Introduction to Transportation Systems

PART I:

CONTEXT, CONCEPTS AND CHARACTERIZATION

Chapter 2:

Transportation Systems Components: An Internal Perspective

Infrastructure

- Guideways: Special Purpose vs. General Purpose Guideway -- some examples
  - Highway
  - Railroad
  - Pipeline
  - Air Corridors
- Terminals/Stations -- some examples
  - Rail Freight Yards
  - Container Port
  - Airports
  - Bus Stations
  - Transit Stations
  - Street Corner Bus Stops/Taxi Stands

Vehicles

- Automobiles
- Rail Locomotives
- Airplanes
- Tractor Trailer
- Truck Trailers
- Railroad Cars
- Containers

Vehicle Characteristics

- Crashworthiness
- Degree of Automation
- Energy Source: internal vs. external
- Weight
- Material
- Aerodynamics
- Emissions

Equipment -- some examples

- Loading Crane at Container Port
- Railroad Track Maintenance Equipment
- Airport Baggage Handling
- Snow Removal Vehicles

Power Systems

- Internal Combustion Engine
- Diesel Engine
- Electric Motors
- Humans
- Animals
- Gravity
- Windmill
- Solar Panels
- Tidal Baffles

Fuel

- Gasoline
- Natural Gas
- Diesel
- Coal
- Electricity (e.g., as generated from coal)
- Electricity (as in an onboard battery)
- Solar Energy
- Tides/Currents
- Wind

Control, Communications and Location Systems

- Humans
  - Driver
  - Controllers (as in air traffic)
  - Dispatcher
- Technology
  - Traffic Lights
  - Sensors -- e.g., Loop Detectors
  - Fleet Management Systems
  - Automated Vehicles
  - Block Control (railroad)
  - Global Positioning Systems (GPS)
  - Intelligent Transportation Systems (ITS)

Summary -- Transportation Physical System Components

- Infrastructure
  - Guideway
  - Terminals
  - Stations
- Vehicles
- Power Systems
- Fuel
- Control, Communications & Location Systems

Figure 2.1

“Operators”

- Labor
- Management
  - Marketing
    - Intramodal
    - Intermodal
    - Intersectoral, e.g., Transportation vs. Communication
  - Strategic Planning
  - Operations

Operations/Marketing "Tension"

- Marketing people like to provide high-quality service. To a first approximation, they want to maximize revenues.
- Marketing people like to provide universal, direct, frequent, and high-quality service to transportation customers.
- Marketing people are basically concerned with maximizing the revenues that flow to the company.

Operations/Marketing "Tension"

- Operations people are cost-oriented.
- Operations people are typically worried about minimizing cost.
- Operations people want to run an efficient and cost-effective operation.

“Operators”, continued

- Maintenance Management
- Information Management
- Operations Research
- Administration

Operating Plans

- Schedule
- Crew Assignments
- Vehicle Distribution

Connection Patterns -- Hub-and-Spoke

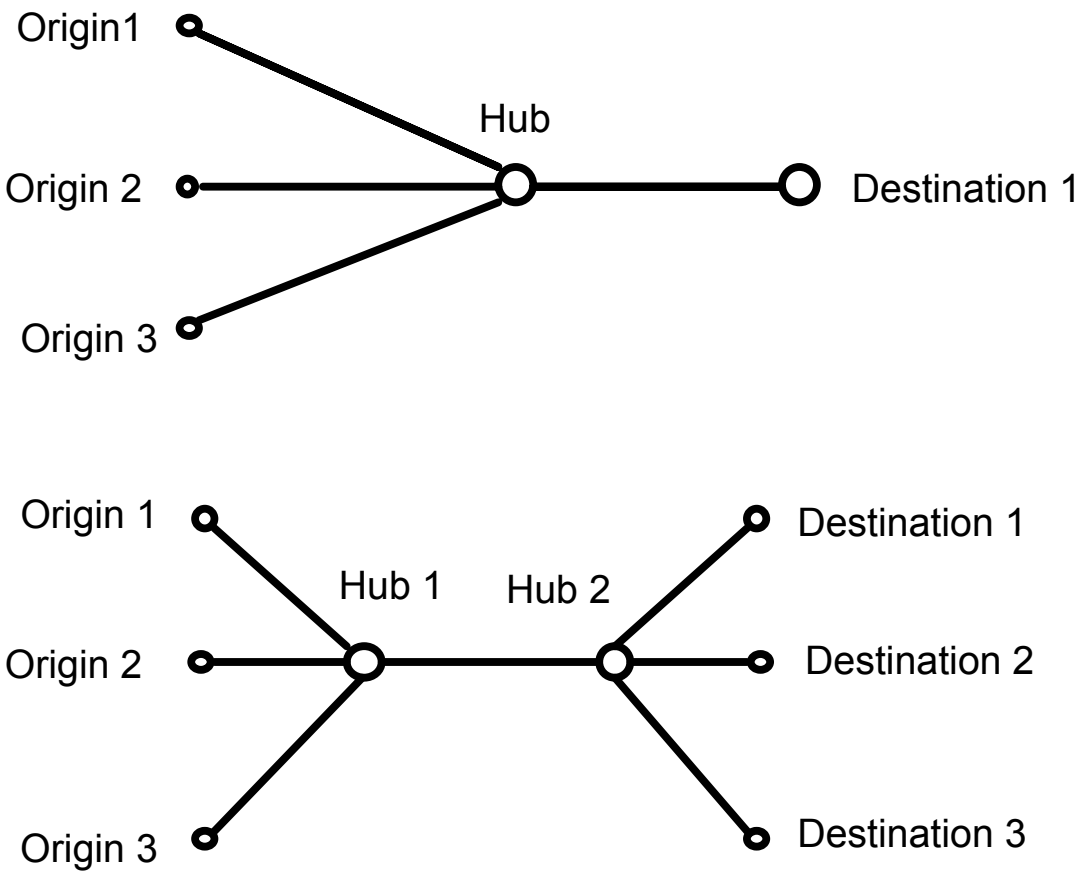

Figure 2.2

Cost/Level-of-Service Trade-off

Two Connection Patterns

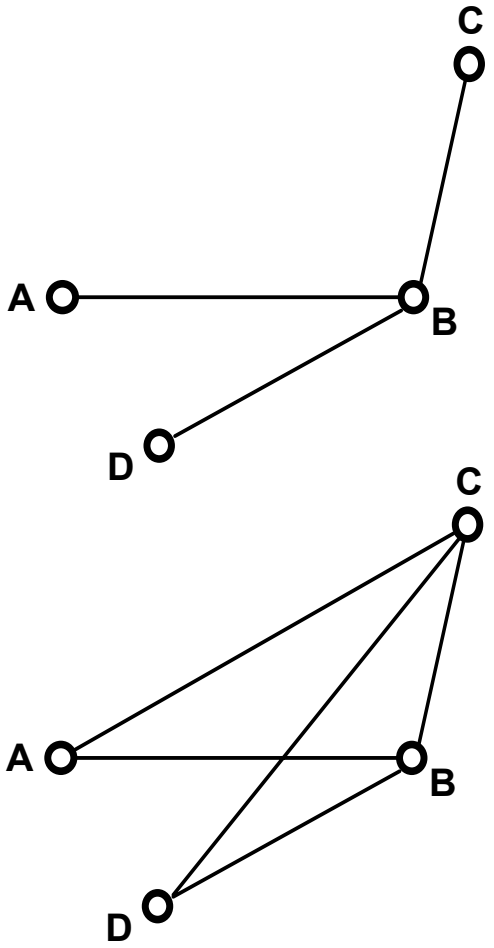

Figure 2.3

Do we provide direct, high-quality service from A to C as shown in the lower figure, or do we consolidate passengers at Node B with other passengers from Node D, into a single flight from B to C?

Here we have some fundamental *cost/level-of-service trade-offs*.

Which pattern does the VP-Marketing like? How about the VP-Operations?

Contingency Planning

What do we do when things go wrong? How do we decide how to alter our operating plan to reflect changes in weather, demand for service and accidents -- such as a derailment?