Regional ATFM

Dr. Hsin Chen Chung

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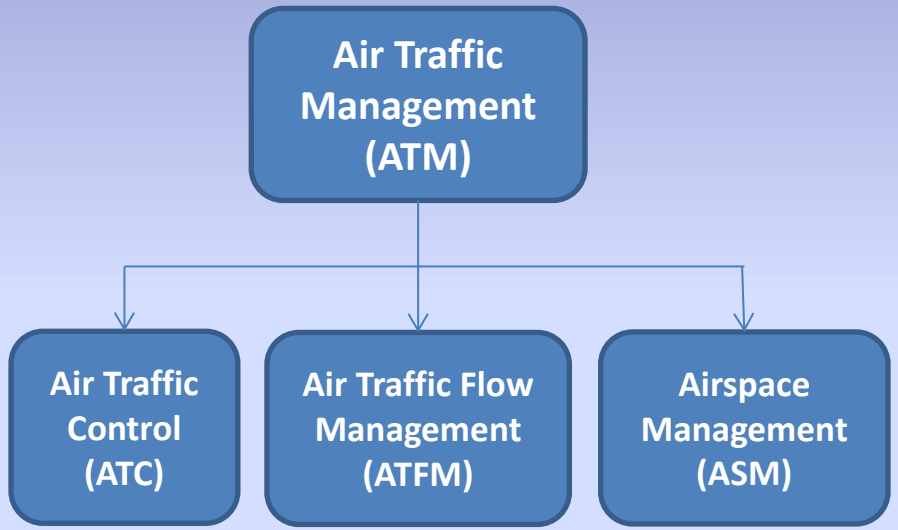
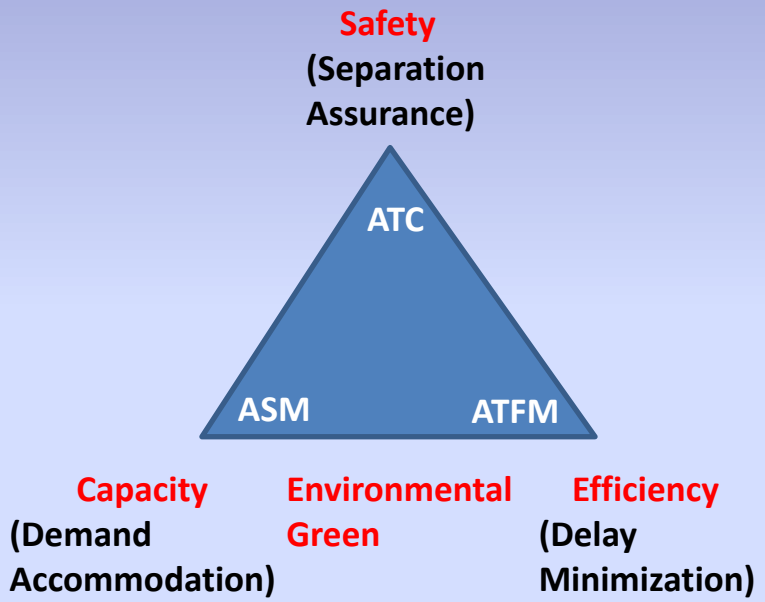
Roles of ATFM

- ICAO Elements of ATM



- Objectives of ATM

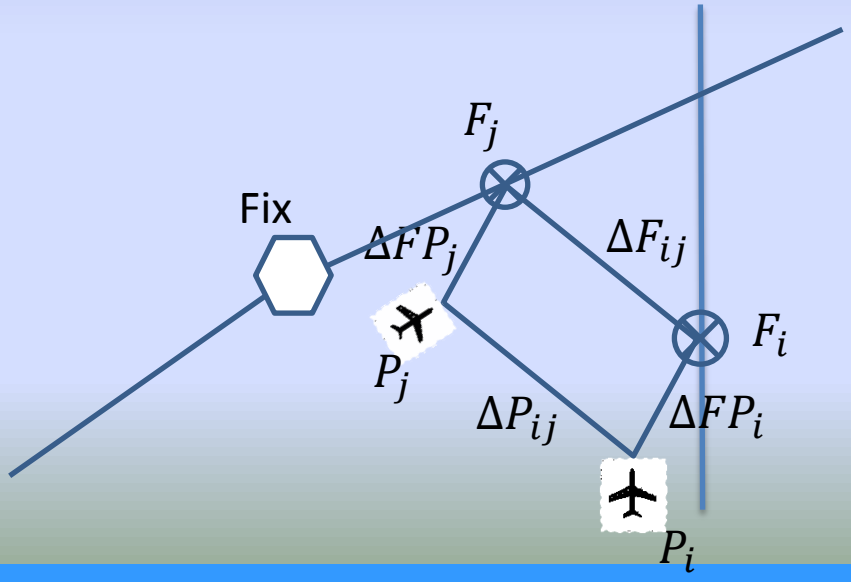


Realities of ATFM

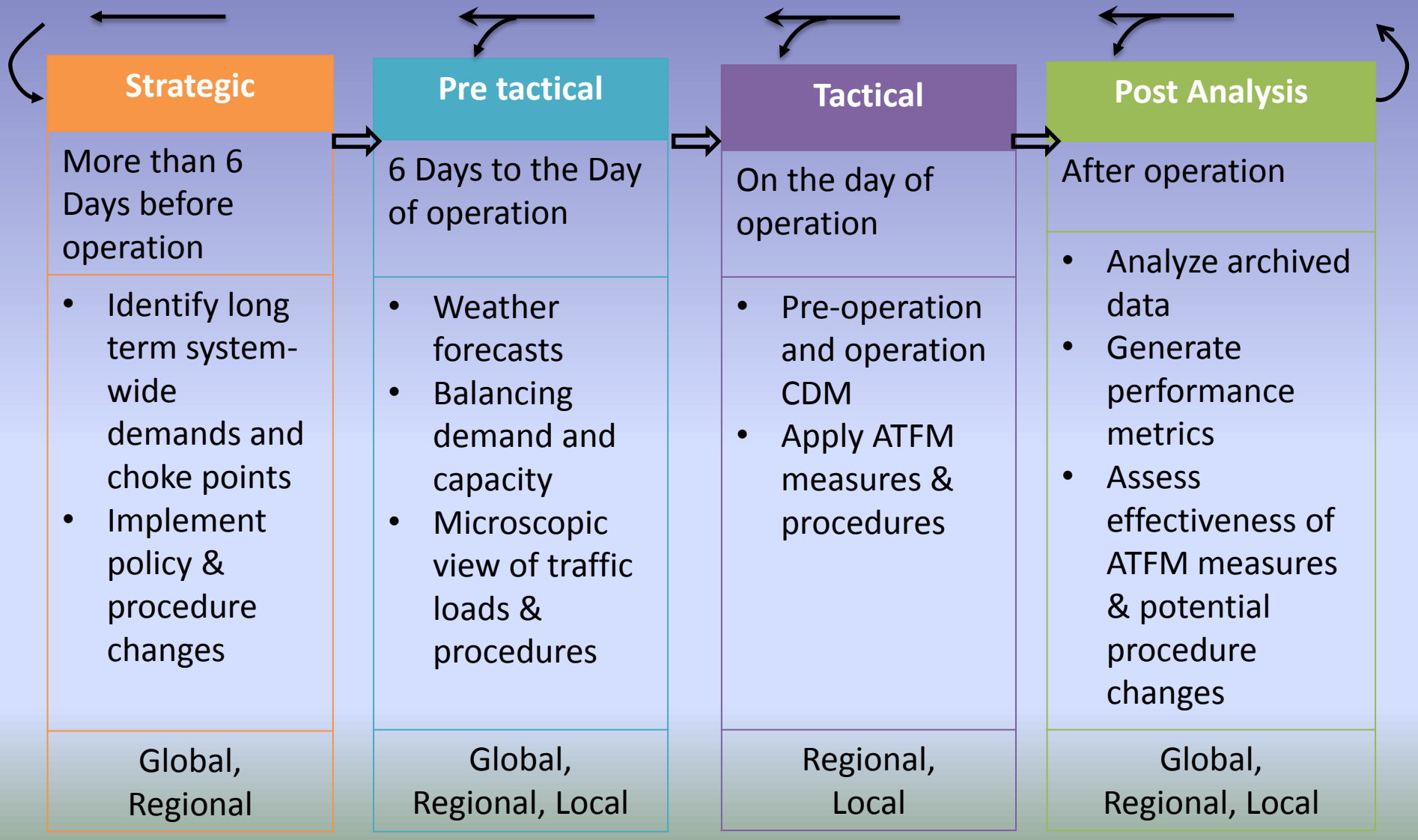
- Objective of ATFM is to efficiently control the traffic to maximize throughput and minimize delay
- Due to random, stochastic nature of air traffic, delay always exists
- As demand approaching capacity, delay exponentially increases
- Delay takes place on the book, at the gate, in the taxiway, approach area & en route airspace, and at the waypoint/fix, with different impact
- The single most significant factor causing delay is the reduction of capacity due to weather
- ATFM measures often impact on multiple services in multiple segments of flight, collaborative decision making (CDM) is necessary
- The earlier we could foresee the needs and apply the measures, the less negative impact

Quantities of Interest to ATFM

- **Flight Plan** $(F_i, F_j, ..)$ **and Position** $(P_i, P_j, ..)$
- **Maximizing throughput**
  - **Subject to: Total Flight Plans** $\{F_i + F_j + F_k + ..\}$ **< capacity**
- **Minimizing delay, i.e. total Flight Plan Deviation : Min** $\{\Delta FP_i + \Delta FP_j + \Delta FP_k + ..\}$
  - **Subject to conflict free Flight Plan Separation:** ΔF_{ij} **> separation standards**
  - **Subject to hazard free Position Separation:** ΔP_{ij} **> separation standards**
- **Satisfying environmental greenness, i.e. minimizing Fuel Burn & Emission**

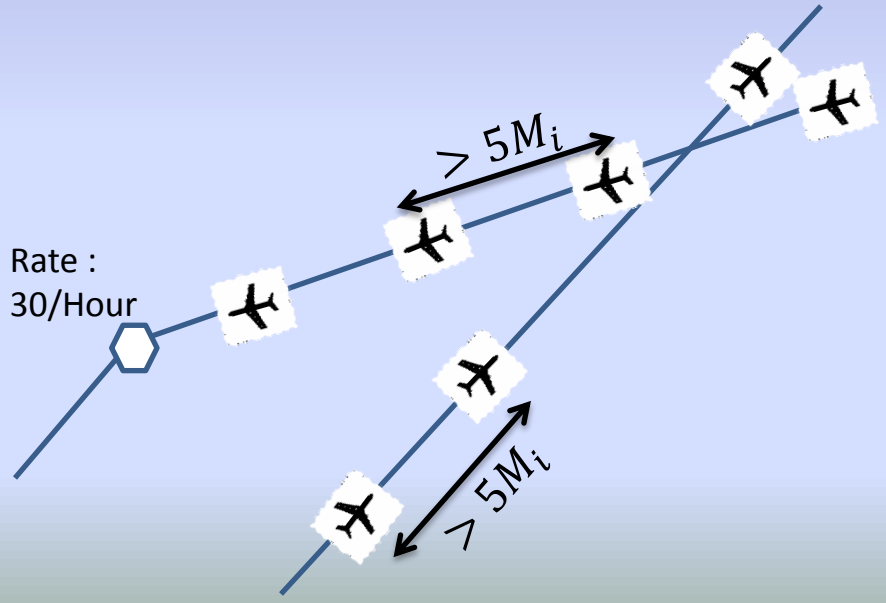


ATFM Measures Timeline

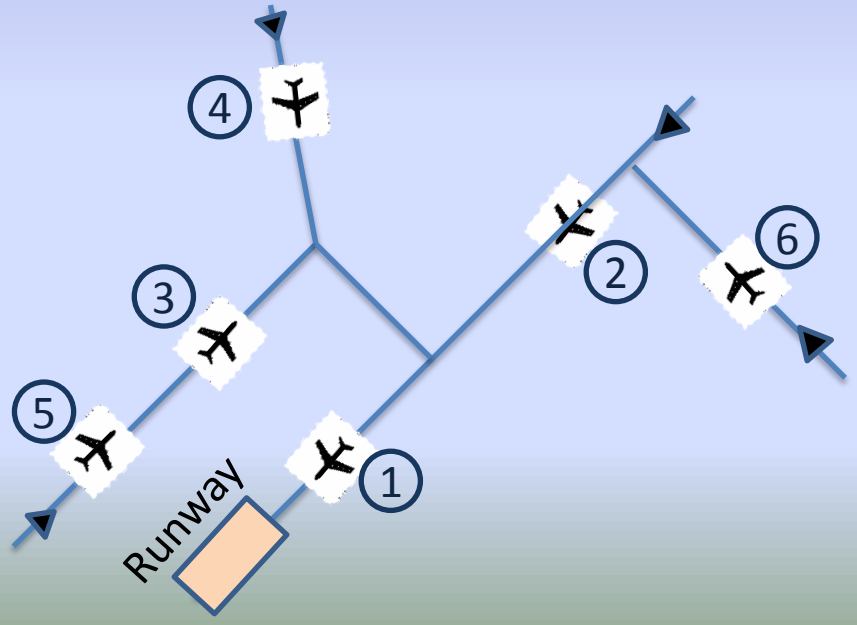


ATFM Measures

- **Metering and Spacing**
  - Maximize the rate of traffic flow while satisfying the separation standards
  - Through distance based (miles-in-trail) or time based (minutes-in-trail) measures such as speed control, fix balancing or airborne holding

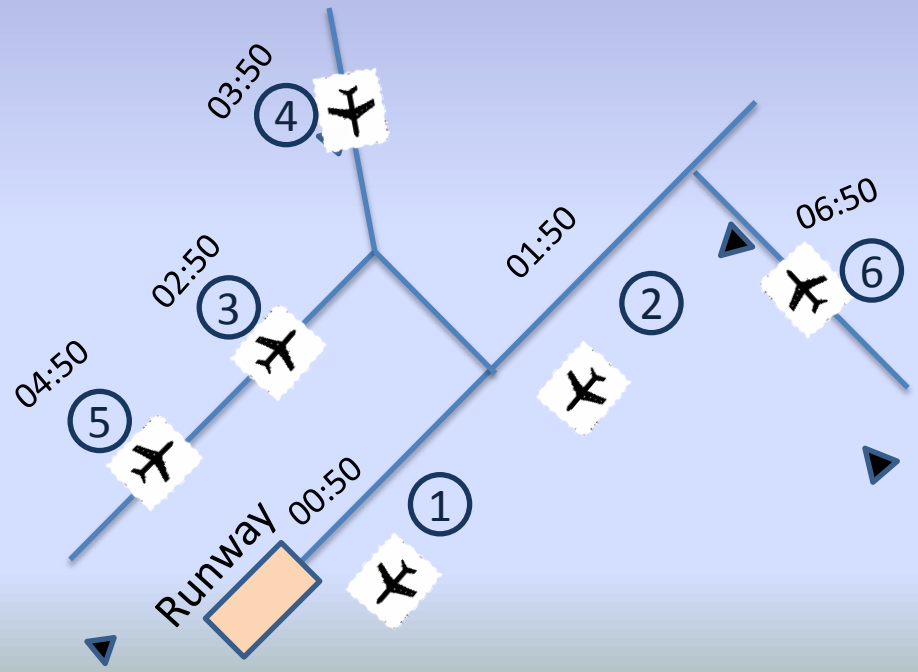


- **Sequencing**
  - Optimize the sequence of traffic flow to minimize delay and environmental impact
  - Arrival Sequencing Program (ASP), Departure Sequencing Program (DSP), En Route Spacing & Sequencing Program (ESSP)

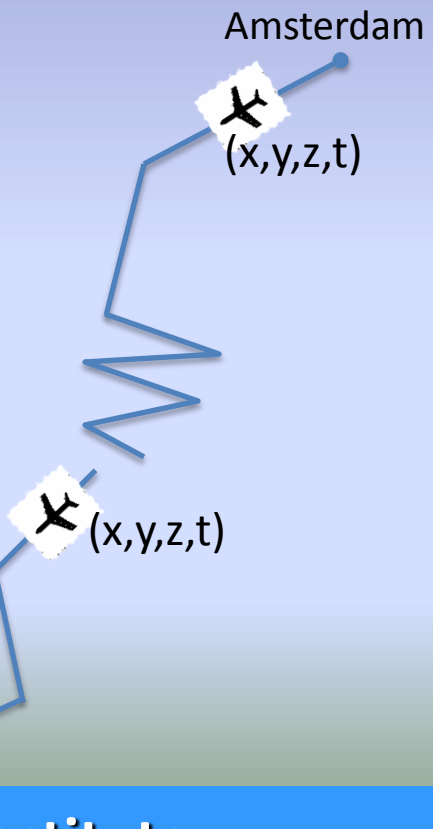


ATFM Measurements (Continued)

- **Scheduling**
  - Optimal delivery of traffic flow with precision
  - Time of arrival specified at fixes, control hand off & runway threshold



- **4-D Trajectory**
  - Optimal delivery of traffic flow with 4-D trajectory
  - Multiple, point-to-point conflict free trajectories

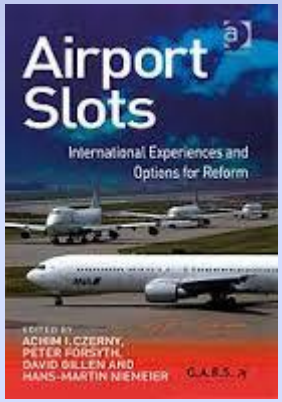


ATFM Measurements (Continued)

- **Ground Hold/Ground Stop**
  - **Hold flight at the departure gate with or without a specified delay**

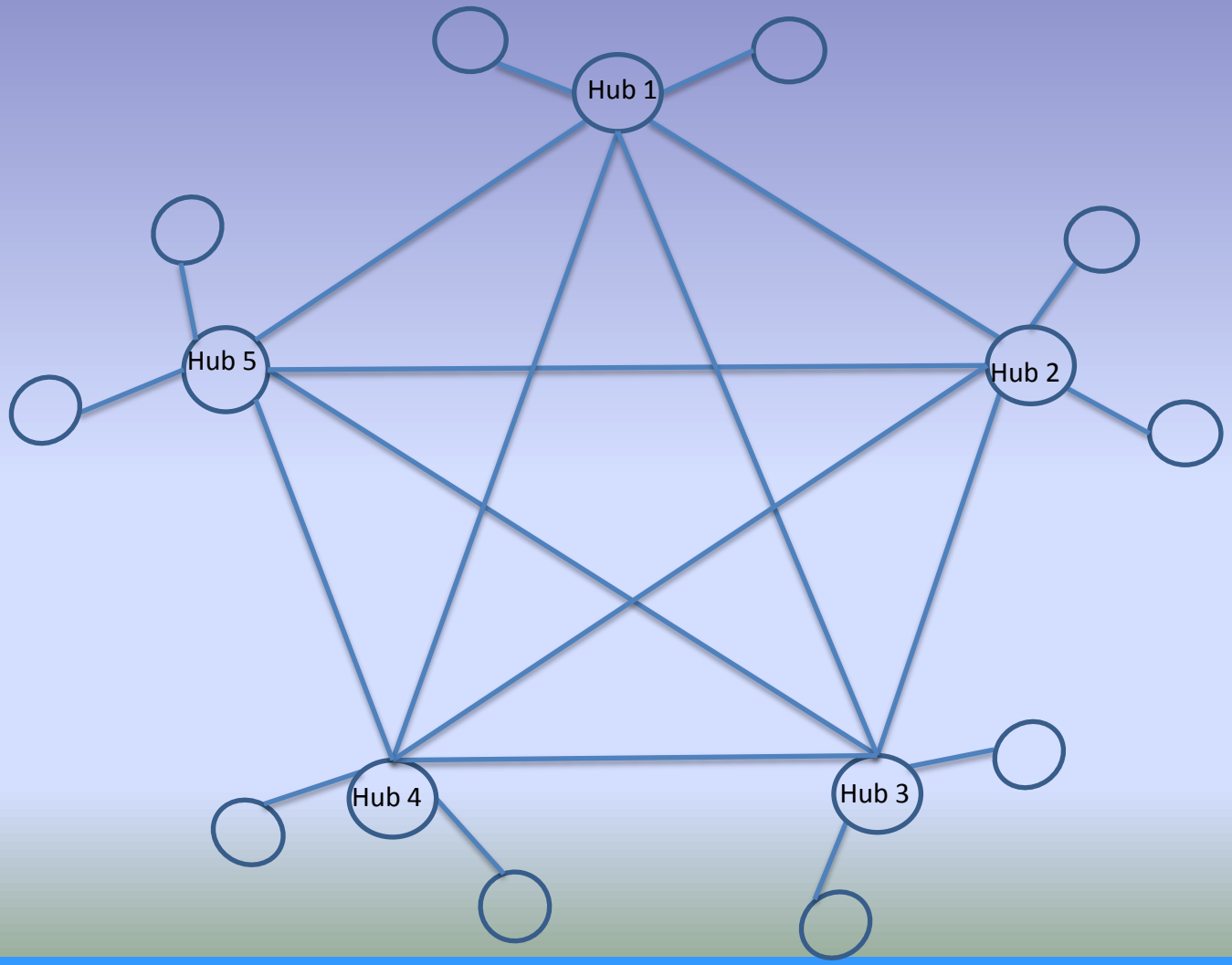
ATFM Measurements (Continued)

- **Slot Allocation System**
  - Define available time slots based on capacity and allocate departures or arrival into slots
  - Take into account optimal sequence
- **Play Book**
  - Responding to changing demand and/or capacity due to Wx, airport conditions, military operation, etc.
  - Through CDM, select specific measures based on pre-defined scenarios



ATFM Measurements (Concluded)

- **Traffic Network Management**



Collaboration Decision Making (CDM)

- Safety
- Separation Assurance

Air Traffic Control

Air Crews

- Operate Flight Safely
- Meet Operational Objectives

- Balancing System Demand / Capacity
- Efficiency, Effectiveness, Equity & Environmentally Green

Air Traffic Flow Management

Airport Operation & Management

- Airport Operational Control
- A-CDM
- Efficiency, Security, Safety

Airline Planning & Dispatch

- Airline Operational Control
- Fleet Safety, Efficiency & Equity

Regional ATFM Characteristics

Roles in ICAO GANP	A necessary capability toward seamless ATM
Relationship with Other ATM Elements	- Closely related to ASM in solving capacity and efficiency issues
Relationships with Local ATFM	- Work along with local ATFM to effect complete ATFM
Involvement in Different Phases of Flight	- More in strategic, pre-tactical and post flight phases, less in tactical phase
Prerequisites for Successful Operation	- Bi-lateral, Multi-lateral and regional agreements; - CDM/A-CDM; SWIM

Regional ATFM Operation

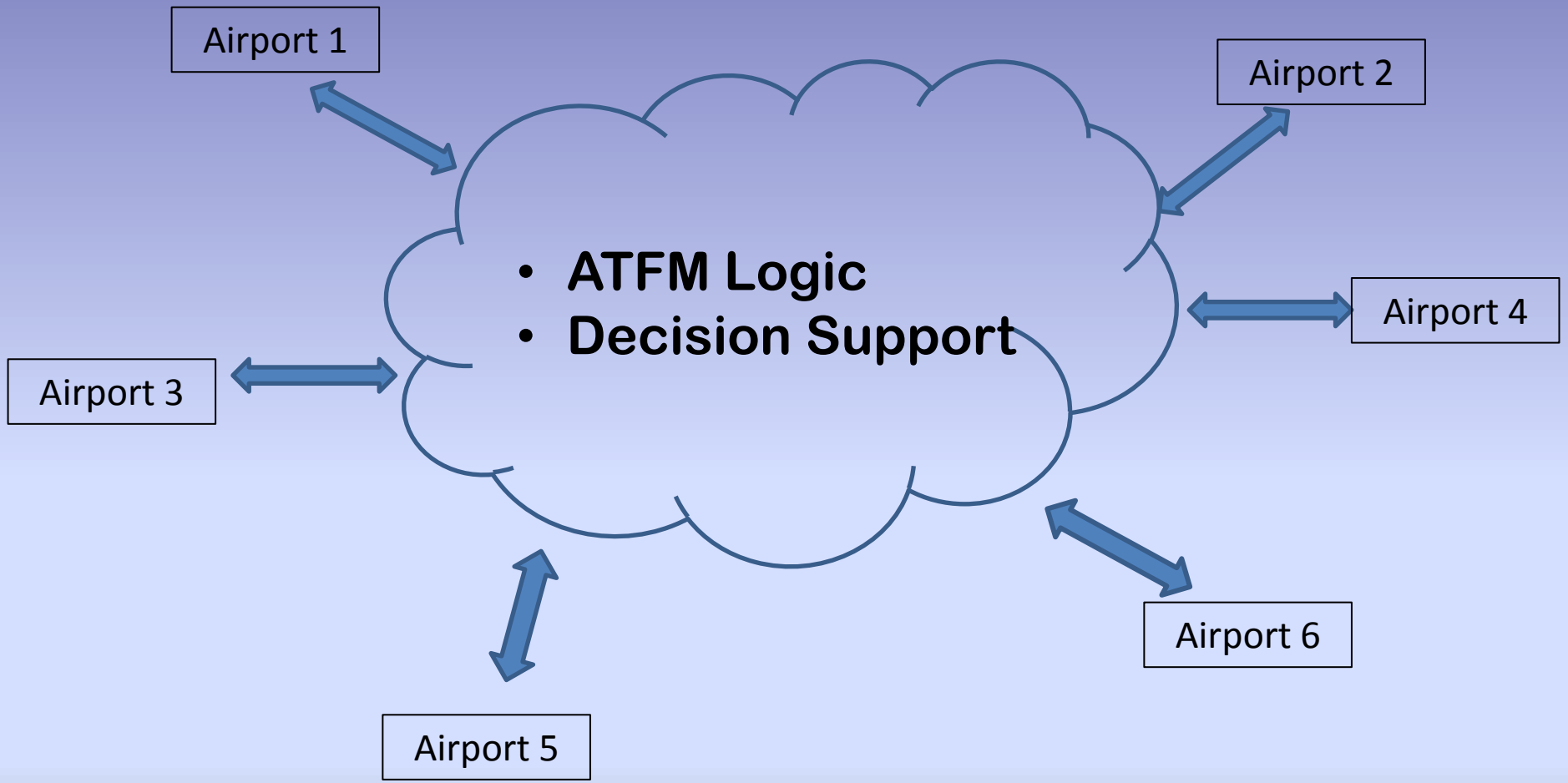
Principles of Operation	- Lead role for handling traffic situations with extreme situation, long-lasting cause or broad impact; - While satisfying efficiency objective, also adhering to equity, effectiveness and transparency principles
Interfaces	- ASM, local ATFM, Wx, general aviation, airlines, and to a lessor degree, airport operations;
Key Functions	- Approval authority for inter-facility ATFM initiatives; - Network-wide coordination planning; - Focal point for interaction with airlines & airspace users; - Plan, execute and monitor ATFM measures/procedures; - Balance demand/capacity, responding to large scale changes in boundary conditions; - Assess system-wide performance
Applicable Measures	4-D trajectory, ground hold/ground stop, slot allocation, play book, traffic network management, etc.

Regional ATFM Models

Centralized	- Centralized planning and execution of ATFM measures in the strategic and pre-tactical phases; - Interface directly with local ATFM facilities; - Examples include EUROCONTROL's ATFCM and FAA's ATCSCC
Distributed	- Each local facility plans its own ATFM measures; - Through information exchange and multi-lateral negotiation, finalize and execute ATFM measures; - Examples include current day Asia Pacific operations
Virtual	- Each local facility selects its ATFM measures based on a common set of ATFM rules; - Through multi-lateral information exchange, finalize and execute ATFM measures - The ability of validating solutions rests in the cloud

EUROCONTROL ATFCM & US ATCSCC

Concept of Virtual Regional ATFM



Conclusions

- Regional ATFM is essential for accommodating the continued traffic growth in the Asia Pacific Region
- Extensive R&D effort is required for satisfying ATFM roles in balancing capacity/demand, and achieving efficiency and environmental greenness,
- The region needs to decide on the model that fits the regional characteristics


Thank You