

From first lecture:

Read TGA1 Chapter 1

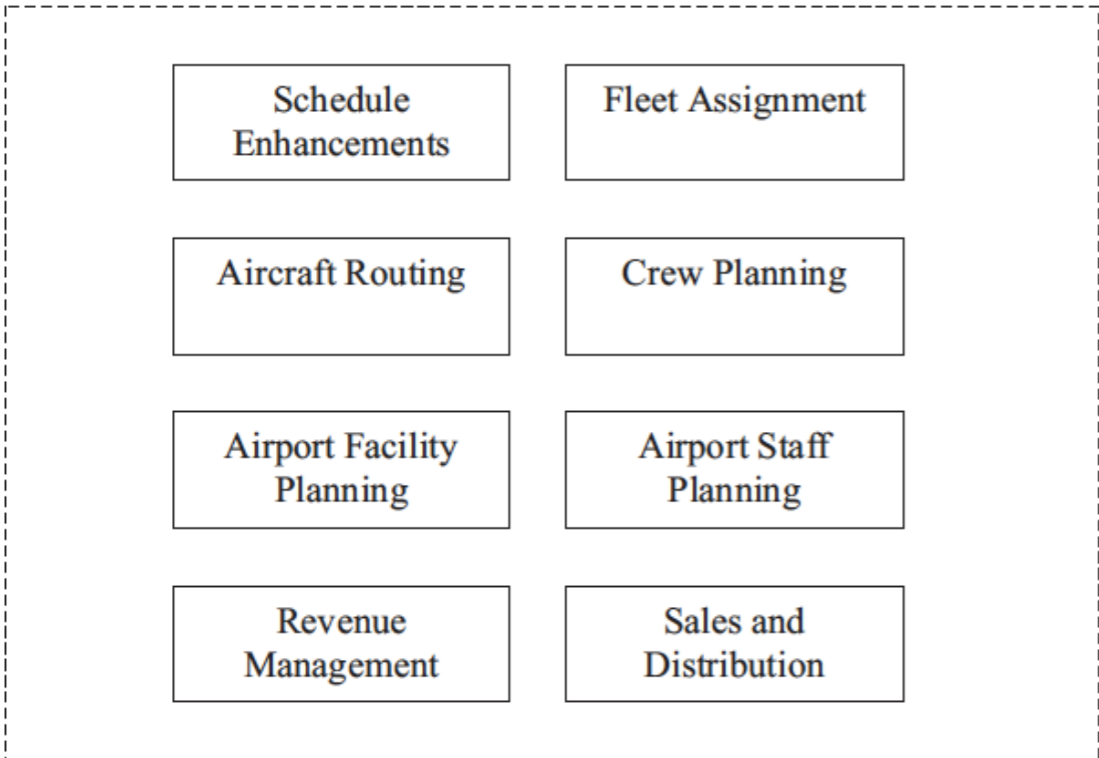
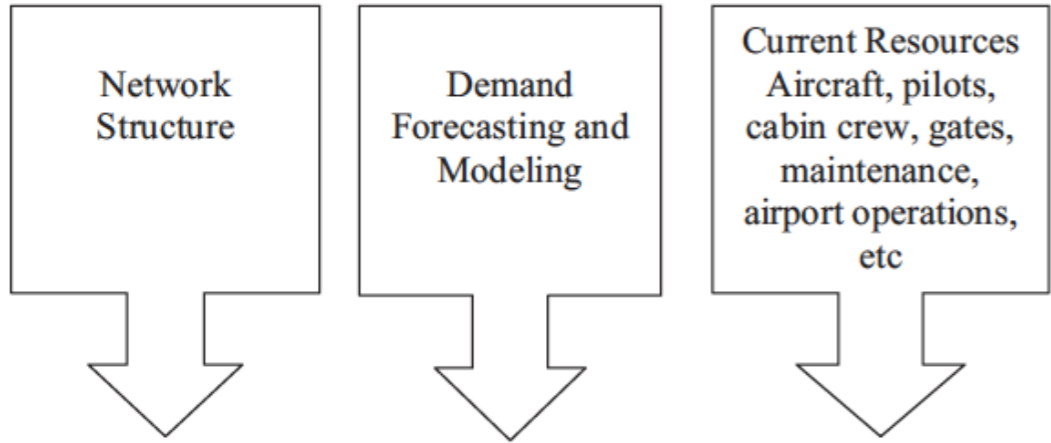
Answer online quiz: <http://www.quiz-maker.com/QMSOHP1>

homepage: <http://weber.itn.liu.se/~chrsc91/teaching/f19/tnfl01/index.html>

Air Traffic and Air Transportation Flygtrafik och flygtransporter

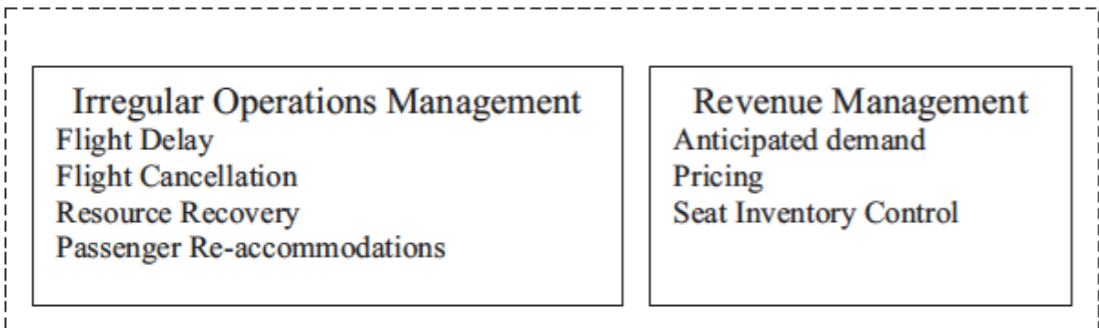
Airlines #2 Management of Resources

TGAI Chapter 7



Planning Phase

- Planning:
- Starts by recording anticipated demand and supply
 - Set of interrelated planning processes is considered:
 - Schedule planning
 - Time banking
 - Fleet assignment
 - Aircraft routing
 - Crew scheduling
 - Airport facility planning
 - Airport staff scheduling
 - Pricing
 - Seat inventory control
 - Sales
 - Marketing initiatives
 - Planning processes typically completed by a month/few months before implementation of the schedule
 - Repeated on a frequent basis



Operations Phase

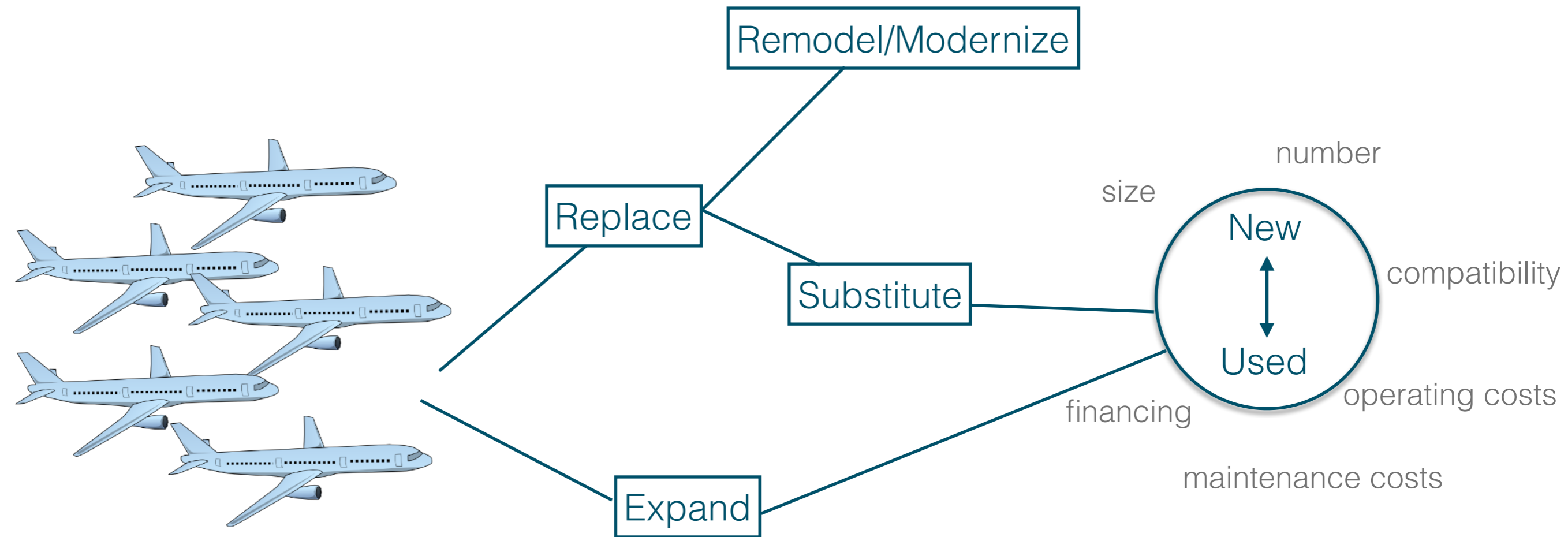
- Operations phase:
- Implementing the planned airline schedule, while
 - Taking into consideration recovery for any unanticipated incidents such as:
 - Adverse weather conditions
 - Aircraft breakdown
 - Crew absence
 - Decisions are made to:
 - Recover the airline schedule from flight delay and cancellations
 - Compensate for missing or delayed aircraft and crew
 - Reaccommodate stranded passengers
 - Monitors seat bookings in different markets
 - Updates seat inventory control and pricing decisions

Abdelghany&Abdelghany, 2010

Airline Planning

How to determine which aircraft to use?

TGAI Chapter 7.1



What is available?

- Boeing
 - American company
 - 737-787
 - <http://www.boeing.com/company/about-bca/index.page%23/prices>
 - Older: DC and MD
- Airbus
 - European company
 - A300-A380
 - <http://www.airbus.com/presscentre/pressreleases/press-release-detail/detail/new-airbus-aircraft-list-prices-for-2016/>
- Fokker
- Bombardier
- Canadair
- Embraer
- SAAB

Aircraft fleet SAS

The SAS Group's fleet of aircraft at October 31, 2012¹

	Age	Owned	Leased	Total	In service	Leased out	On order
Airbus A330/A340	10.4	5	6	11	11	0	
Airbus A319/A320/A321	8.8	4	10	14	12	0	30
Boeing 737 Classic	19.4	0	10	10	10	0	
Boeing 737NG	11.4	23	49	72	72	0	
Boeing 717	12.2	0	9	9	9	0	
McDonnell Douglas MD-80-serien	23.1	13	8	21	19	0	
McDonnell Douglas MD-90-serien	0.0	8	0	8	0	8	
Avro RJ-85	0.0	0	5	5	0	1	
deHavilland Q-serien	14.7	32	10	42	39	0	
Bombardier CRJ900NG	3.4	12	0	12	12	0	
Total	13.1	97	107	204	184	9	30

1) In addition, the following aircraft are wet leased: four CRJ200s and one ATR for SAS in Denmark and two ATRs and four SAAB 2000s for Blue1 in Finland.

The aircraft fleet divided by airline and leased-out aircraft

	Age	Owned	Leased	Total	In service	Leased out	On order
SAS Scandinavian Airlines	12.6			143	136	8	30
Widerøe	14.9			39	39	0	
Blue1	12.2			13	9	1	
Leased-out aircraft				9			
Total	13.1			204	184	9	30

SAS FLYGPLANSFLOTTA 31 OKTOBER 2015

SAS flygplan i trafik	Ålder	Ägda	Leasade	Totalt	Order köp	Order lease
Airbus A330/A340/A350	11,9	7	7	14	10	-
Airbus A319/A320/A321	10,7	6	19	25	30	-
Boeing 737NG	12,8	15	69	84	-	-
Totalt	12,3	28	95	123	40	0

Flygplan i trafik under annan trafiklicens än SAS (SK)	Ålder	Ägda	Wet leasade	Totalt	Order på wet lease
Boeing 737	10,2	-	1	1	-
Bombardier CRJ900	6,4	12	-	12	8
ATR-72	3,7	-	13	13	3
SAAB 2000	18,6	-	3	3	-
Totalt	6,6	12	17	29	11

Read TGA1 Chapter 7.1 until before 7.1.2.1 starts (9 pages)

Find data on the fleet development of either Emirates, Etihad, Qatar or Turkish airlines over the last ~5-15 years.

Answer:<https://goo.gl/forms/vVOMR1qCFhqUeaXV2>

Aircraft Type	Number	Fleet Age	Total Capacity (Seat)
Commercial Aircraft			
A340-300	9	14.2	2,446
A330-200	7	4.6	1,812
A330-300	4	0.1	1,156
B777-300ER	9	1.6	2,933
A319-100	4	4.9	528
A320-200	25	3.7	3,962
A321-200	21	4.8	4,017
B737-400	3	18.9	450
B737-800	52	7.5	8,596
B737-700	14	5.0	1,986
Cargo Aircraft			
A310-300F	4	22.5	-
A330-200F	1	0.3	-
TOTAL	153	6.5	27,886

2016



NARROW BODY (234 Ea)

- 15 Ea B737-900ER
- 110 Ea B737-800
- 29 Ea A320-200
- 66 Ea A321-200
- 13 Ea A319-100
- 1 Ea B737-700



WIDE BODY (87 Ea)

- 20 Ea A330-200
- 31 Ea A330-300
- 4 Ea A340-300
- 32 Ea B777-300ER



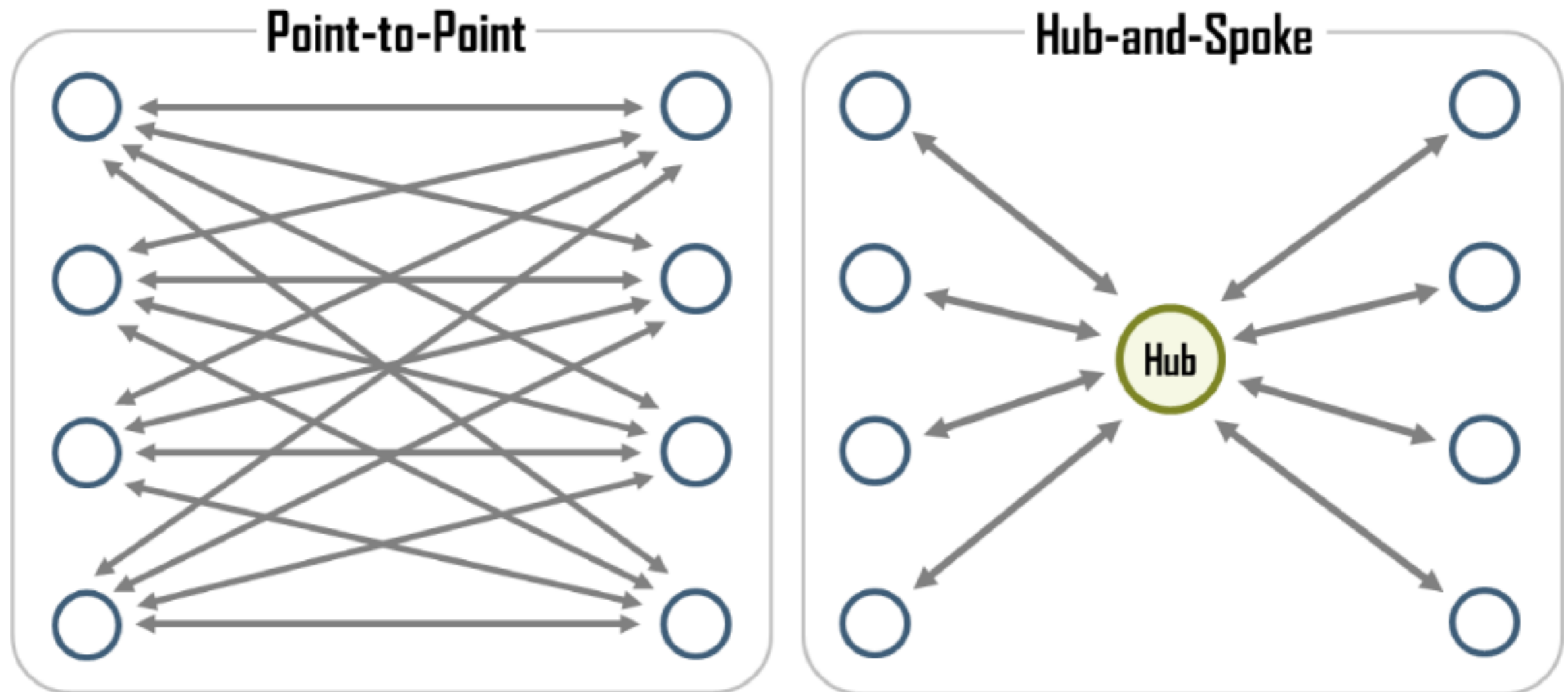
CARGO (13 Ea)

- 3 Ea A310-300F
- 8 Ea A330-200F
- 1 Ea A300-600F
- 1 Ea B747-400F



Total Aircraft: 334

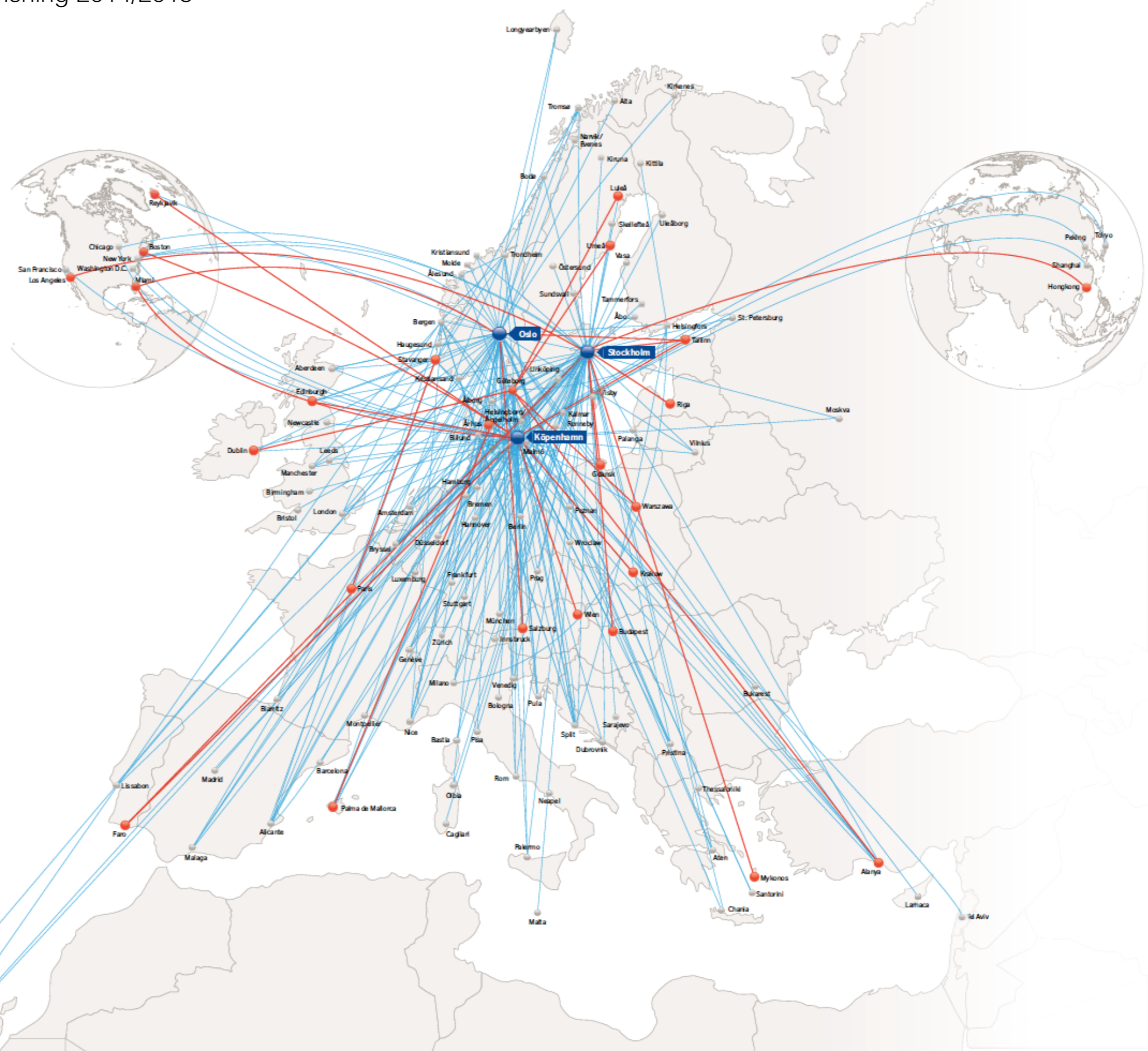
Average Fleet Age: 7,1



often mixed systems, or hub-systems with multiple hubs

source: <https://people.hofstra.edu/geotrans/eng/ch1en/conc1en/hubnetwork.html>

source: SAS årsredovisning 2014/2015



— Befintliga linjer.
— Nya linjer 2015 och 2016.

Time bank:

- Arrivals and departures at the hub are adjusted in time banks
- Consists of a set of flight arrivals followed by a set of departures
- Allows for several connection possibilities during a short period of time

Time bank

Connection possibilities

SFO-DFW-MIA
 SFO-DFW-JFK
 SFO-DFW-ATL
 SFO-DFW-EWR
 SEA-DFW-MIA
 SEA-DFW-JFK
 SEA-DFW-ATL
 SEA-DFW-EWR
 LAX-DFW-MIA
 LAX-DFW-JFK
 LAX-DFW-ATL
 LAX-DFW-EWR
 DEN-DFW-MIA
 DEN-DFW-JFK
 DEN-DFW-ATL
 DEN-DFW-EWR

Timeline

Arrivals

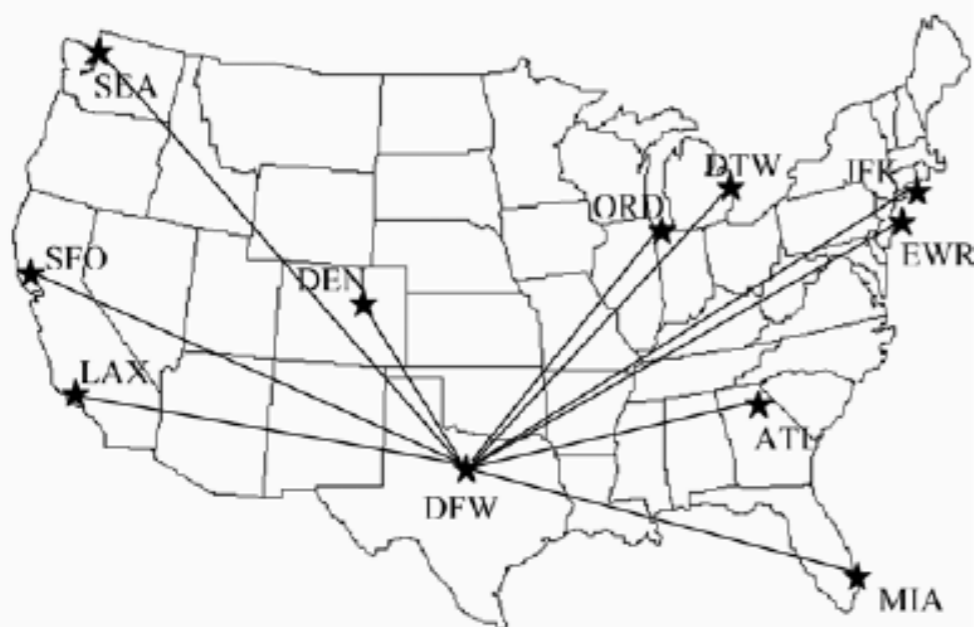
SFO
 SEA
 LAX
 DEN

Departures

MIA
 JFK
 ATL
 EWR

Time bank

Time bank



Abdelghany&Abdelghany, 2010

Read TGA1 Chapter 7.2 until before 7.2.2 starts (7 pages)

Answer:<https://goo.gl/forms/2tm9p7NQXljlSyD2>

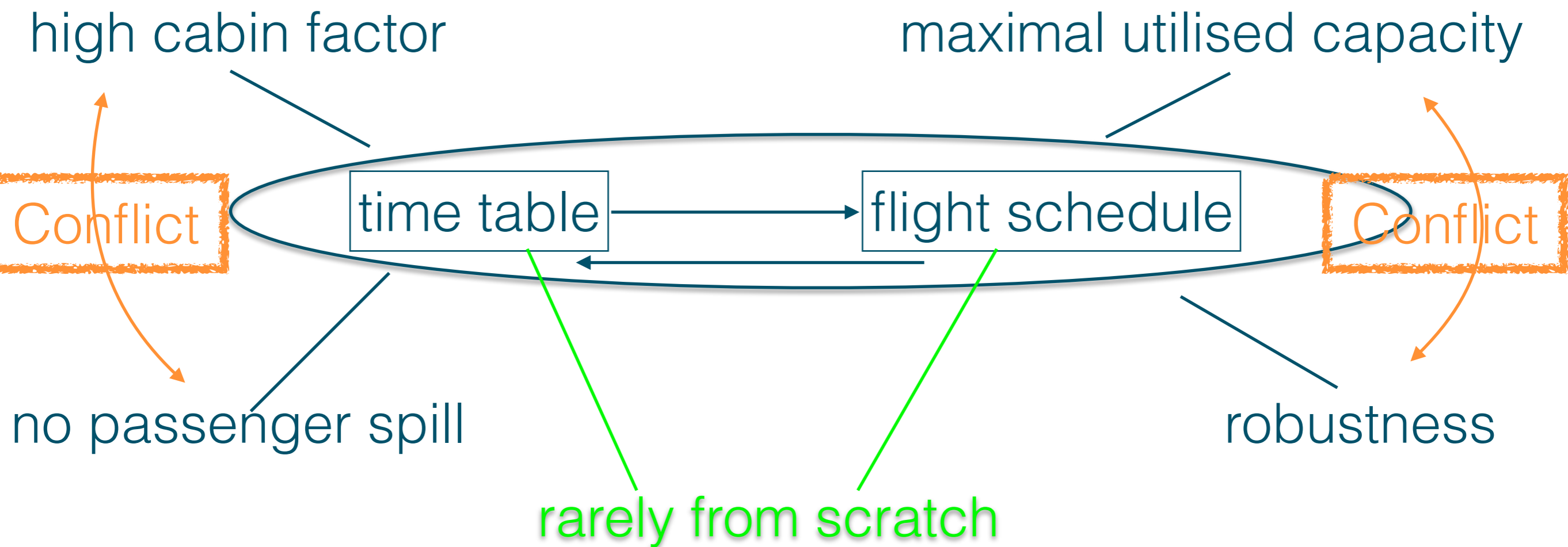
Airline Network

An airline's route network is often a mix of pure hub-and-spoke and pure point-to-point systems. Discuss how an airline can exploit the advantages and avoid the disadvantages of those two extremal network types by using a mixed route network.

- Two seasons: winter and summer
- Product range
 - Large selection of times
 - High cabin factor
- Limitations
 - Physical
 - Contract
 - Slots
 - IATA (International Air Transport Association): airport, strategical
 - CFMU (Central Flow Management Unit): ground holding, operational
 - Flight schedule
 - Staff schedule
 - Turnaround times

TGAI Chapter 7.3.2

Conflictive



- Usually, during the timetable development some flights are deleted, and others are added
- One problem is to estimate the demand on the final flights
 - The total demand between two airports is reduced, when the supply is reduced
 - Certain pax choose different companies if the number of flights is reduced
 - The demand from connecting flights is reduced

- Assume that fleet and timetable (and routes) are available and fixed: come up with a good feasible flight schedule.
- Discuss:
 - Talk to your neighbours
 - Make a list of goals and requirements for a flight schedule

- Goals
 - High cabin factor
 - No pax spill
 - Robustness
- Requirements
 - Balance
 - Airport Limitations
 - Maintenance requirements
 - Aircraft limitations
 - Weather
 - Crew

- Regular check and service
- Requirement from civil aviation authorities (CAA): FAA, EASA, ...
- Usually: each airline develops own CAA-approved maintenance program
- Executed at:
 - Maintenance base (largest, most versatile, best-equipped facility)
 - Major station (incl. large hub cities, substantial inventory of spare parts, extensive facilities)
 - Service station (large stations, not at major hub cities, well equipped and staffed, less than major stations)

Maintenance types:

- Visual inspection
 - Prior to flight (sometimes called “ walk-around”)
 - Ensure no obvious problems: leaks, missing rivets, cracks
 - Overnight maintenance
 - End of working day
 - Ad hoc repairs
 - 1 – 1.5 hours
 - A-check
 - Appx. every 125 flight hours (2 – 3 weeks)
 - Amplified visual inspection, easily reachable parts
 - B-check
 - Appx. every 750 flight hours
 - Exterior wash, engine oil spectro-analysis, oil filters replaced, landing gear carefully examined
 - Incorporates A-check
 - C-check
 - appx. every 3000 flight hours or 15 months
 - Incorporates both A- and B-check
 - Plus: components repaired, flight controls tested, ...
 - D-check
 - Most intensive form
 - Every 6-8 years/appx. every 20000 flight hours
 - Cabin interiors removed —> careful structural inspections
 - 15-30 days
- “line” maintenance:
at airport
usually overnight
- “heavy” maintenance:
special facilities
extensive downtime

Maintenance types:

- Non routine Maintenance
 - Unforeseen event (accident, random occurrence)
 - Response to AD (Airworthiness Directive)

Planning:

- Timers used, e.g., A-timer
- If the check is not performed in time the aircraft can be grounded
- Maintenance must be carefully included in flight schedule