Airline Network Structures

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M.Sc. Program

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Strategic Planning

Module 13: 30 March 2016

Lecture Outline

- **Evolution of Airline Network Strategies**
  - From point-to-point to hub/spoke to global hub-to-hub
- **Hub Economics and Network Structure**
  - Hub/spoke vs. point-to-point
  - Revenue power and load consolidation
  - Operational advantages and incremental costs
- **Hub Network Impacts on Route Planning**
  - Incremental revenue logic for new routes
  - Hub growth by adding cities
- **Recent Trends: Hub Strengthening**
- **International Alliance Hub Networks**

Evolving Network Strategies

- **From linear – to hub construction – to hub-to-hub flying**
- **From regional/country dominance – to a continental footprint – to an inter-continental focus**
- **Intra-country networks supporting intra-continental and inter-continental growth**
- **International expansion contributed to improved revenue for the intra-country operations**

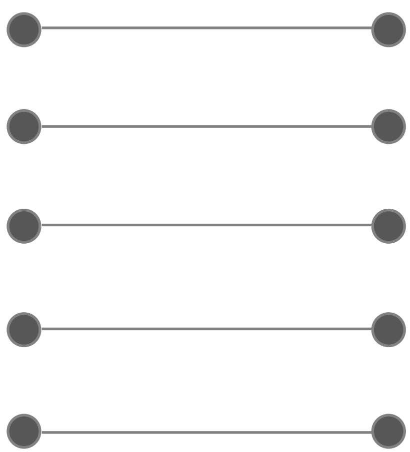
The Evolution of Networks and Competition

COMPETITION

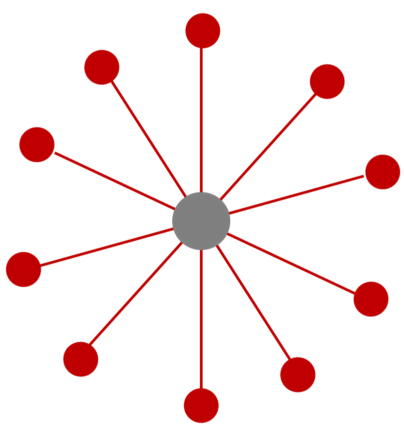
Pre-Deregulation	1980s-1990s	21st Century
Route vs. Route	Hub vs. Hub	Network vs. Network

STRUCTURE

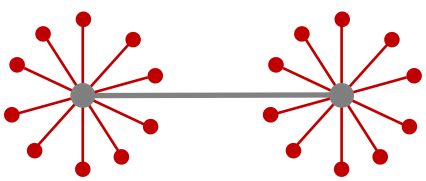
Point-to-Point
5 City Pairs



Hub Operation
55 City Pairs



Network Operation
231 City Pairs

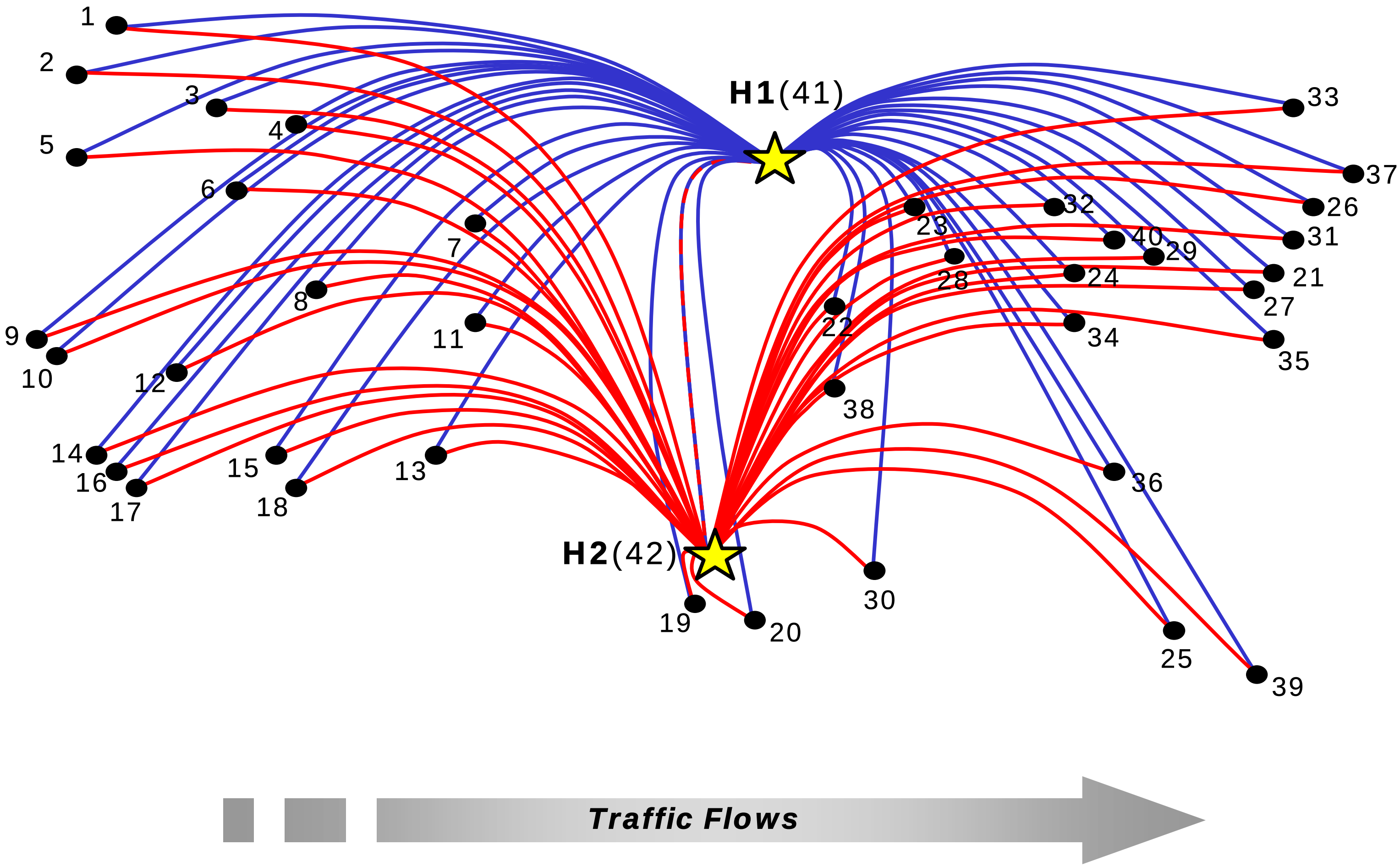


www.airlines.org

Hub Economics and Network Structure

- **Hub/spoke network structures allow airlines to serve many O-D markets with fewer flight departures.**
- **Consider a hub network with 20 flights in and 20 flights out of a single “connecting bank” at a hub:**
  - Each flight serves 21 O-D markets (1 local + 20 connecting)
  - Total of 440 O-D markets served with only 40 flight legs and as few as 20 aircraft flying through the hub
  - Consolidation of loads into and out of the hub allows connecting service to be provided to low demand O-D markets that cannot support non-stop flights
  - Several connecting departures per day in these markets may be more convenient for travelers than 1 daily non-stop flight (“Total Trip Time” is lower, when schedule displacement time included)

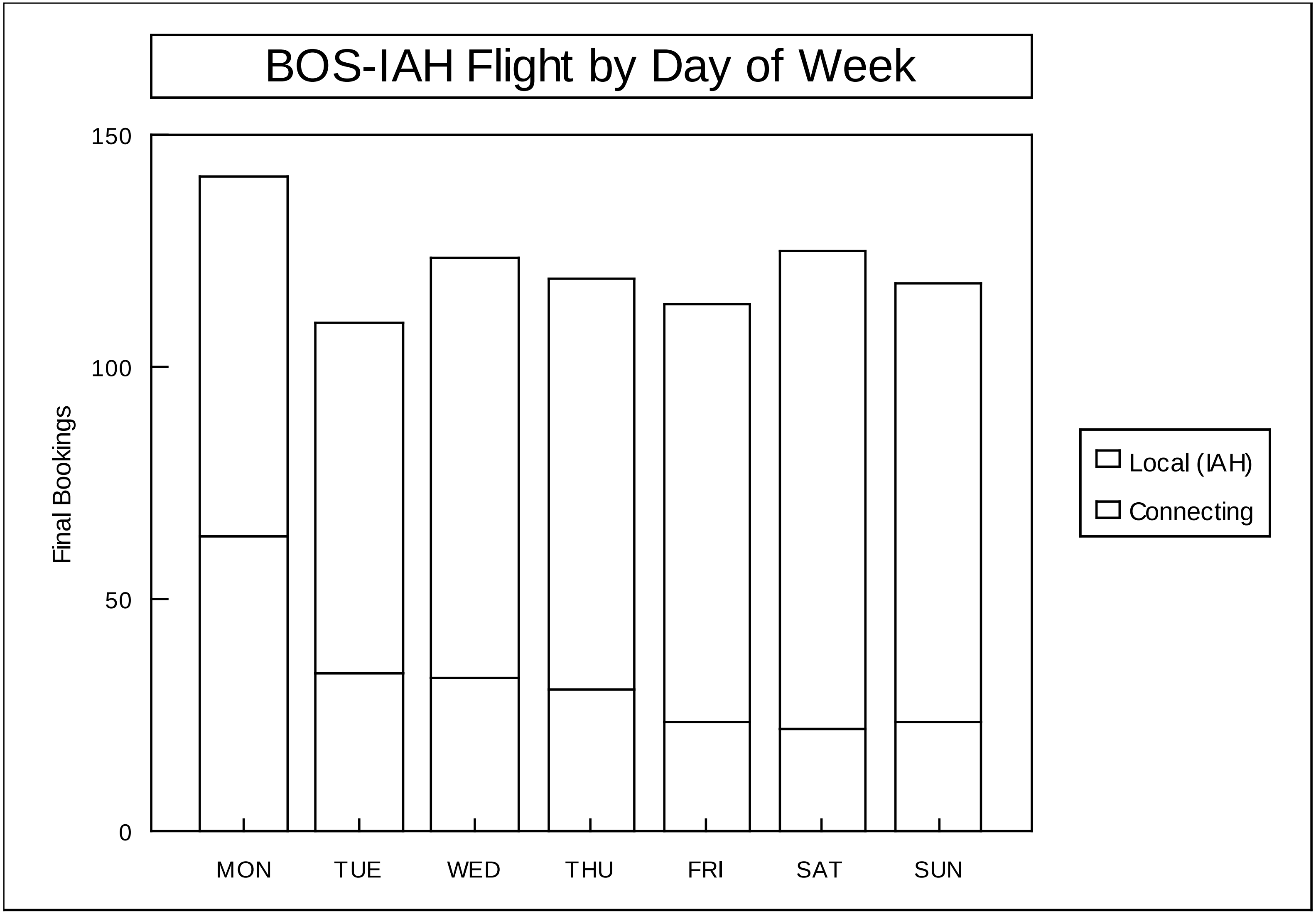
Example: Competitive Hub Networks



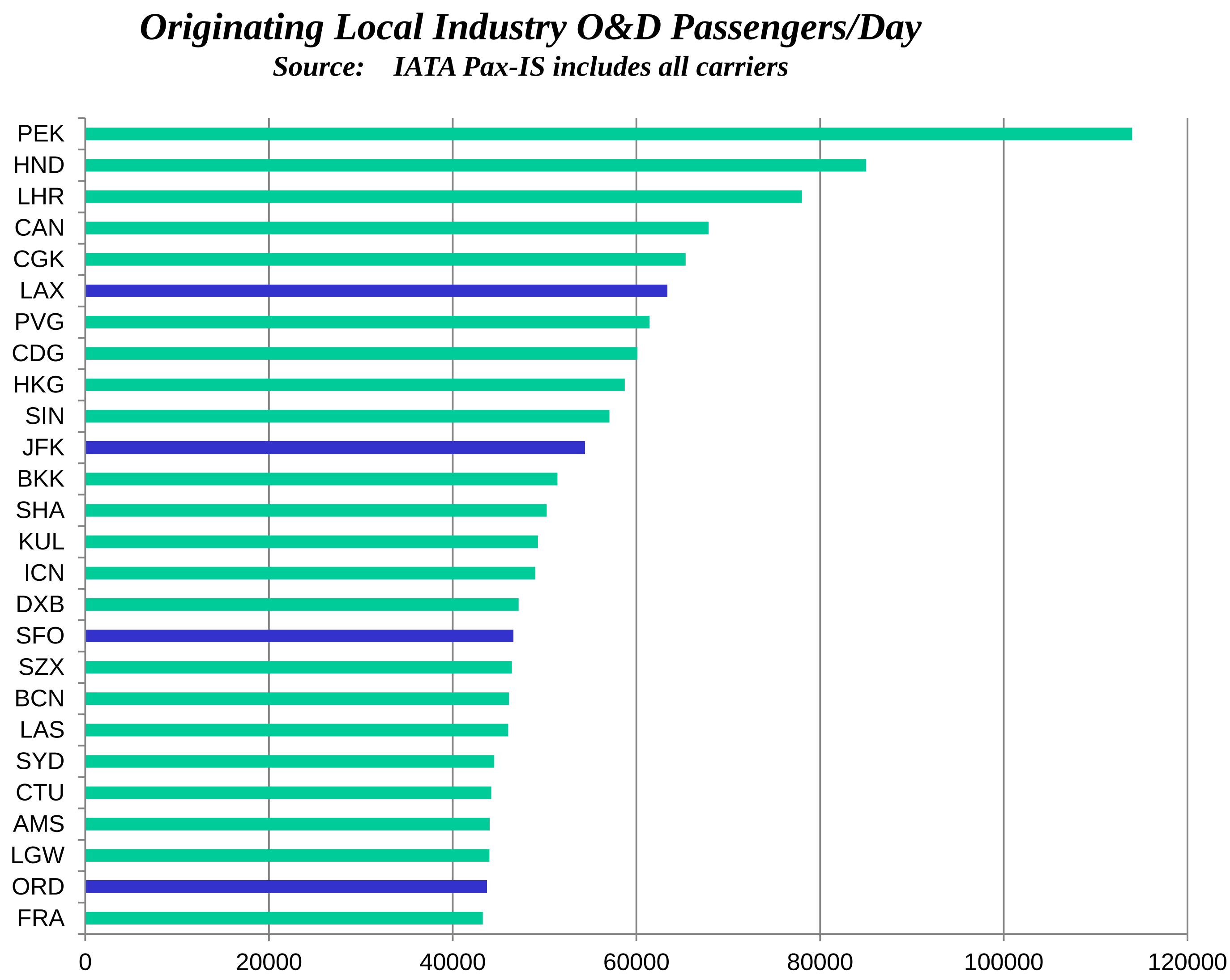
The Revenue Power of Hub Networks

- **Large hub networks result in market share advantages that translate into increased revenue:**
  - Potential for greater departure frequency for many O-D markets, meaning more convenient schedules and higher market shares
  - On-line “seamless” connections improve passenger convenience, compared to inter-line connections
  - Greater frequent flyer program earning and reward options for passengers given larger network coverage
  - Market dominance of “local” markets in/out of hub may lead to pricing and revenue advantages
- **Over 50% of Network Legacy Carriers’ revenue comes from passengers connecting at hubs**

Example: Local vs. Connecting Passengers



Local Demand at Worldwide Hub Cities



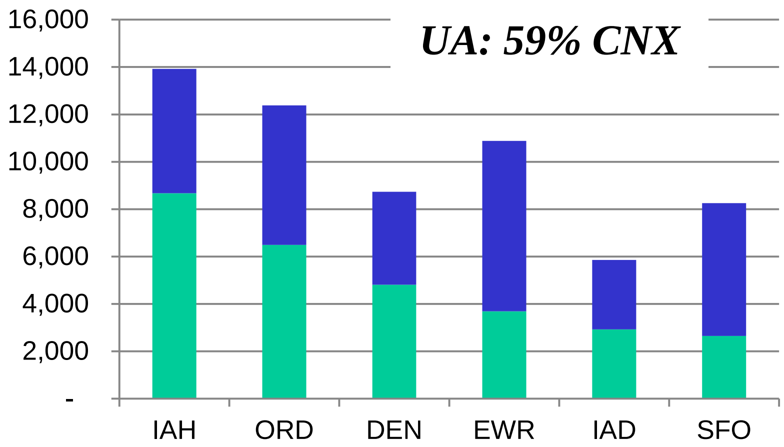
Courtesy: M. Brewer

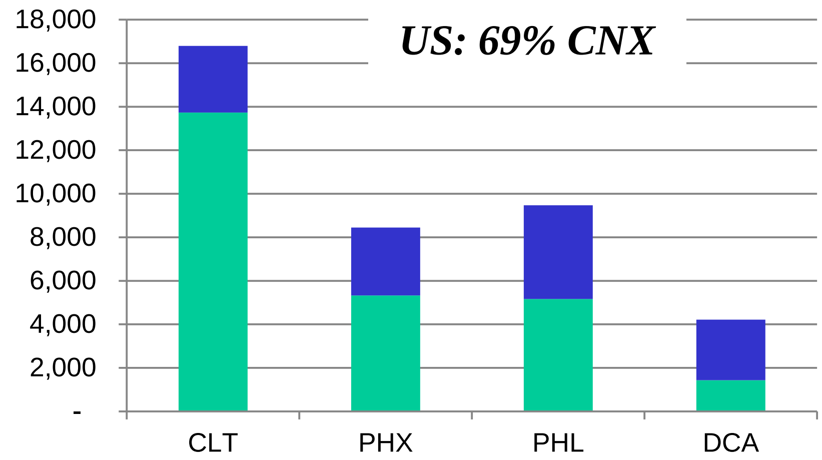
US Network Airlines Rely on Connections

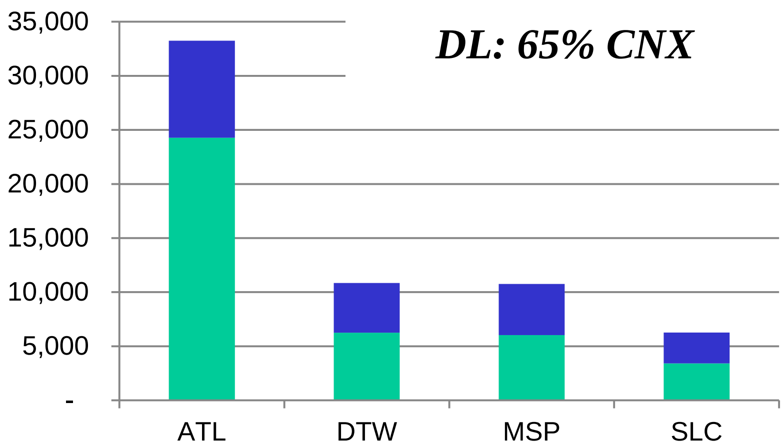
Passengers/Day

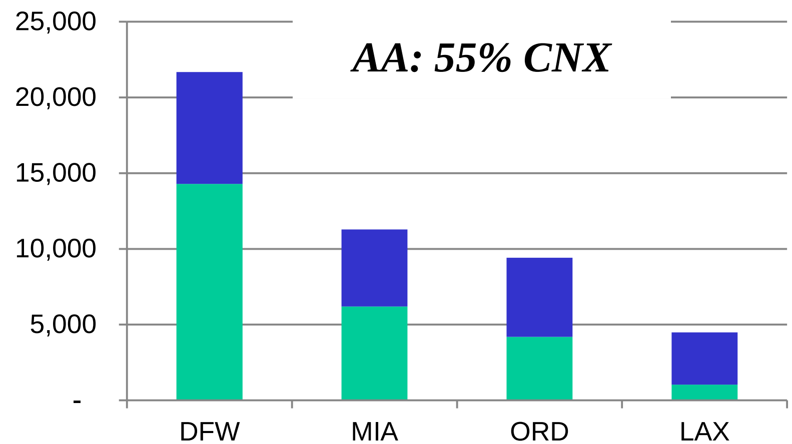
Source: USDOT DB1B, YE 3rd Qtr 2013

Connect ***Local***









Courtesy: M. Brewer

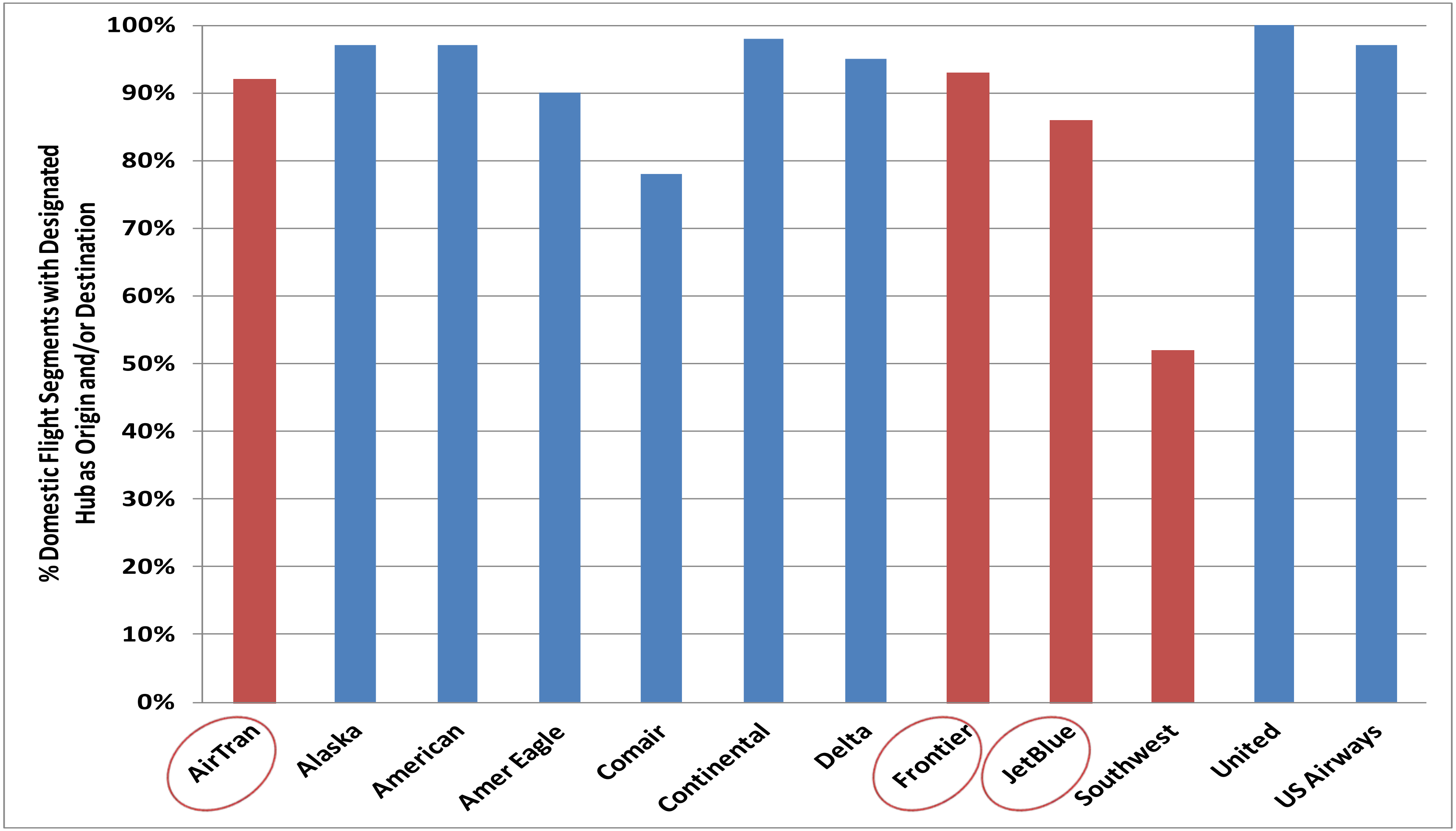
Operational Advantages of Hubs

- **Consolidation of airline operations at a large hub airport has operational advantages:**
  - Fewer aircraft and crew bases required, meaning reduced crew and aircraft maintenance expenses
  - Fewer locations where passengers or bags misconnect
  - Large volume of operations at the hub can result in economies of scale in aircraft maintenance, catering facilities, etc.
- **Scheduled connecting banks allow for:**
  - Simplified (if less flexible) aircraft and crew scheduling
  - Greater opportunities for “swapping” of aircraft in response to delays, cancellations and irregular operations
  - Planning for aircraft swaps in response to changing demand (“Demand Driven Dispatch”)

Incremental Costs of Hub Networks

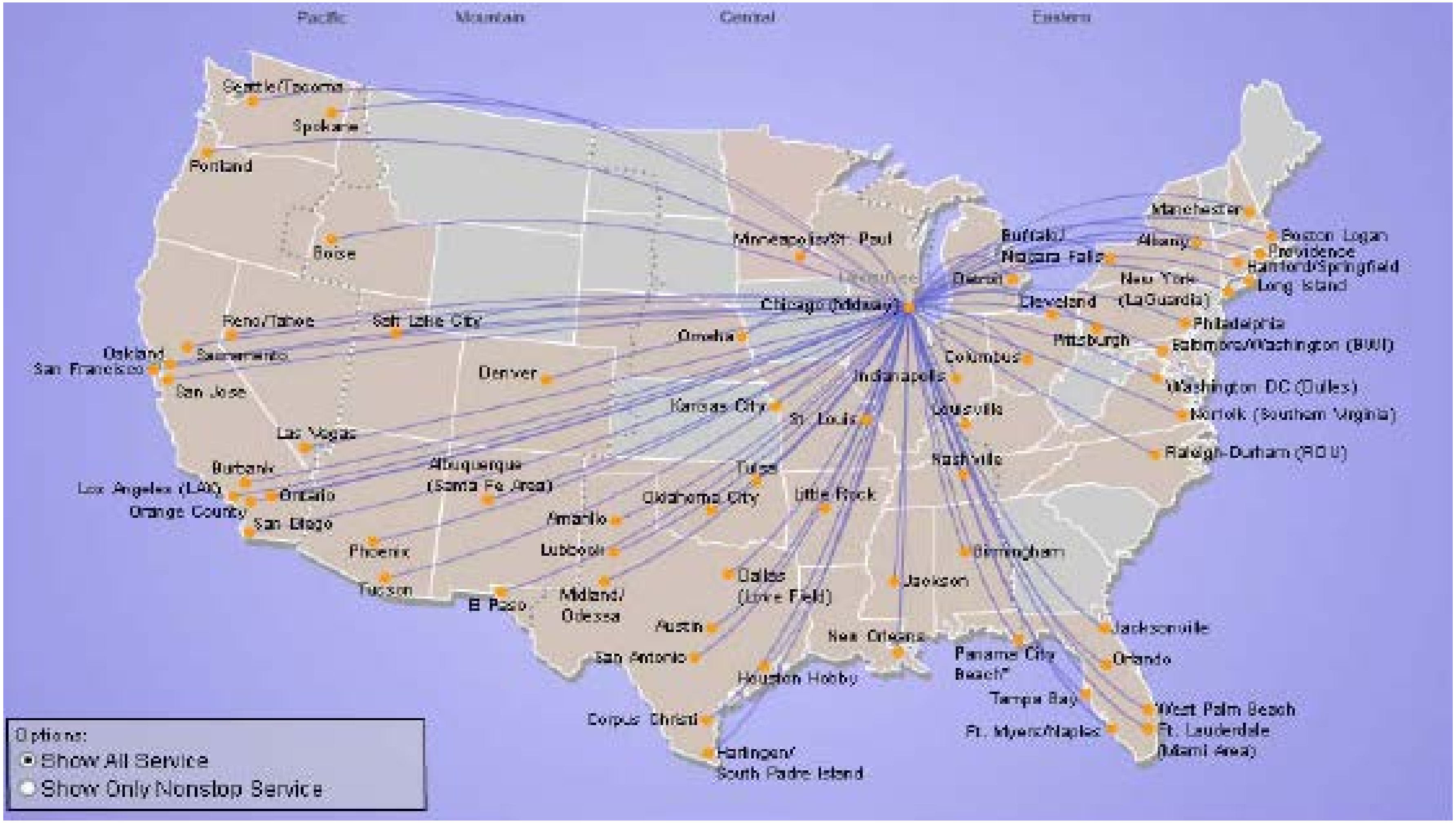
- **Hub operations also raise the potential of reduced aircraft and crew utilization:**
  - Reduced flexibility in scheduling of departures, rotations due to fixed connecting bank timing at hubs
  - Increased ground times at hubs, to accommodate connections
  - Greater turn-around times at spoke cities, waiting for a given departure time to meet next connecting bank
- **Congestion and delay costs at the hub airport:**
  - Connecting banks create extreme staffing peaks
  - Peaks of scheduled operations above and beyond runway capacity
  - Weather delays at a hub will affect the airline's entire network

U.S. Example: Over 90% of US domestic flights are to/from hub airports – including most LCCs!



Source: MIT Airline Productivity Study (2011)

Chicago Hub Network: Which Airline?



Emirates Route Network

The three Gulf Carriers have very similar route networks, focused on providing mid/long haul international connecting service

Etihad Airways Route Network

Qatar Airways Route Network

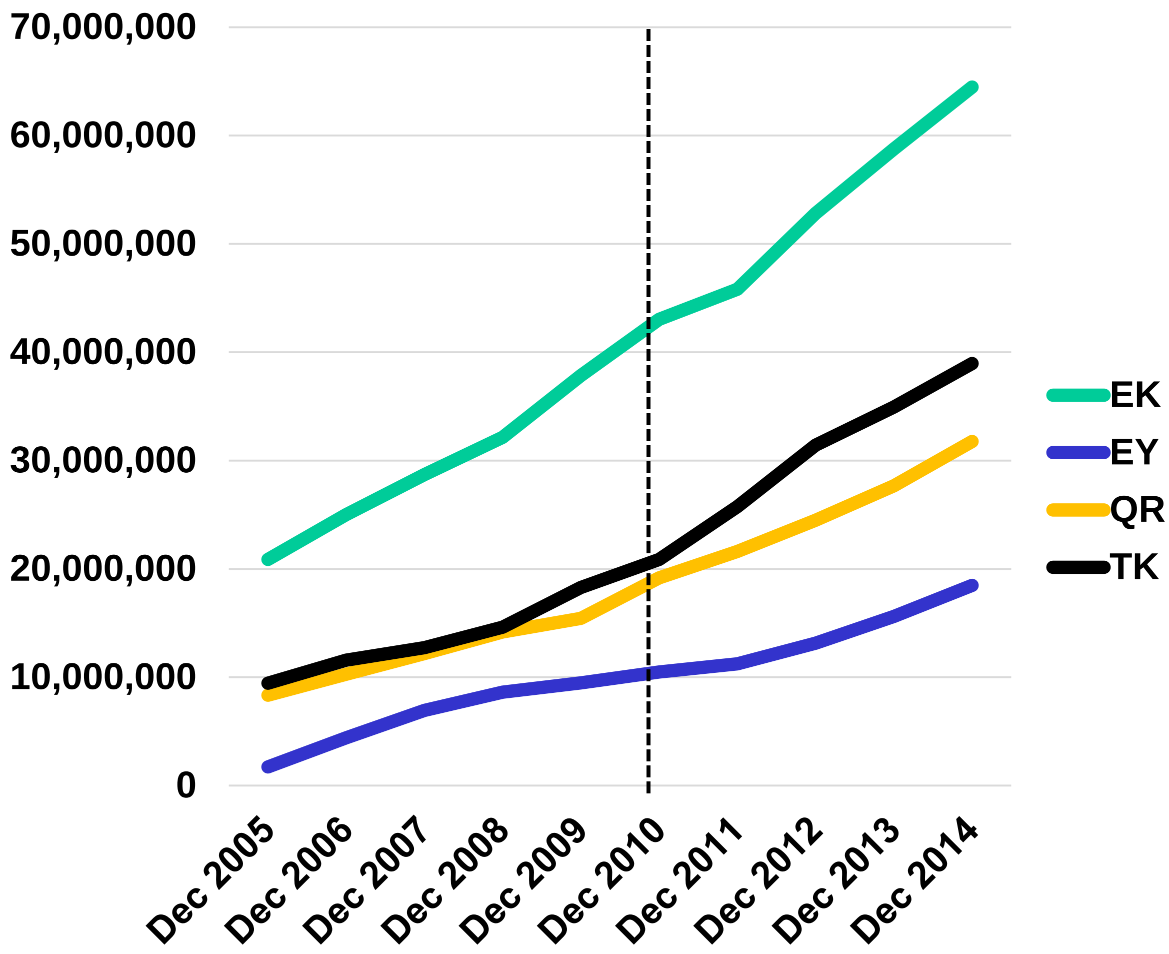
Turkish Airlines Route Network

TK also offers long haul connecting service like the three Gulf Carriers, but also offers short haul flights to Europe

Total Available Seats by Airline from 2005 - 2014

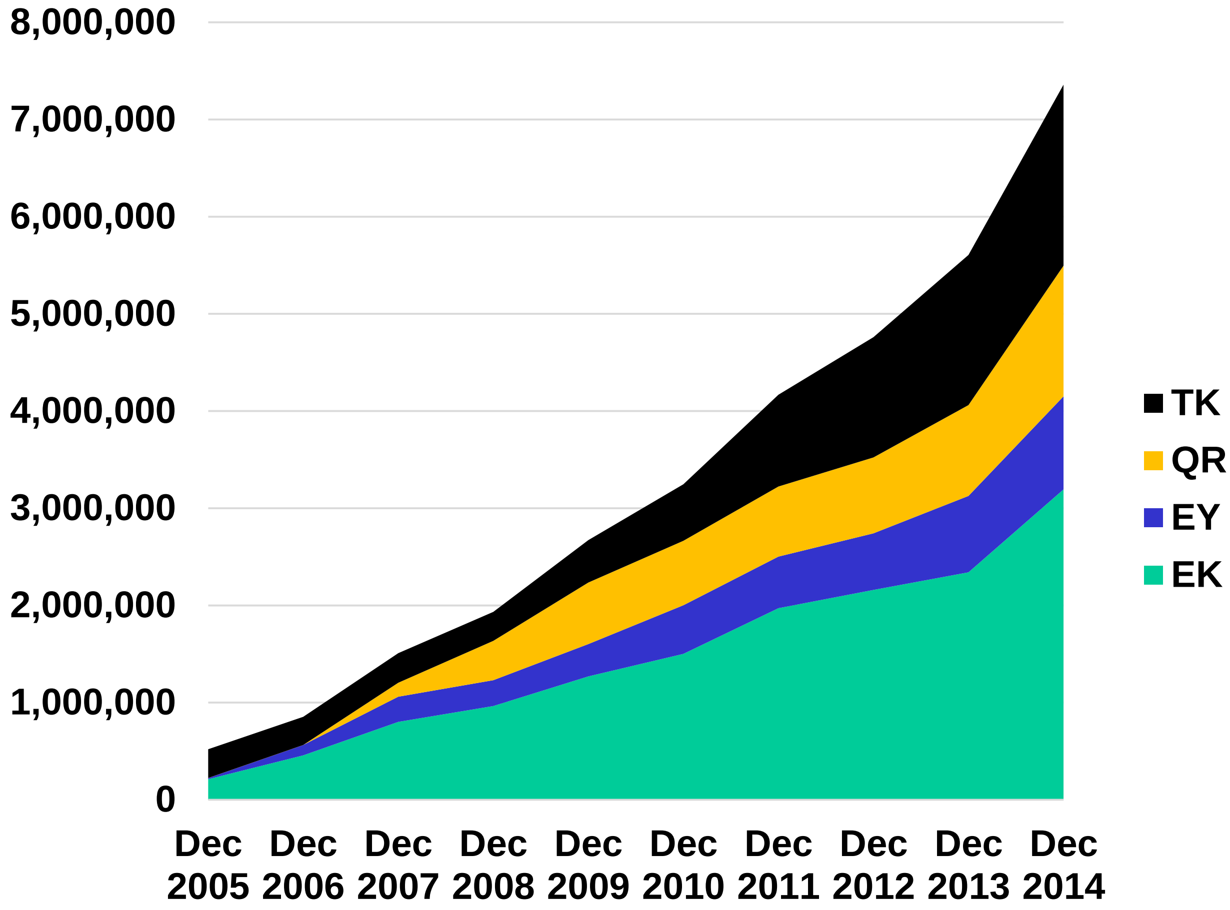
- All four carriers (including Turkish) have experienced rapid growth
- Emirates flies almost twice the number of seats as the next closest airline
- Turkish Airlines has grown the most in % terms over the last 5 years

% Seat Growth	Past 5 years	Past 10 years
Emirates	50%	209%
Etihad	76%	970%
Qatar	66%	280%
Turkish	87%	312%



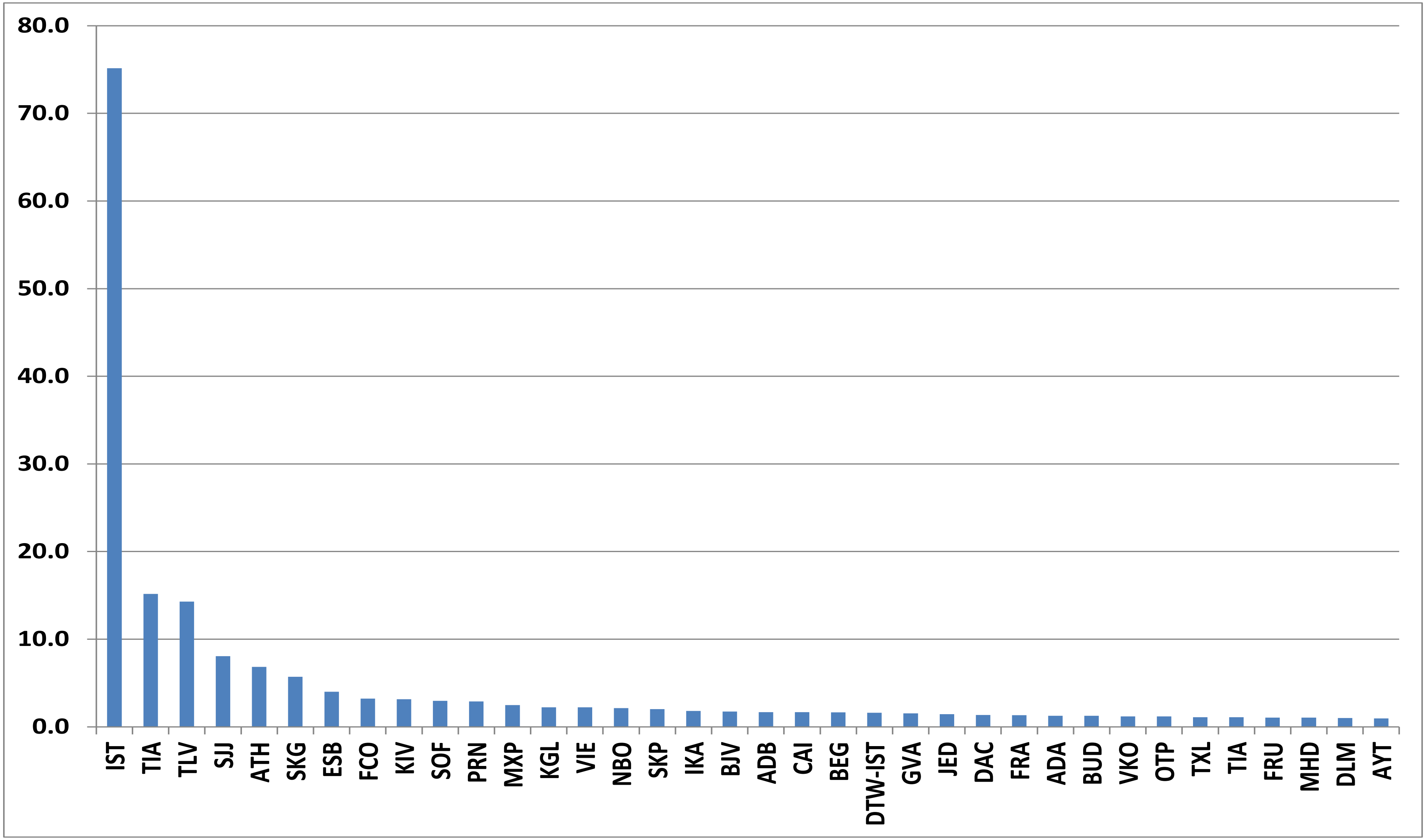
North America Seats by Airline from 2005 - 2014

- Capacity to North America has grown rapidly among the four carriers, particularly in the past 5 years, where overall capacity has grown 127%



Destinations in North America Dec. 2014	
Airline	# of Dest
EK	10
EY	6
QR	8
TK	8

Average O-D Passengers on TK BOS-IST October 2015 (> 1.0 pax/day)

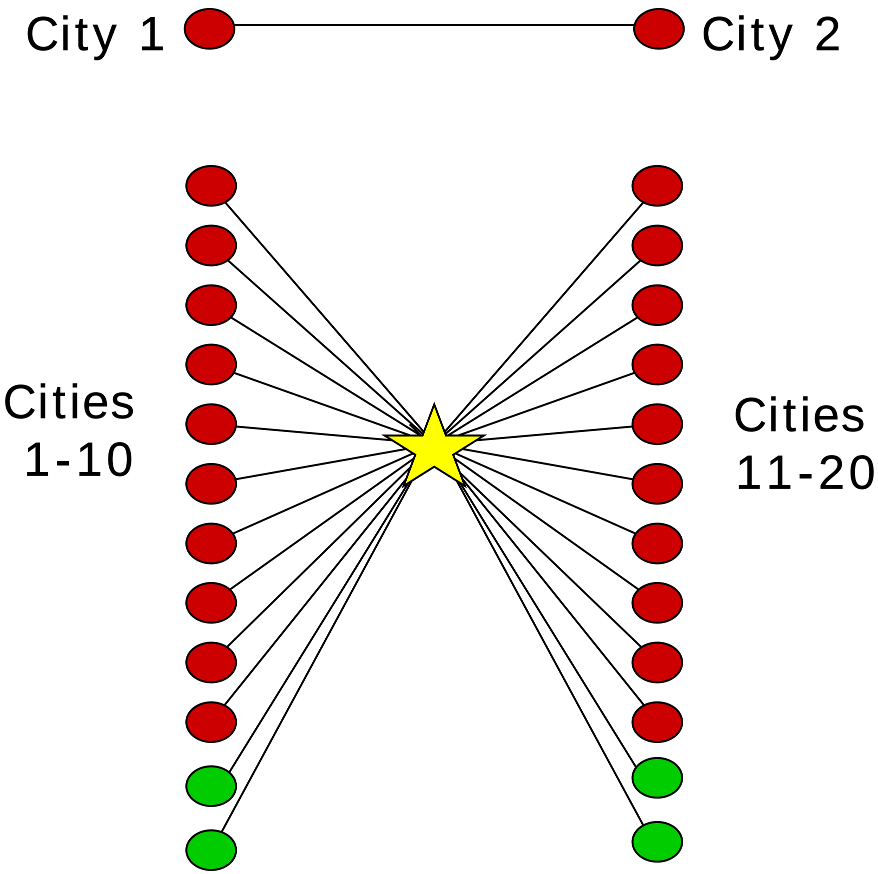


Source: Amadeus Travel Intelligence (2016)

Hub Impacts on Route Planning

- **New routes to smaller spoke cities become much easier to justify in an established hub network:**
  - An airline needs only 1 or 2 passengers per flight to each of 30+ connecting destinations to make a 100-seat aircraft "profitable"
  - However, such incremental analysis leads to a tendency to overlook potential displacement of other traffic on connecting legs
  - Same "incremental" logic makes it more difficult to stop service to a potentially unprofitable destination, which provides connecting traffic support to other flights
- **Difficult to justify a new non-stop service to by-pass the hub, as it might steal traffic from hub flights:**
  - However, large number of departures in a connecting market can allow airline to build market share and perhaps introduce a non-stop flight supported by many connecting opportunities

Hub Growth by Adding Cities



1 O-D Market

120 O-D Markets

+ 2 Cities...

143 O-D Markets

+ 2 More Cities...

168 O-D Markets

Recent Trends: Hub Strengthening

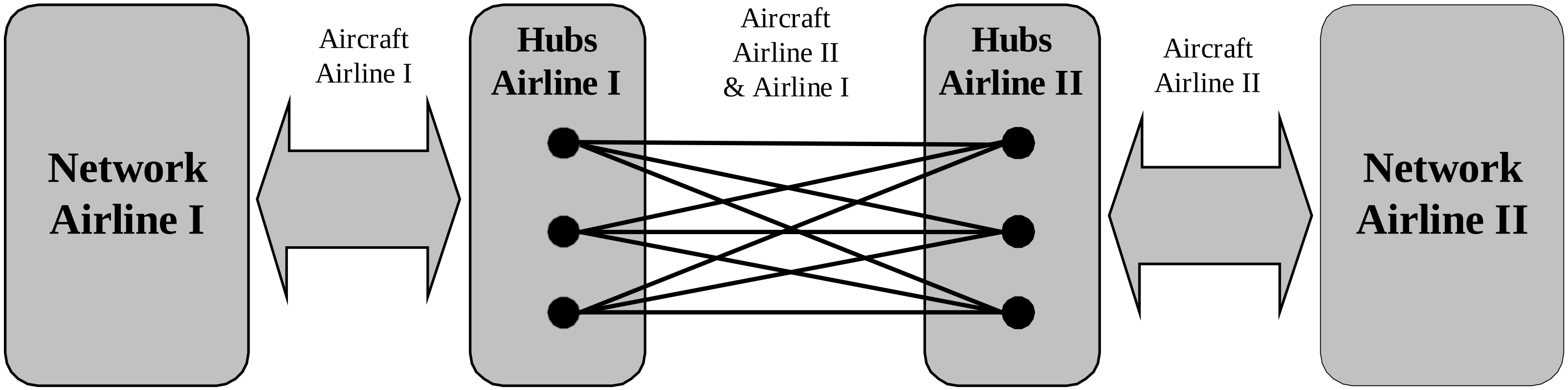
- **Despite forecasts of more non-stop flights, a trend toward bigger and stronger hubs has re-emerged:**
  - Largest US and European airlines have cut virtually all flights that do not originate or terminate at their hubs
  - Several smaller, weaker US hubs have been shut down
- **Factors that continue to reinforce hub growth:**
  - Liberalized bilateral agreements have allowed airlines to fly even low-density international routes from their hubs (e.g., CVG-MUC)
  - Small regional jets are being used to increase frequency of flights to small spoke cities, <u>not</u> to over-fly the hub with non-stops
  - Airline alliances focus on linkages between major hub networks
- **Hub operations will continue to be important, given their fundamental economics.**

Airline Alliances and Network Coverage

- **"Strategic alliances" between two airlines take the economic logic of hub networks one step further:**
  - Partner airlines can expand their network coverage without increasing their own flights and operating costs
  - Leads to further consolidation of loads, as two or more airlines now contribute passengers to a single "alliance flight"
  - Marketing power of larger networks is reinforced--more destinations, seamless connections, frequent flyer benefits
  - Additional cost savings are possible in alliance airlines due to combined flights, airport check-in and club operations, integrated purchasing and information systems

International Alliance Networks

- **International alliances link their networks through hub-to-hub flights**
- **<u>Global Strategic Alliance</u> -- Strongly connected domestic networks linked together through high-density flights between international hubs**



United's Washington - Frankfurt

Percent local is only 17% as two major Star Alliance Hubs are connected

Passengers/Day

Source: IATA O&D

Orig	Dest	Pax
IAD	**FRA**	**69.26**
IAD	BCN	6.26
IAD	IST	4.77
IAD	ABV	4.65
ORF	BAH	4.16
CLE	FRA	4.16
IAD	ADD	4.10
IAD	PRG	3.97
IAD	TXL	3.97
IAD	RUH	3.61
IAD	CAI	3.55
IAD	KBP	3.35
RDU	FRA	3.29
IAD	BUD	3.19
IAD	BEY	3.06
IAD	GVA	3.00
IAD	ACC	2.74
IAD	ALA	2.71
IAD	DME	2.65
IAD	EBL	2.42
LAS	FRA	2.39

Orig	Dest	Pax
IAD	VCE	2.35
IAD	AMM	2.32
IAD	LIS	2.29
IAD	NCE	2.29
IAD	OTP	2.19
IAD	BLR	2.16
IAD	VKO	2.13
IAD	TIP	2.10
IAD	WAW	2.06
IAD	DEL	1.90
IAD	FLR	1.90
ABQ	AMM	1.87
FAY	VCE	1.87
FAY	FRA	1.81
ORF	FRA	1.68
IAD	ATH	1.68
DEN	FRA	1.65
IAD	LED	1.61
IAD	GYD	1.58
PIT	FRA	1.58
IAD	VIE	1.55

Orig	Dest	Pax
IAD	TUN	1.52
IAD	AMS	1.52
IAD	HAM	1.48
CLT	FRA	1.48
IAD	LYS	1.45
IND	FRA	1.45
IAD	MAD	1.39
IAD	KWI	1.39
IAD	LOS	1.32
IAD	BSL	1.29
SAN	BAH	1.29
SAN	FRA	1.26
IAD	CDG	1.23
TPA	FRA	1.23
IAD	STR	1.19
IAD	MAA	1.19
MCI	FRA	1.16
CMH	FRA	1.16
IAD	JED	1.13
IAD	DXB	1.10
IAD	ADA	1.10

Courtesy: M. Brewer

Strategic Partnerships Both Within and Outside Alliance Structures

Gulf Carrier + Hybrid Carrier:

- *Hugely important for growth to large markets with no huge alliance connection – JFK/BOS.*
- *Provides feed into large JetBlue markets like MCO*

Intra-Alliance Partnership transcending JV:

- *Growth between Canada and Turkey but facilitating feed into Africa and Asia*
- *Partly political in nature to increase frequencies between countries*

Inter-Alliance Partnerships:

- *Better for local market ties and increased access to China through Dragonair for booming NZ-China market*
- *Better access to Europe based on hub times than SIN*

Equity Partnerships:

- *Allows a carrier to guide decision make in a non-competitive manner*
- *Sometimes helps carriers obtain increased access into a particular region*