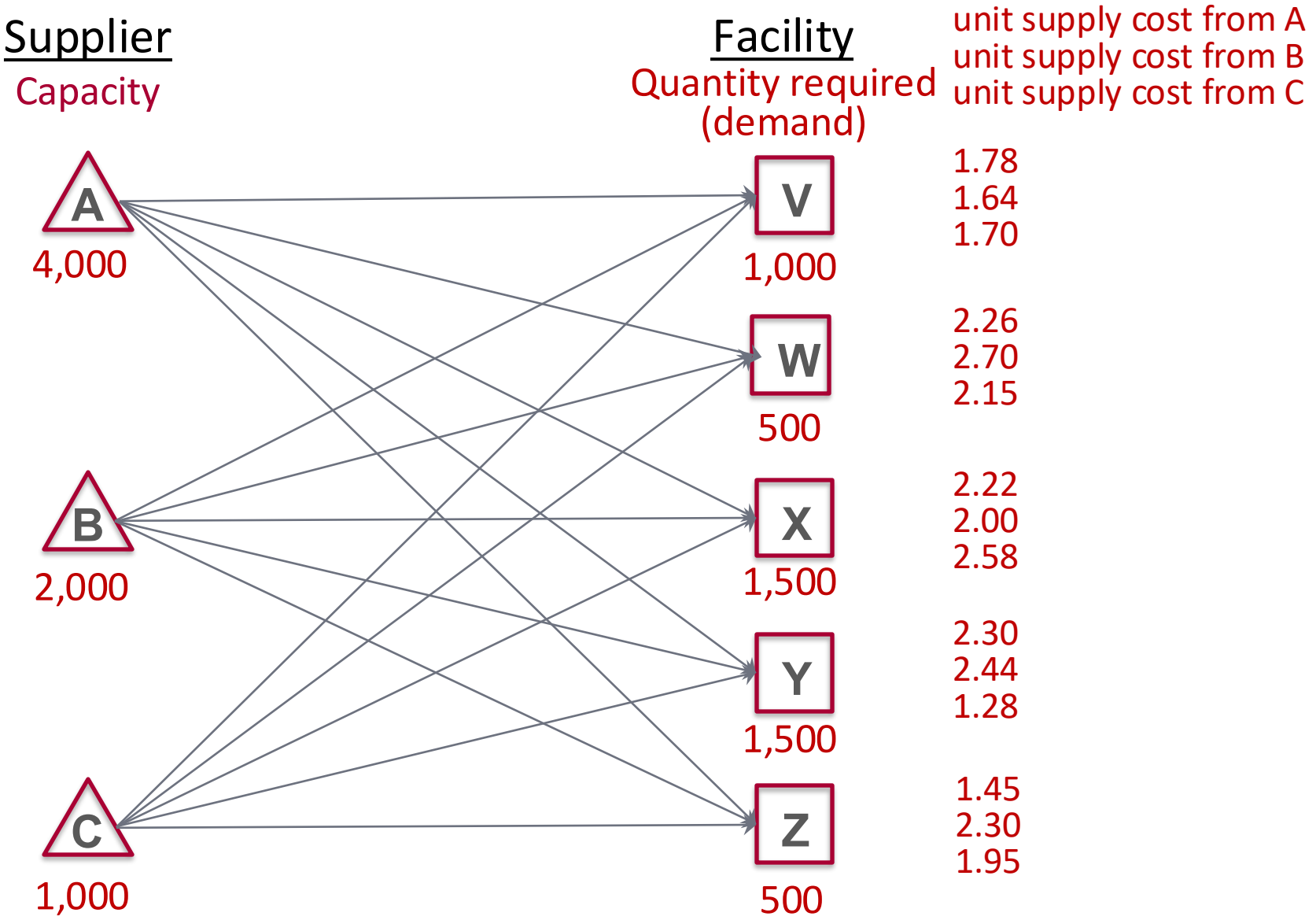
- Supply Costs in €1,000 per ton of fabric:

Supplier	Cost of supplying 1 ton to Facility				
	Valencia	**Wiesbaden**	**Xanten**	**York**	**Zaragoza**
Amadora	1.78	2.26	2.22	2.30	1.45
Bergamo	1.64	2.70	2.00	2.44	2.30
Casablanca	1.70	2.15	2.58	1.28	1.95

- Supply costs include purchase, transportation, and all other variable costs
  - Example: It costs €1,780 to supply 1 ton of fabric from the supplier in Amadora to the production facility in Valencia

- Ignore fixed supply costs (for now)

Summary


Supplier
Capacity
Facility
Quantity required
(demand)
unit supply cost from A
unit supply cost from B
unit supply cost from C
A
4,000
B
2,000
C
1,000
V
1,000
W
500
X
1,500
Y
1,500
Z
500
1.78
1.64
1.70
2.26
2.70
2.15
2.22
2.00
2.58
2.30
2.44
1.28
1.45
2.30
1.95