

How the Internet is Impacting Revenue Management, Pricing, and Distribution

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Prices and Sales

A Common Business Model

Available Inventory
for Each Product

List Price for
Each Product
in Inventory

Negotiated
Price for
Each Product
in Inventory

- Products are determined and a record of available inventory is maintained
- List prices for each product in inventory are established (and then promptly ignored)
- Sales representatives negotiate prices at which inventory is sold and under what terms

The Airline Business Model

Booking Classes for
Travel from One City
to Another
(RES)

List Price for
Each
Booking
Class/City
Pair

Negotiated
Price for
Each
Booking
Class/City
Pair

- Products are booking classes
- List prices are established and posted at an industry centralized location
- Sales representatives negotiate special terms – commonly discounts off of list price

The Airline Business Model

- Products are sold through inventory availability, not by direct reference to price
 - ◆ The price received for a product may vary substantially depending upon who purchased it
- Airlines often don't know what payment they received for a ticket until months after the sale
 - ◆ Compliance with terms is a huge issue unto itself
 - ◆ Keeping record of terms is a huge issue unto itself

Implications for Pricing Optimization

- Commercial reasons for this type of pricing
 - ◆ Buyers can leverage purchasing power due to volume
 - ◆ Sellers are afraid of losing large blocks of business
- Many commercial application deal specifically with keeping the pricing chain under control
 - ◆ The McKinsey waterfall model

Distribution and the Internet

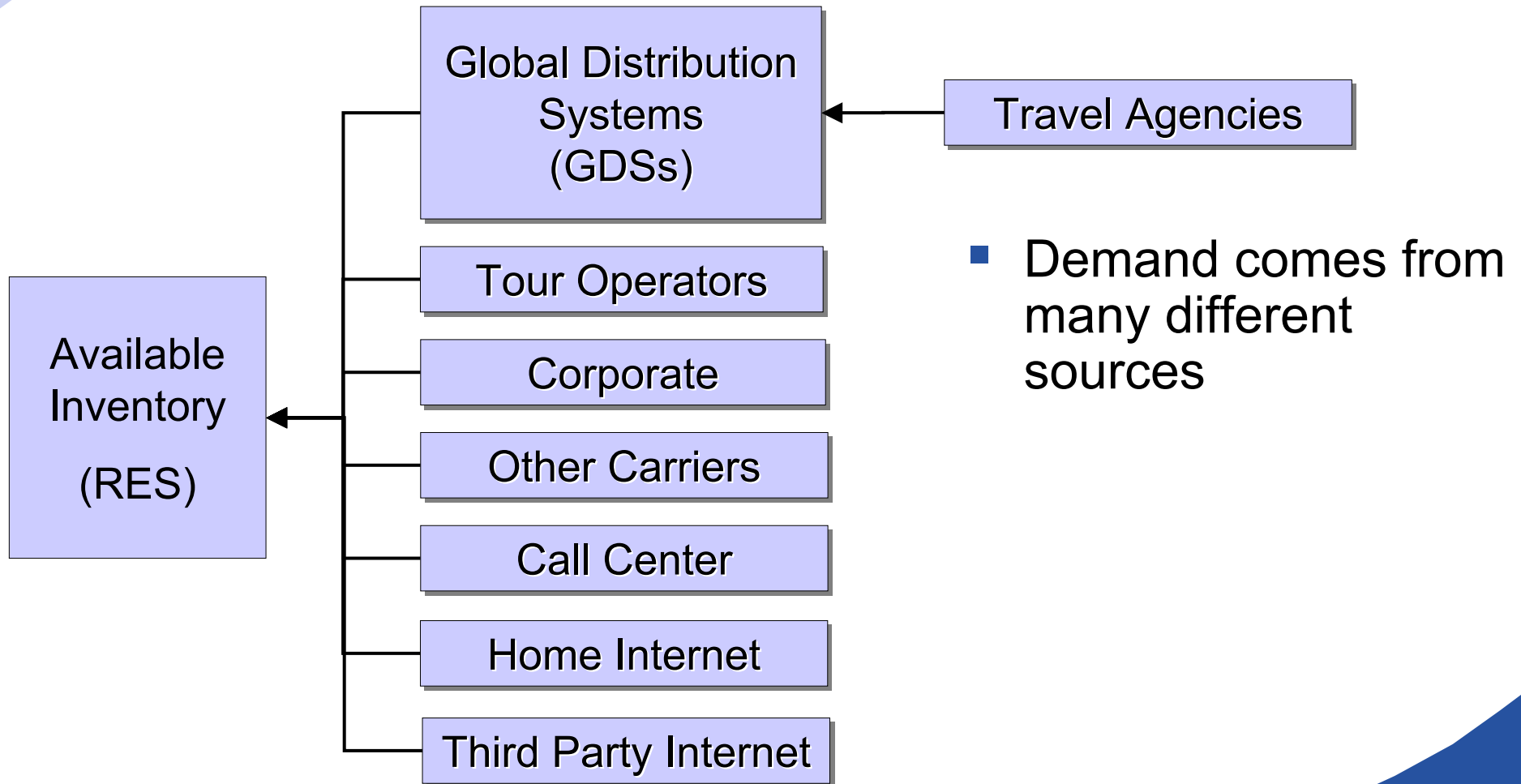
Travel and Transportation Industry

Distribution Channels: Where Does Demand Come From?

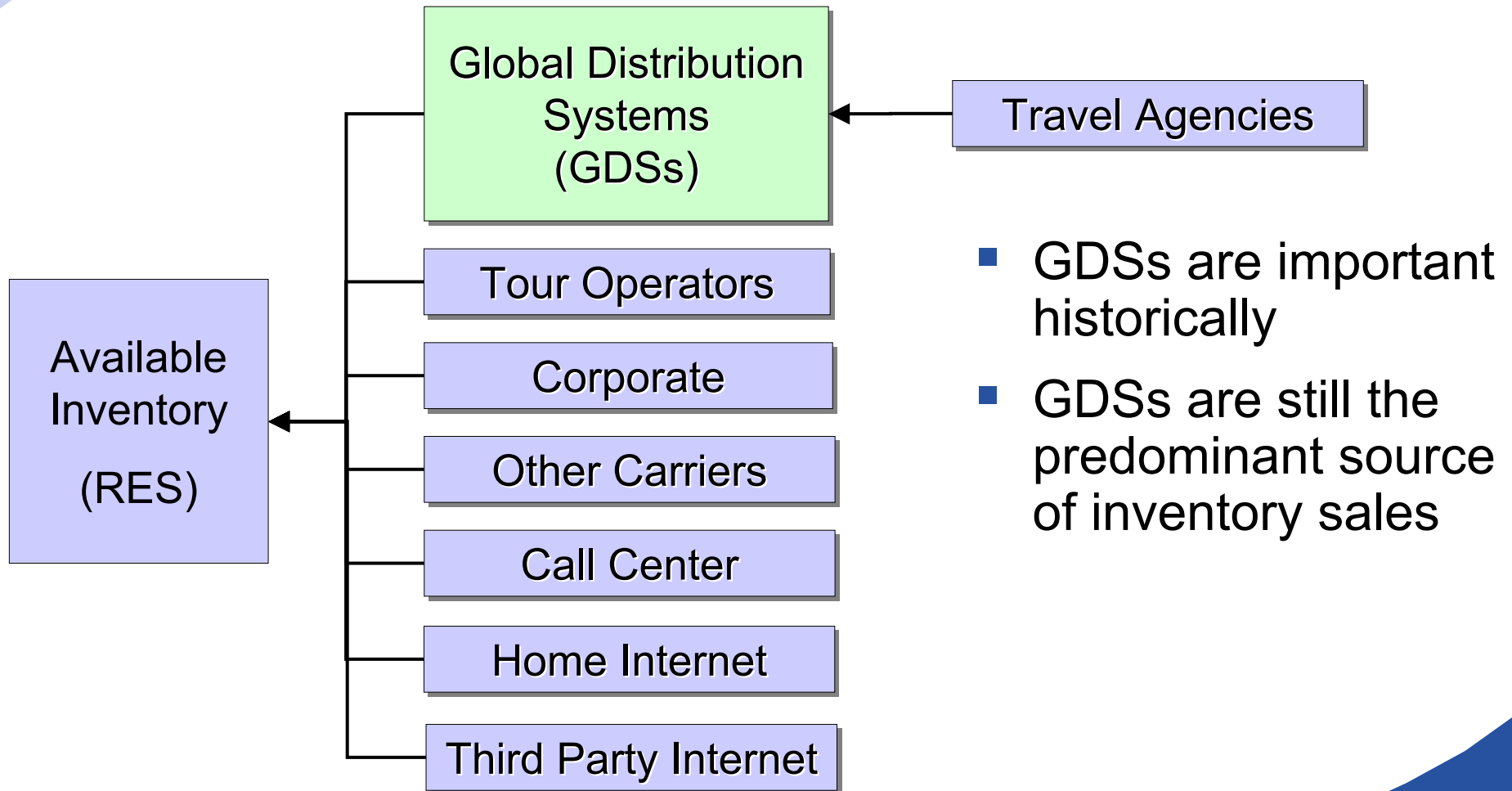
Available
Inventory
(RES)

- Available inventory is maintained in a “centralized” location

Distribution Channels: Where Does Demand Come From?

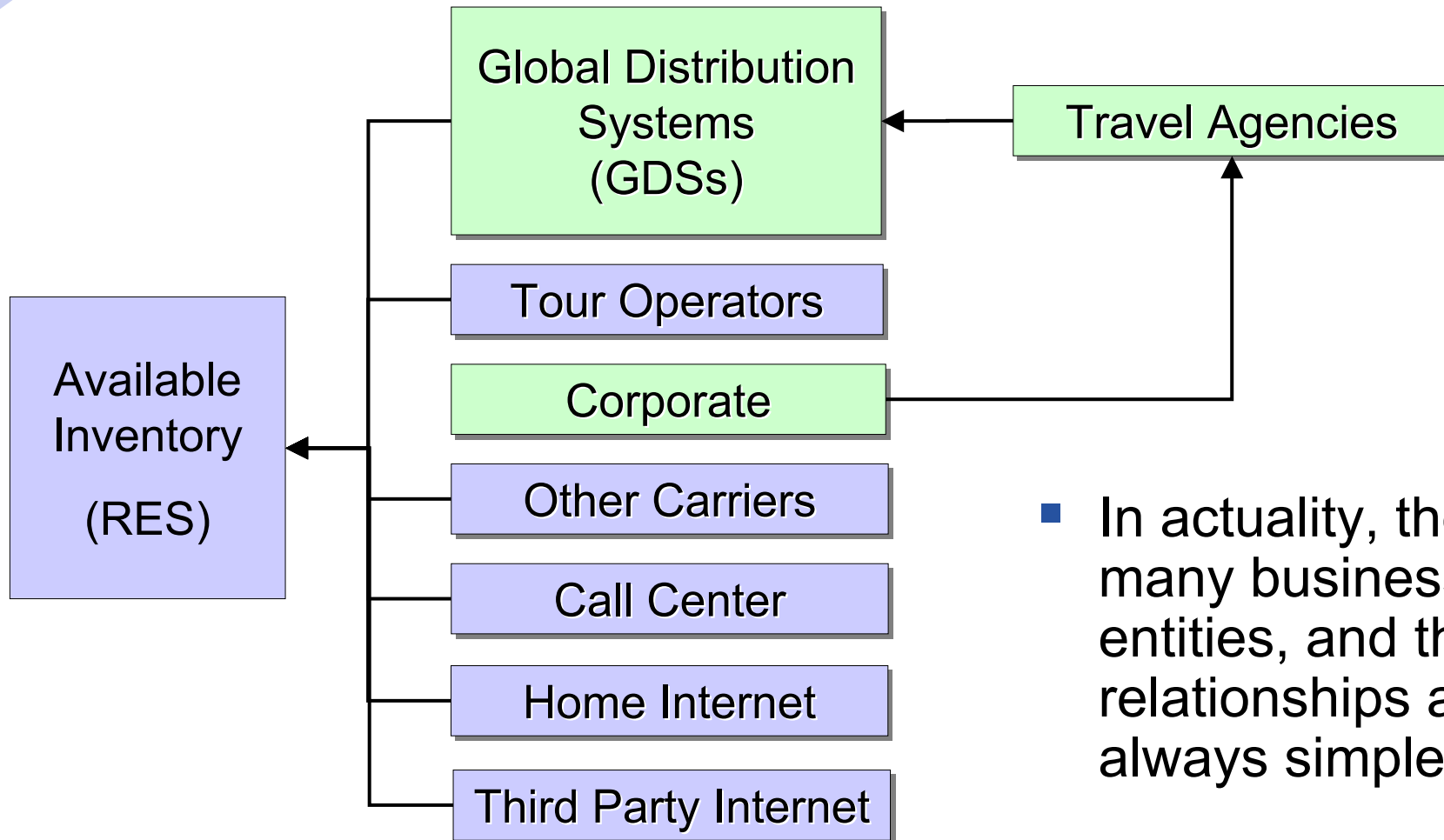


Distribution Channels: Where Does Demand Come From?



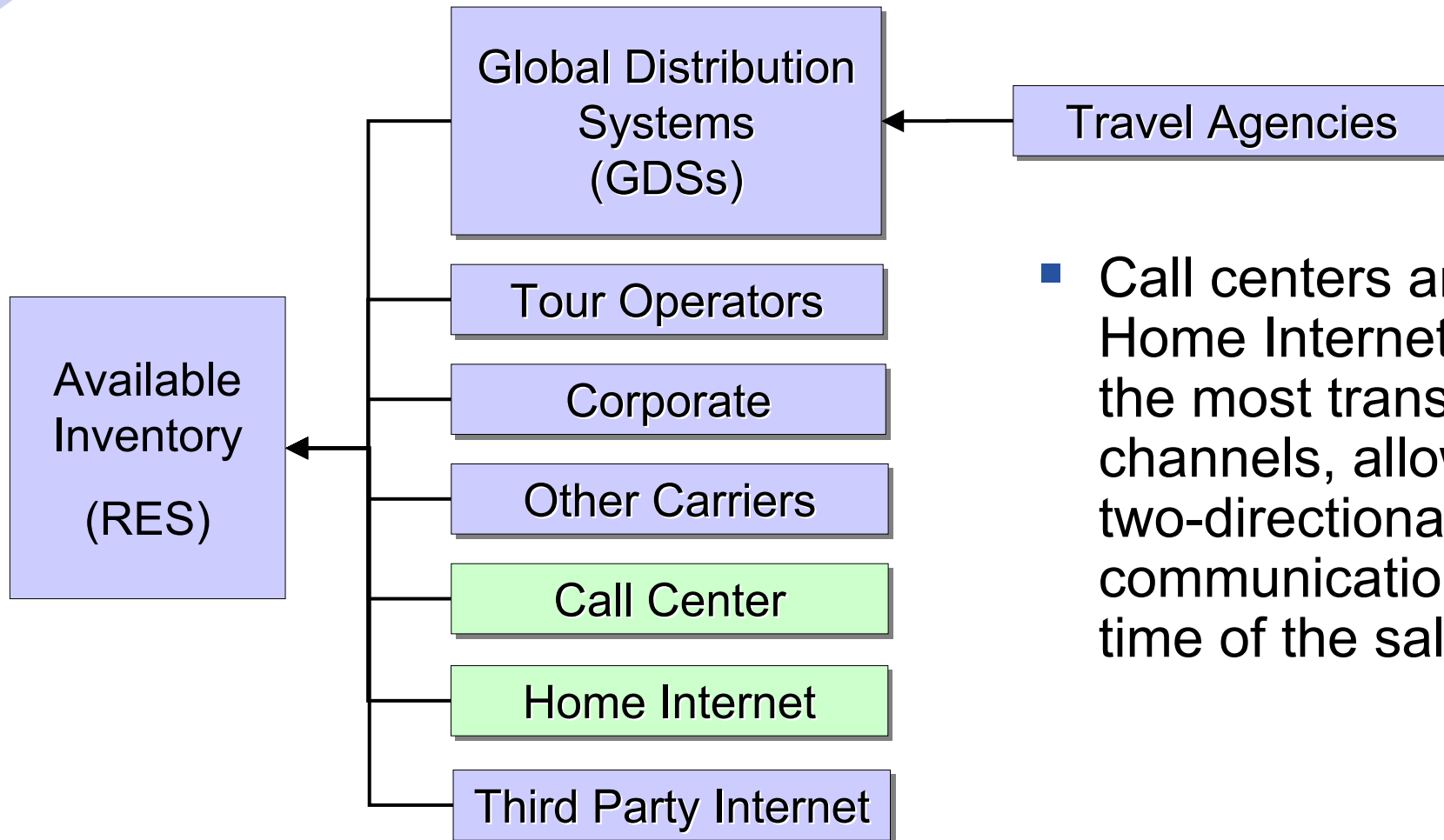
- GDSs are important historically
- GDSs are still the predominant source of inventory sales

Distribution Channels: Where Does Demand Come From?



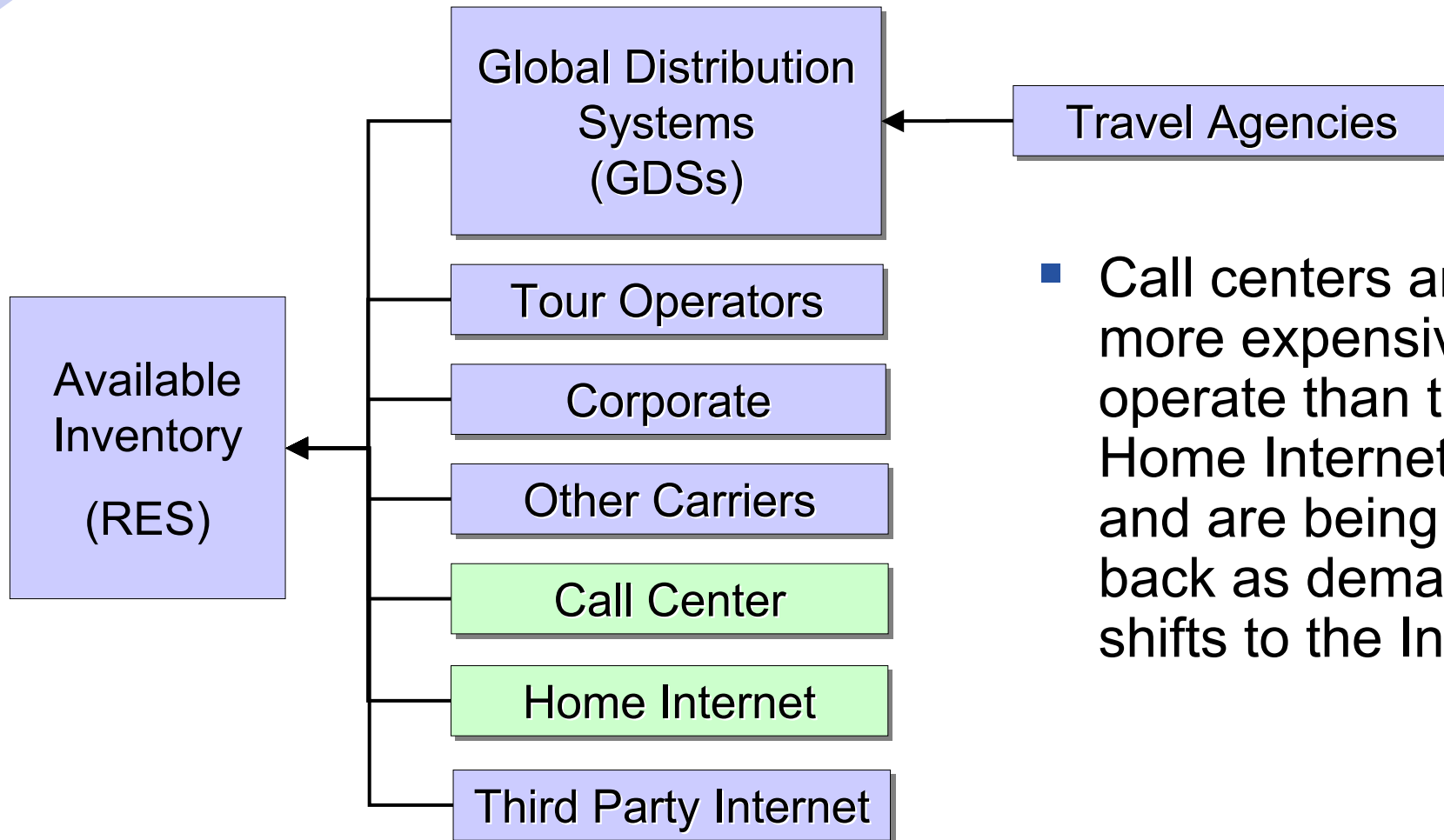
- In actuality, there are many business entities, and the relationships are not always simple

Distribution Channels: Where Does Demand Come From?



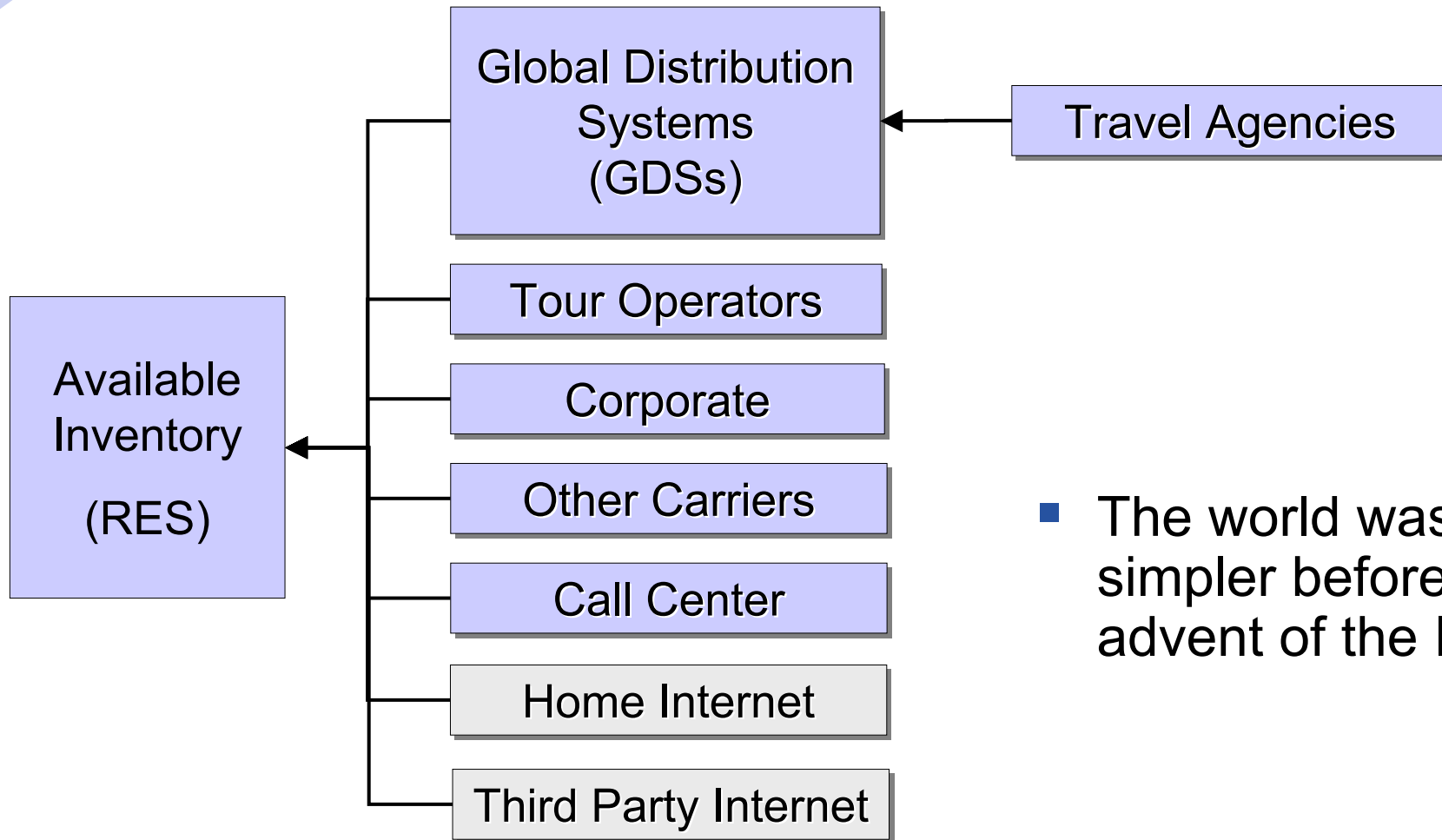
- Call centers and the Home Internet site are the most transparent channels, allowing two-directional communication at the time of the sale

Distribution Channels: Where Does Demand Come From?



- Call centers are much more expensive to operate than the Home Internet site and are being scaled back as demand shifts to the Internet

Distribution Channels: Where Does Demand Come From?



- The world was simpler before the advent of the Internet

Without the Internet

- Airline sales departments actively pursued large accounts, giving discounts in exchange for assurances of purchasing from the carrier
 - ◆ Locked people into a particular purchasing behavior
 - ◆ Much segmentation occurred as a result of contractual arrangements and the process by which people purchased tickets

Without the Internet

- Competitive fare information was difficult for consumers to gather
 - ◆ Call multiple airlines to get itinerary and price information
 - ◆ Call a travel agent with the expectation of receiving the lowest price
 - ◆ Travel agents were locked into incentive structures and contractual arrangements with carriers and GDSs

Without the Internet

- The net result is that contracts and incentives led to a “smoothly” operating machine
 - ◆ “Sublime ignorance”
 - ◆ Forecasting demand by product may have been a reasonable approach

With the Internet

- Ease of use
- Services and benefits not available through other channels
 - ◆ Seat selection
 - ◆ Better prices
 - ◆ Rewards
- Competitive fare information readily available
- Alternative purchasing models
 - ◆ e.g., Priceline

With the Internet

- Internet purchases continue to rise
 - ◆ North America, 2003
 - ◆ 40% of all ticket sales occurred on-line
 - ◆ 27% of all ticket sales occurred on airlines' own web sites

With the Internet

- The net result is that the smoothly operating machine is being dismantled
 - ◆ Segmentation is eroding
 - ◆ Price is becoming a more dominant factor in buying decisions

Internet Implications for Pricing Optimization

- Practitioners are aware of severe downward price pressure
- The Internet is a leading cause, but there are other important contributing factors
 - ◆ Historically high fares in the late 1990s
 - ◆ Low fare competition

Internet Implications for Pricing Optimization

- Two research challenges
 - ◆ Demand modeling and the resultant changes in forecasting and optimization models
 - ◆ Includes competitive pricing
 - ◆ New models to take advantage of the special characteristics of the home web site

Demand Modeling

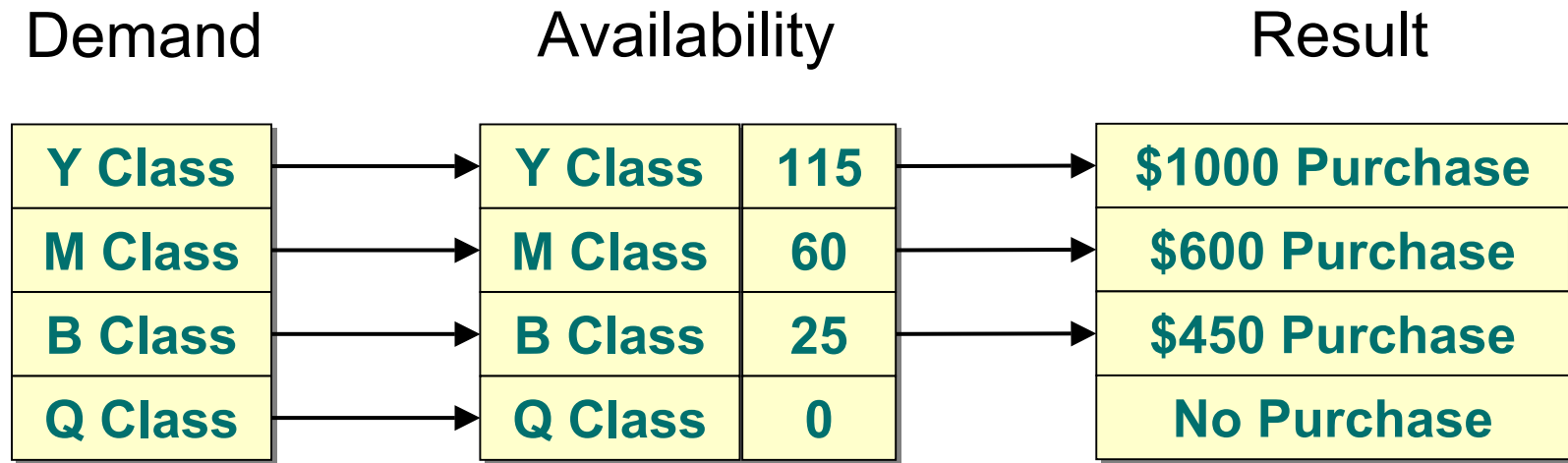
The Issue

- As a result of changes in the distribution environment (and low fare competition)
 - ◆ Is demand behaving as it is presently modeled in most of the revenue management literature?
 - ◆ If not, how can the models be improved?
- Note that the question is one of demand behavior, not forecasting methods

Historically Predominant Model

- A fare class represents a product with its own unique demand
- A customer arrives with a desire to purchase that product, and if it is not available he does not make a purchase
- Model embodies an underlying assumption of different fare classes representing truly different products
- Refer to this model as the *yieldable* demand model (independent demand model)

Yieldable Demand



\$1000 Y \$600 M \$450 B \$250 Q

- Customers arrive to purchase a specific product, and walk away if the product is unavailable

Alternative Demand Models

- Discrete choice
- Correlation with _____
- Sell-up / Buy-down
- Recapture factors
- Simulate customer types
- Aggregate / Disaggregate forecasting

Alternative Demand Models

- Where do the many alternative demand models leave us? What approach to choose, and why?
 - ◆ Start from the fundamental business issues
 - ◆ Models typically aren't accepted unless they first and foremost address a business issue
 - ◆ Must be intuitively measurable

Some Key Business Issues

- Many people purchase by price rather than product (*priceable* demand)
 - ◆ Many interesting research questions with just two types of demand behavior
- Purchase decisions are strongly influenced by competitor prices
 - ◆ Competitor prices are becoming available
 - ◆ Business rules impacting thought process
- The effect of schedules

Resolving the Demand Model Issue

- Will the demand model issue ever be “resolved”?
 - ◆ Forecasts are never perfect
 - ◆ Forecast measurement is always open to question
 - ◆ The world and the people in it are dynamic
- Letting the key business issues drive the eventual approach can lead to significant, fundamental changes to how we view demand

Demand Models Impact Optimization

- New demand models typically require new optimization models
- The dynamic interaction of demand models (forecasting) and optimization models over time remains a challenge
 - ◆ Good qualitative results about self correcting policies would prove very helpful
 - ◆ Avoid chronic problems like spiral down

Models for the Home Web Site

The Issue

- With purchases migrating to the web, how can this channel be leveraged for increased sales?
 - ◆ Issue is not unique to the travel and transportation industries
 - ◆ Mathematically, the issue is not unique to the web
- More general question
 - ◆ How to use mathematical models to manage the dynamic sales process?
 - ◆ Web, call centers, car sales, ...

An Example

- A person comes to an airline web site wanting to purchase four tickets from Boston to Bermuda the third week of January
 - ◆ Airline sites are typically set up to find the lowest available price with different schedule options
 - ◆ Other revenue generating options:
 - ◆ Alternative vacation destinations
 - ◆ Alternative dates
 - ◆ Upgrade for a special price
 - ◆ Packages

The Issue

- Present focus on many web sites is
 - ◆ Low price
 - ◆ Customer experience
- Where automated sales efforts are being made, the most common approaches include
 - ◆ Rules
 - ◆ Often driven by rules of thumb
 - ◆ Static analysis
 - ◆ More dynamic analysis is needed

Rules

■ Example

- ◆ Our traveler has booked four plane tickets to Bermuda and is looking for a hotel
- ◆ Start by requesting what hotel quality the customer desires
 - ◆ Unless the traveler is an elite flier, in which case _____
 - ◆ Or a car is already rented, in which case _____
 - ◆ Or there is a special incentive for selling at hotel X and the moon is full,
 - ◆ Unless ...

Rules

- Rules can be based on some type of modeling and analysis, but are frequently based on “sound business judgment” – a best guess
- When rules engines are used, it can be frightfully difficult to unwind the web of actions to determine what action is leading to what consequence with what probability

Rules

- Rules and mathematical modeling have the potential to live a harmonious coexistence
 - ◆ Incumbent on the mathematical modeling community to carry the quantitative flag

Static Analysis

■ Example

- ◆ There exists an extensive historical database of customer transactions, with information on customer attributes, purchases, and how offers were made to customers
- ◆ A data intensive six month effort is made to determine customer segments and the right way to make offers to each customer segment

Dynamic Analysis

- Example
 - ◆ There exists a team that modifies web offerings daily to a limited number of customers
 - ◆ Could include something as simple as relocating a button on a screen
 - ◆ Based on customer response, the change is either adopted as a part of the standard web presentation, or it is discarded
- Basic approach is experimental
 - ◆ Assumes little if any modeling

Research

- Integrate the two approaches described in the previous examples
 - ◆ Quantitative analysis to support intelligent experimentation
 - ◆ Experimentation to validate and measure the impact of proposals arising from models

In Conclusion

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- The Internet continues to bring major changes to business, and pricing and sales in particular
- There are a wealth of research opportunities
- Two addressed here
 - ◆ Demand models
 - ◆ Home web site / interactive sales process
- Many more ... exciting time ... exciting field

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