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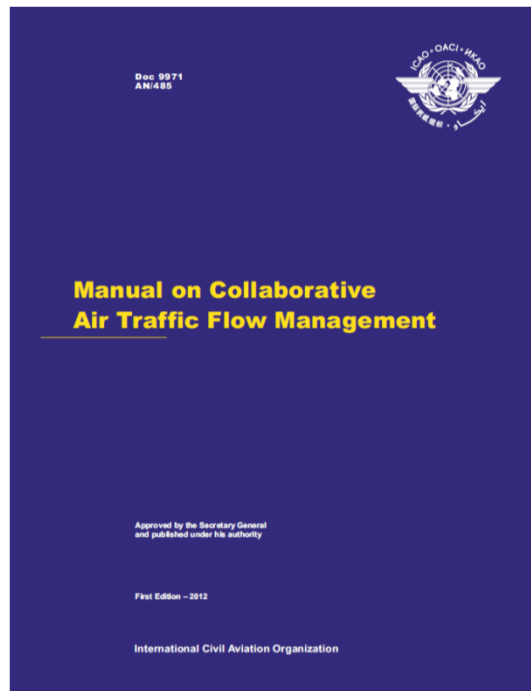
# ATFM Workshop Asia Pacific 2014

Educational Session (Day 2)





# Doc 9971 – Manual on Collaborative Air Traffic Flow Management



- Part 1 – Collaborative Decision-Making (CDM)



## What goes on behind the scenes?



同一个世界 同一个梦想  
*One World One Dream*





# Success Story





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# Collaborative Environment





## **Purpose of Training**

### **Summary of Doc 9971 Part 1 – CDM**

- 1) Introduction**
- 2) Description of collaborative decision-making (CDM)**
- 3) Role of information exchange**
- 4) Articulating a CDM process**



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# Chapter 1

## Introduction



## History

- **Agreed Recommendations at the 11<sup>th</sup> Air Navigation Conference (AN-Conf/11) held in Montréal from 22 September to 3 October 2003**
  - Recommendation
    - *The goal, therefore, was an evolution to a holistic, cooperative and **collaborative decision-making environment**, where the expectations of the members of the ATM community would be balanced to achieve the best outcome based on **equity and access***
  - Recommendation
    - *Develop a set of ATM functional and operating requirements for a global ATM system on the basis of the global ATM operational concept*



# Introduction

- **Collaborative Decision-Making (CDM)**
  - Not limited to any specific domain such as airport or en-route
  - Allows air traffic management (ATM) community to participate in ATM decisions that affect them
  - Applies to all layers of decision-making from longer-term planning activities through to real time operations
- **Intention**
  - Effective information management and sharing
  - Enables each stakeholder to be aware of relevant information
  - Allows stakeholder to propose a solution\*



## Where we are now

### Insufficient Collaboration

- **Between Various Stakeholders:**

- Air Navigation Service Providers (ANSPs), airports, airspace users, manufacturers, regulators and ICAO
- At local, regional and global levels

- **Results:**

- A fragmented air navigation system
- Less than ideal interoperability and geographic differences in terms of performance and maturity
- Fragmented approach from an operational perspective
- Less than optimum flight and airport operations efficiency



## Where we are now

**Lack of Harmonization is a hindrance to achieving:**

- **Seamlessness**
- **Ability to identify inconsistencies across decisions**
- **Robustness**





## What's Next

### Collaboration

- Ensuring that airspace users are included in all aspects of airspace management
- Managing all airspace, and where necessary, amend the rules and priorities relating to access and equity that may have been established for particular volumes of airspace
- Establishing a collaborative process to allow for efficient management of air traffic flow through the use of information on system-wide air traffic flow, weather, and assets



## Key to Collaboration

- **Data and Information Sharing**

- Feed / exchange data between various stakeholders into ATFM/CDM System:

- Current issues:

- Political willingness
- Different data formats
- Complexity in systems integration

- Harmonization





## Considerations of Harmonization

- **Definition of Data requirements**
- **Ability to Forward Automation**
- **Ability to extend CDM to Flight Deck (ie Airborne)**
- **Training to handle variation in processes**



## **What this manual provides**

### **Chapter 2 – Overarching collaboration principles and processes:**

- **Description of ATM areas suitable for collaboration**
- **Classification and description of types of collaboration**
- **Issues to be addressed when implementing collaborative processes**



## **What this manual provides**

### **Chapter 3 – Guidance on the important considerations for information exchange:**

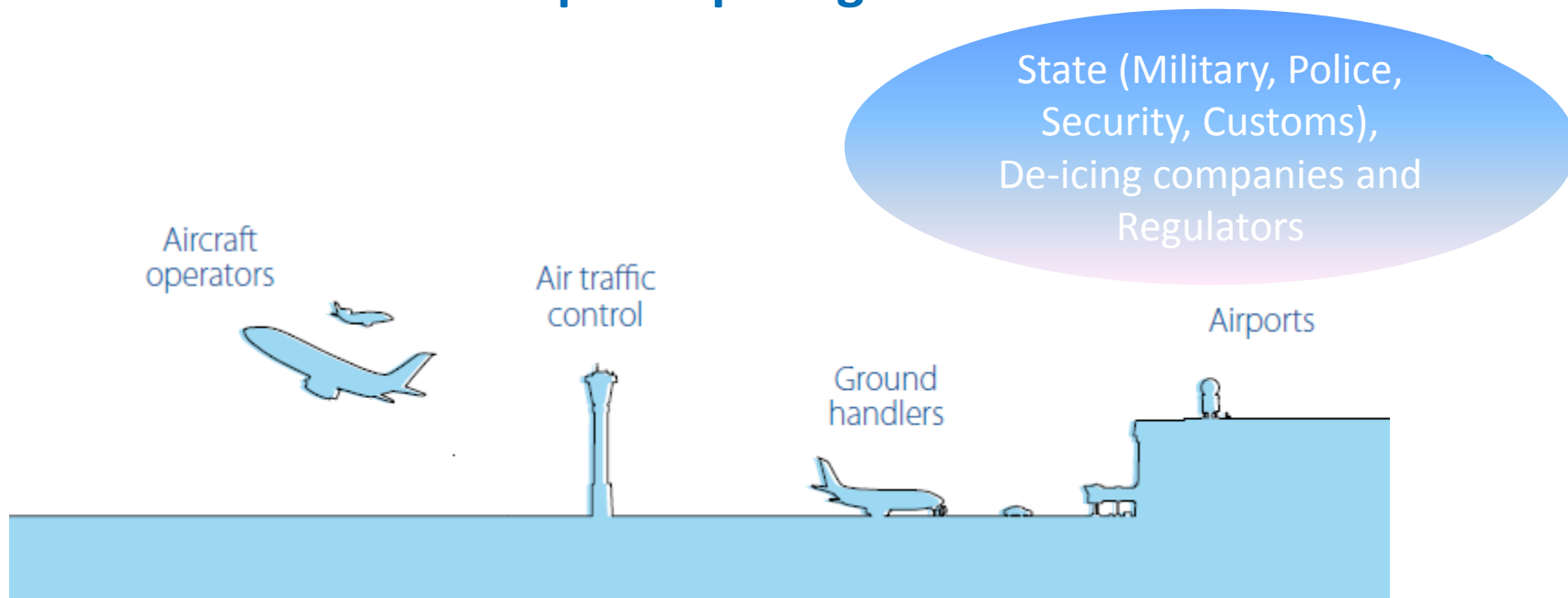
- **Data standards (syntactic and semantic)**
- **Information quality**
- **Information for a collaborative environment**



## What this manual provides

### Chapter 4 – Identifying what is necessary to describe a CDM process, including:

- Stakeholders — who is participating





## What this manual provides

### Chapter 4 – Identifying what is necessary to describe a CDM process:

- Roles and responsibilities — what functions do stakeholders perform and how they interact
- Information requirements — description of requirements and standards imposed on information exchanged as part of above interactions
- Making decision — how is decision made
- Rules — what are rules constraining behaviour



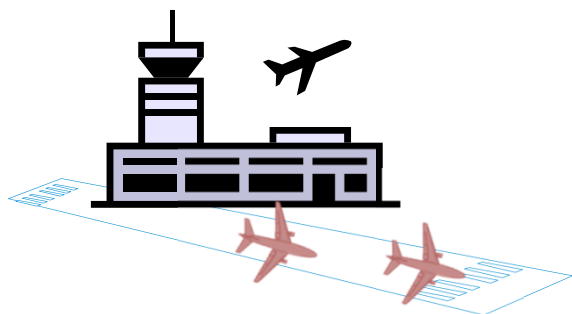
## Exercise 1

- **Scenario:**

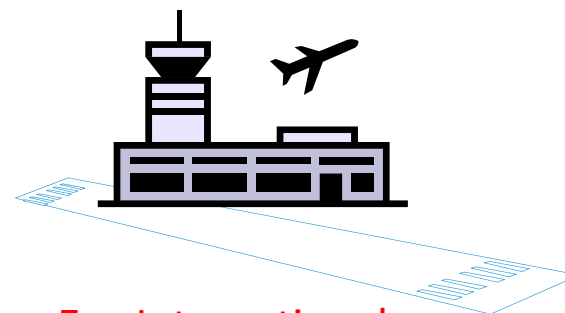
- 3 aircraft have scheduled departure time of 0900hrs at Adam International Airport.
- 2 of the aircraft are from Airline A and both are bound for Eve International Airport. Only 1 has a connecting flight upon reaching destination.
- The 3<sup>rd</sup> aircraft is from Airline B.
- There is only 1 ground handler at Adam International Airport.



# Exercise 1



Adam International  
Airport



Eve International  
Airport



## Exercise 1

- **Form 3 groups**
- **Group A = ANSP / ATC**
- **Group B = Airport / Ground Handler**
- **Group C = Airlines**



## Exercise 1

- **Task:**

- As ANSP/ATC, how would you line them up for departure?
- As Airport / Ground Handler, how would you manage these departures?
- As Airline A, what would you say to ATC if there is only 1 available slot at 0900hrs?

30 Minutes



## Exercise 2

- **Form 2 groups**
- **Each group to have “representatives” as:**
  - ANSP / ATC
  - Airport
  - Ground Handler
  - Airlines
  - Any additional Stakeholders?



## Exercise 2

- **Scenario:**

- 3 aircraft have scheduled departure time of 0900hrs at Adam International Airport.
- 2 of the aircraft are from Airline A and both are bound for Eve International Airport. Only 1 has a connecting flight upon reaching destination.
- The 3<sup>rd</sup> aircraft is from Airline B.
- There is only 1 ground handler at Adam International Airport.



## Exercise 2

- **Task:**
  - Describe all assumptions and constraints
  - Develop a departure strategy for these 3 aircraft

30 Minutes



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# Chapter 2

Description of collaborative decision-making (CDM)

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## Topics

- **Approach and Principles**
- **Governance**
- **Areas of Application**
- **Types of CDM**
- **Harmonizing CDM Processes**
- **CDM Process Details**
- **Harmonizing Data**
- **Harmonizing Rules and Compliance**



## Approach and Principles

- **CDM is a process:**

- Applied to support other activities such as demand/capacity balancing
- Applied across timeline of activities from strategic planning (e.g. infrastructure investments) to real time operations
- A way to reach performance objectives of the processes it supports
- Requires investments and thus needs to be justified in accordance with performance-based approach\*

\*Early forms of CDM require no further investment





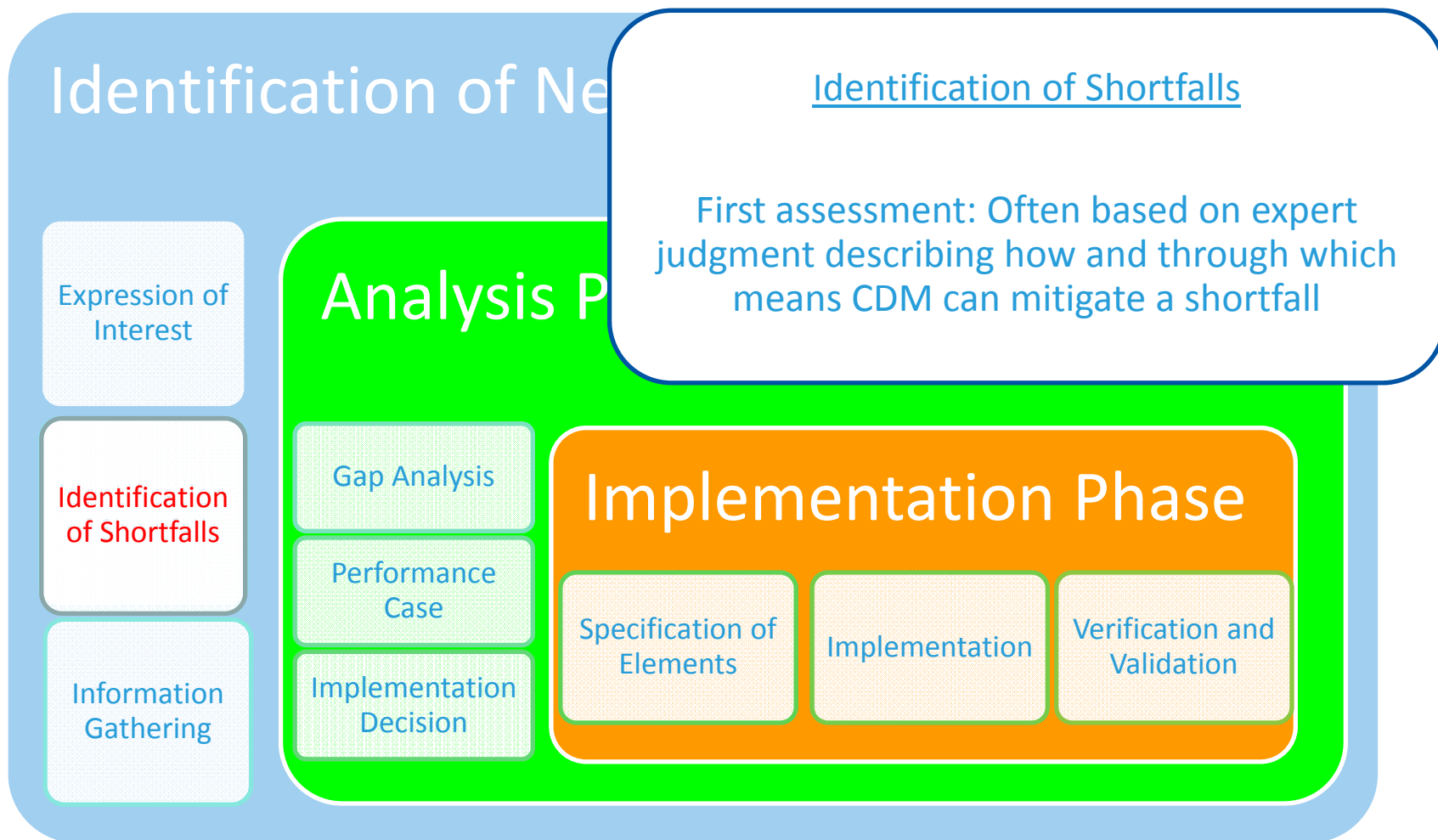
# Approach and Principles

## Principles of CDM process

- **Information-sharing is an important enabler but not sufficient to realize objectives of CDM**
- **Requires pre-defined and agreed upon procedures and rules to ensure that collaborative decisions are made expeditiously and equitably**
- **Ensures decisions are taken transparently based on best information available**
- **Stakeholders provide information in a timely and accurate manner**



# Development of CDM process





## What is a Shortfall?

- Shortfalls can be identified in **11 Key Performance Areas (KPAs)** as identified in **Doc 9854**
  - Safety being the highest priority





## 11 Key Performance Areas

- 1) Access and equity
- 2) Capacity
- 3) Cost Effectiveness
- 4) Efficiency
- 5) Environment
- 6) Flexibility
- 7) Global Interoperability
- 8) Participation by the ATM community
- 9) Predictability
- 10) Safety
- 11) Security

CDM specifically addresses these 2 performance areas



# Development of CDM process

## Gap Analysis

What decisions to be made?

Which community members are involved (or affected)?

Which information is used to support decision(s)?

Which process(es) are followed?

How and through which means the decision-making process can be improved?

How such an improvement could contribute to better performance?



# Development of CDM process

## Objective of Performance Case

Justify decision to implement CDM process

Make necessary investments

Determine what the costs are

Determine what benefits are as a result from CDM operations

>>>>>> IMPLEMENTATION DECISION





# Development of CDM process

## Identification of Need Phase

Expression of Interest

Identification of Shortfalls

Information Gathering

### Analysis Phase

Gap Analysis

Performance Case

**Implementation Decision**

### Implementation Phase

Specification of Elements

Implementation and Training

Verification and Validation



# Development of CDM process

## Specifications

Decisions to be taken, how they are reached and finalized

Community members involved and their roles & responsibilities in the decision(s)

Agreement on objectives

Decision-making rules, processes and principles

Information requirements

Maintenance process



## Implementation Phase

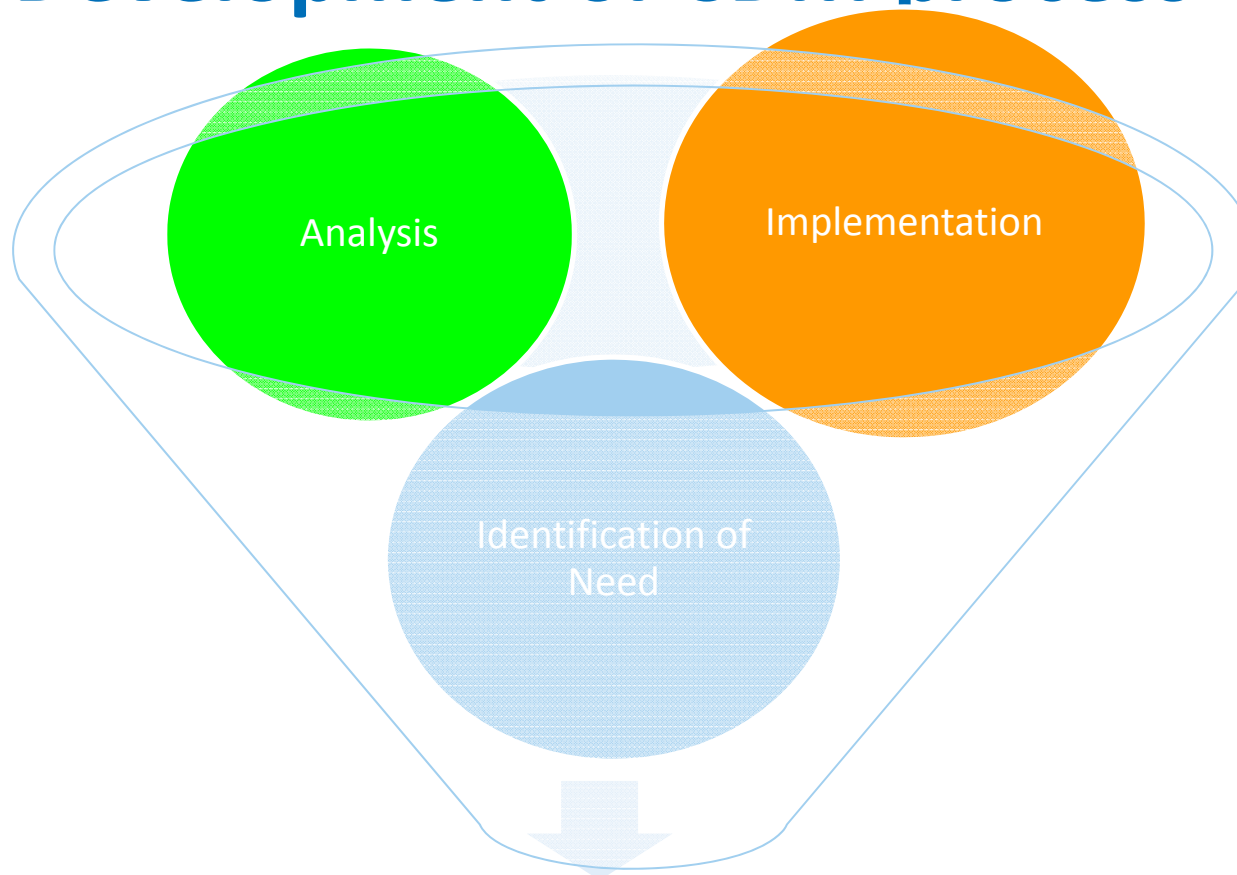
All steps required to bring CDM into operations including:

- Implementation / adaptation of systems and information networks
- Training
- Informing staff





## Development of CDM process



***Operational Evaluation***



## Operational Evaluation Phase

After CDM process is operational:

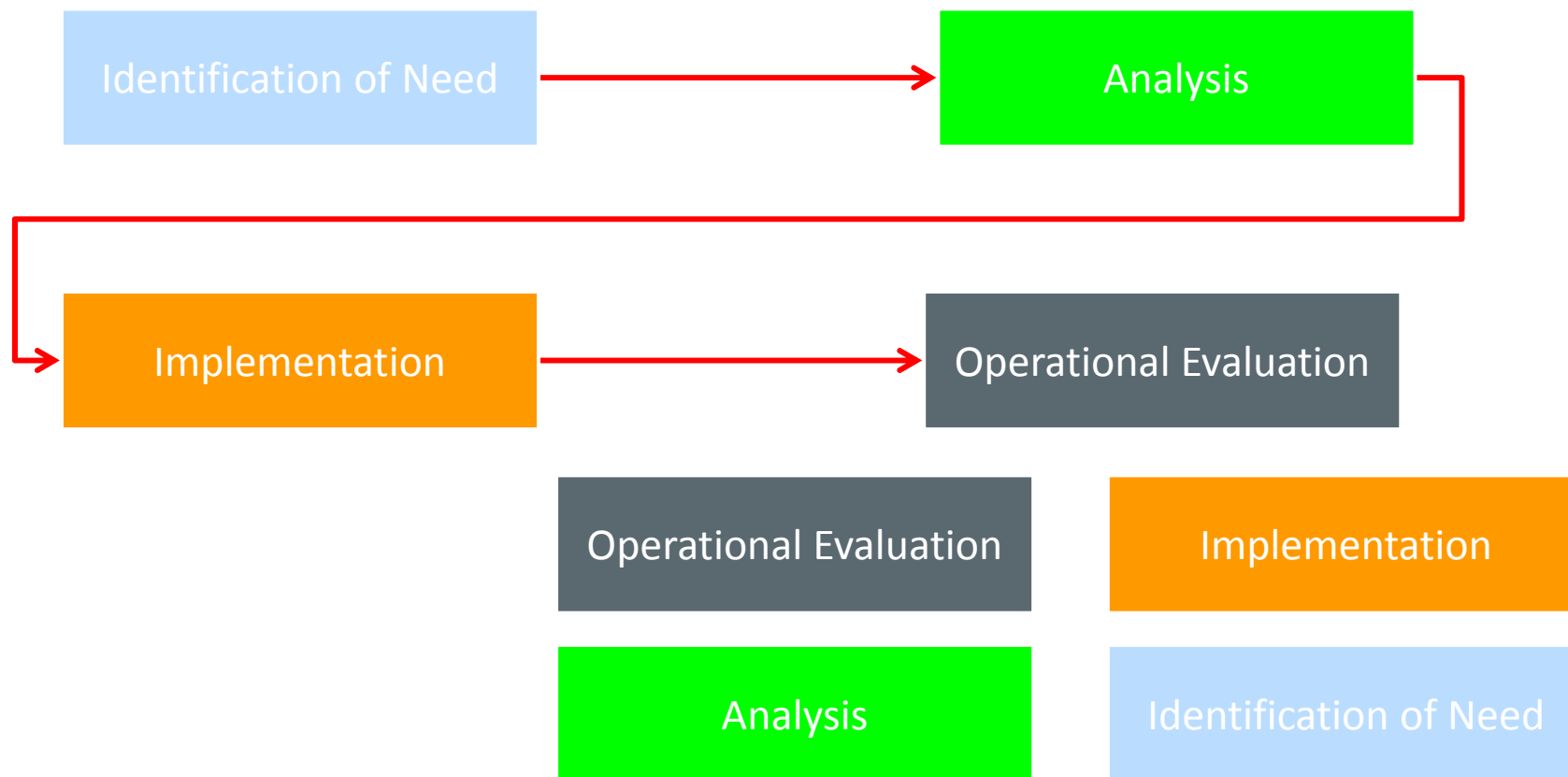
- Subject to continuous and shared review
- Maintenance and improvement
- Performance can be continually improved





## Mini Quiz

- Put the CDM process into the correct order





## Governance

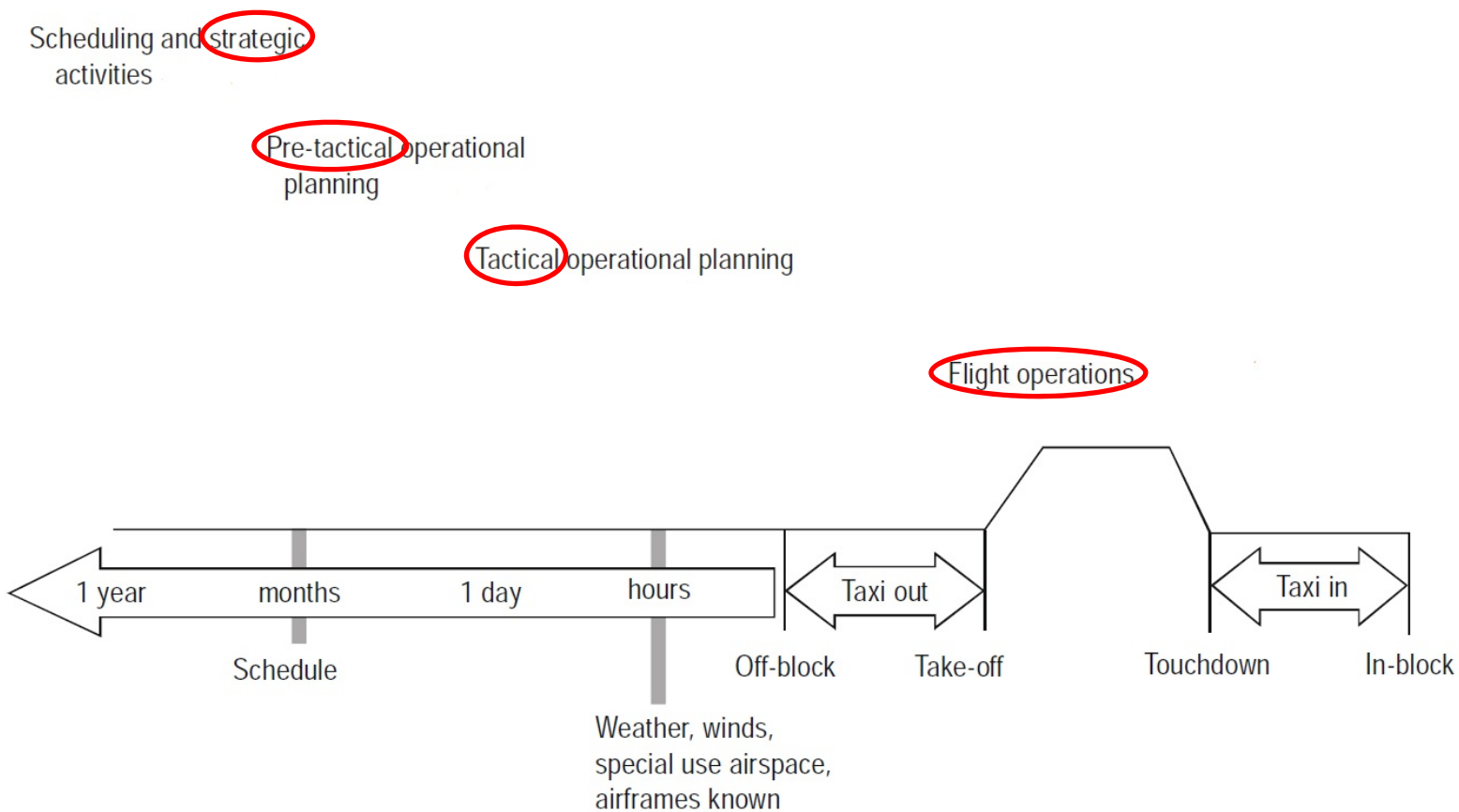
- As described in 1994 World Bank report, *Governance: The World Bank's Experience*, as follows:

“Good governance is epitomized by predictable, open and enlightened policy making; a bureaucracy imbued with a professional ethos; an executive arm of government accountable for its actions; and a strong civil society participating in public affairs; and all behaving under the rule of law.”



# Areas of Application

- **Timeline for information provision**





## Areas of Application

- **Doc 9971 Part 1 does not address CDM in the context of performance-based strategic planning**
- **Refer to Doc 9883 for more guidance to address:**
  - Collaboration on long-term performance outcome and targets
  - Collaboration on implementation of operational improvements
    - Changes to procedures
    - Airspace organization
    - Infrastructure
  - Collaboration on forecasts and post-event analyses
    - Long term strategic planning



## Areas of Application

- **CDM may be applied to the below concept components as identified in Doc 9882**
  - Airspace organization and management
  - Aerodrome operations
  - Demand and capacity balancing
  - Traffic synchronization
  - ATM service delivery management



## Areas of Application

- **Good practices indicate that decision is based on:**
  - Best available information
  - According to pre-defined, transparent and agreed criteria and processes





## Areas of Application

- **CDM becomes especially relevant when:**
  - One or more decisions are required
  - More than one stakeholder is impacted by the outcome of the decision(s)
  - One or more stakeholders are best suited to evaluating the impact of the decision(s) on their own interests
  - Time is available prior to the decision(s) deadline to accommodate collaboration



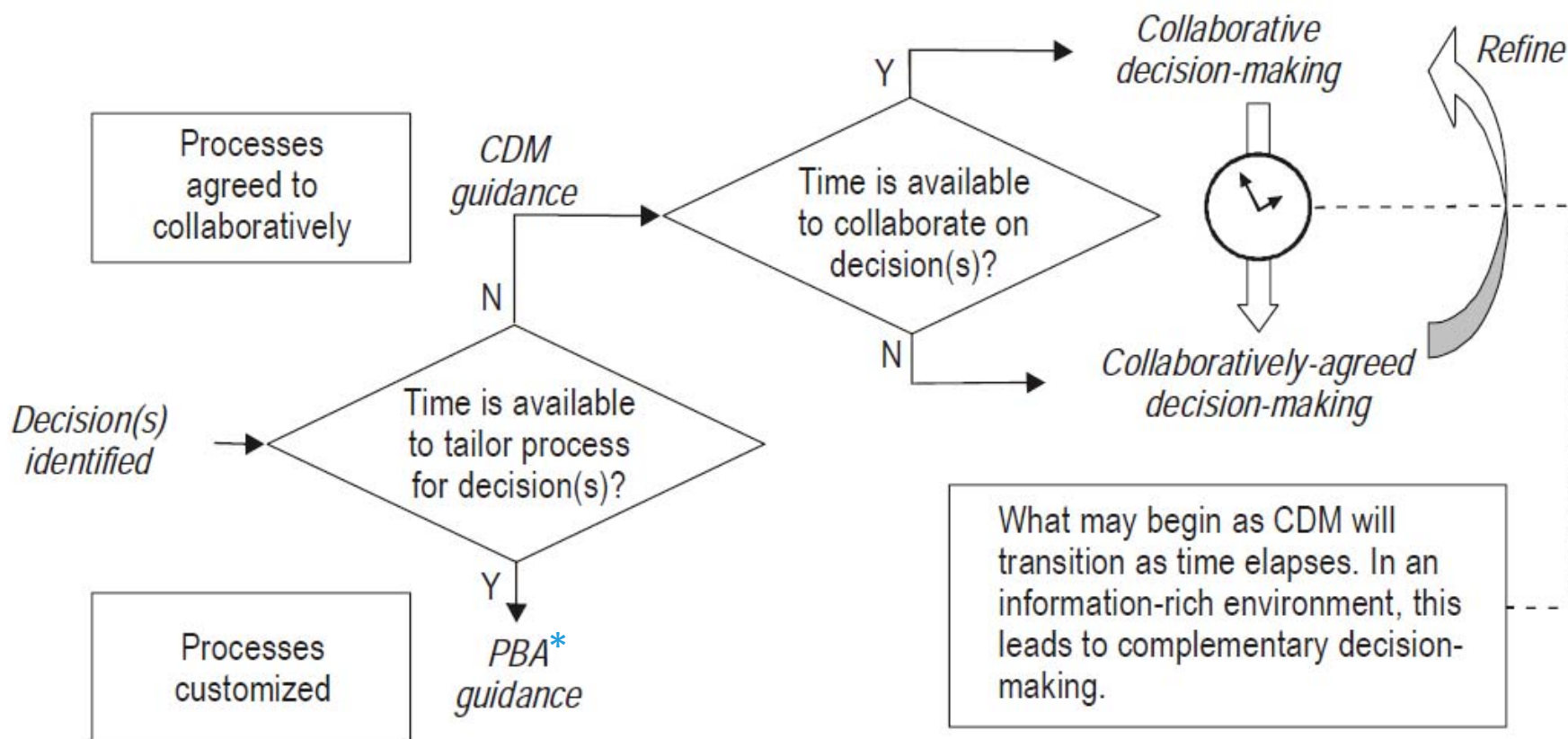
## Areas of Collaboration

### Collaboration is applicable:

- Prior to departure (pre-departure) to manage turn-around process and departure queue
- Manage flows through control and synchronization of individual flights
- Implement airspace/airport flow restrictions based on agreed weather forecasts
- Timing and selection of dynamic airspace configurations
- Determine relevant performance criteria to be applicable to a given period
- Determine equitable unilateral responses to event(s) when time does not permit further collaboration in response to the event(s).



# Areas of Application



\*Performance-Based Approach



# Complementary Decision-Making

- **Scenario Example**

- Airspace congestion prior to flight's planned departure time
- Decisions on routes required
- Airlines unwilling to re-route own flights

- **Action:**

- ANSP assign re-routes
  - Unilateral decision to various impacted flights
- Complementary Decision Making occurs when outcome of unilateral Decision-Making is known to all



## Mini Quiz

- Which of the below can CDM be applied to?
  - (a) Strategic
  - (b) Pre-Tactical
  - (c) Tactical
  - (d) Real-Time Flight Operations
  - (e) All of the above

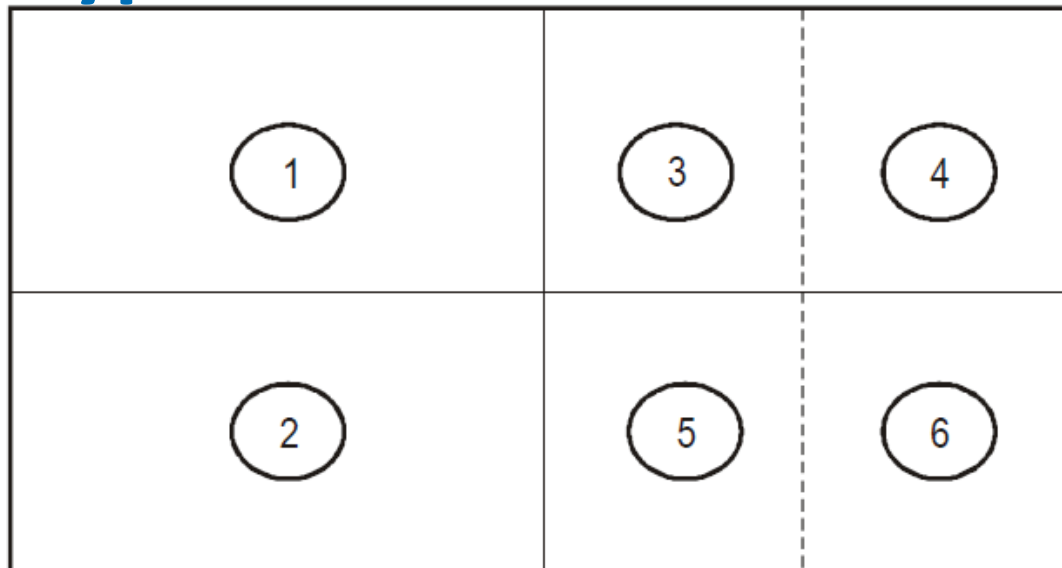
**ANSWER: (e) All of the above**



# Types of CDM

Decision-making

Decisions are made by 1 stakeholder (unilateral) or multilaterally across multiple stakeholders



Common goal

Individual goals

Alignment

- Identifies interests of stakeholders:
- Driven by single common goal; or
- Individual goal

Complementary

Adversarial



## Types of CDM **1**

- **Multilateral decision-making with a common goal:**

- All in agreement on common, socialised goal
- Multiple stakeholders hold best information and is difficult or undesirable to share the information
- **Criteria:**
  - Relationship between decision and desired outcome must be known to decision-makers
  - Appropriate levels of information-sharing must be maintained
  - Possibility of applying additional / individual goals to close problems





## Types of CDM (2)

- Unilateral decision-making with a common goal:

- All are in agreement on common, socialized goal
- Single decision-maker
- Criteria:
  - Rules governing decisions are collaboratively agreed-to prior decision making
  - Adequate information must be provided to decision-maker by all stakeholders
    - Information has sufficient Quality, Stability & Timeliness
  - Secondary objectives may be addressed
  - Relationship between decision being taken, goal being pursued and information supporting the decision must be understood.





## Types of CDM **3**

- **Multilateral decision-making with complementary individual goals**
  - Similar to common goal
  - Added complexity:
    - Decisions may have geographically separate impact
    - Different ATM service providers (ASPs) making decisions affecting flights operating across multiple ASPs
    - Individual objectives may align with a common goal
    - Once constrained resources have been allocated, decisions may occur within those constraints to achieve secondary objective

## Types of CDM (4)

- Multilateral decision-making with adversarial individual goal:
  - Frequent in a capacity constraint environment
  - Set of rules governing the process should be agreed-to prior to initiating collaboration
  - Rules to include specified deadlines for decision-making
  - Rules to include mechanism for constraining decisions of individual stakeholders
  - Verification function





## Types of CDM (5)

- Unilateral decision-making with complementary individual goal:
  - Pre-collaboration is applied to identify decision maker and the rules by which decision are made
  - Rules to consider differences in goals through information (eg preferences) provided by stakeholders





## Types of CDM (6)

- Unilateral decision-making with adversarial individual goal:
  - Pre-collaboration is applied
  - Clearly establish rules of behaviours and information provision
  - Ensure that rules are not being “gamed”





## Mini Quiz

- How many types of CDM are there?

(a) 2

(b) 4

(c) 6

**ANSWER: (c) 6**



## Analysis of Exercise 2

- **Which Performance Area was met and which could have been additional considered?**
- **What is the guiding principle behind the decision on the departure sequence?**
- **What type of CDM was used?**



## Harmonizing CDM Process

**CDM process** should be specified to a level of details to ensure:

- Process allows decisions to be reached
- Compatibility exists when multiple decision-makers are participating and applying different internal processes



## Harmonizing CDM Process

- **CDM processes will not be identical across all regions of the globe or across all borders**
- **With airspace users operating globally, counter-balancing performance benefit should exist to justify for investments in automation supporting CDM**
- **Harmonizing processes to enhance rather than degrade performance**



## Consequence of Not Harmonizing

**Lack of Cross-border CDM processes leads to**

- **Inefficient flight profiles**
- **Different objectives across locations not met**
- **Different means in addressing capacity constraint resources**
  - First-come-first served
  - Ration-by-schedule
  - Market-based approaches





## Harmonizing CDM Process

**CDM process** needs to “make sense” across boundaries by:

- **Defining CDM process in each location**
- **Harmonizing processes across locations**
- **Standardizing**
  - Processes or interacting processes
  - Data and information standards
  - Rules and compliance monitoring



## CDM Process Details

- **Below section highlights some considerations for the application of CDM process without providing “recipe”**
- **CDM is expected to be flexible in its implementation**





# CDM Process Details

## Analysis of processes and interactions

### Understand objectives (shared and individual)

- Seek to achieve shared objectives
- Ensure proper information exchange

### Understand decisions made by stakeholders

- What decisions to be made?
- Who makes these decisions?
- What does decision affect?
- How does one achieve convergence and avoid stalemates?

### Determine compatibility of interacting processes

- Time evolution
- Differences across ATM Service Providers

### Ensure compatibility of interactions between various stakeholders

- Timing of events
- Information exchange
- Consistency of rules



## Harmonizing Data

- **Data exchange is critical to CDM**
  - Information is necessary to make decisions consistent with sought objectives
  - Information standards to be defined to:
    - Reduce incompatibilities in decisions due to conflicting interpretation of information
    - Reduce development costs for automation of systems interacting across disparate locations



## Harmonizing Data

- **Information Standards are to address:**
  - Syntactic Interoperability
  - Data Definition
  - Update Requirements
  - Information Quality





## Harmonizing Rules and Compliance Monitoring

- **Rules of behaviours to be defined at Pre-Collaboration:**
  - Description of information to be provided
  - Indication of deadlines for provision of information
  - Identification of quality of information to be provided
    - Including accuracy
  - Allowable use of provided information and requirements on protection of provided information
  - Identification of decision-makers and constraints on decisions



## Harmonizing Rules and Compliance

- **Compliance Monitoring Function**
  - Ensure rules are followed
  - Verification of accuracy of information when that information is used for allocation of resources





## Mini Quiz

- What are the 4 steps to analyse CDM processes and interactions?

### Answer:

- 1) Understanding Objectives
- 2) *Understanding decisions made by stakeholders*
- 3) *Determine compatibility of interacting processes of various types*
- 4) *Ensure compatibility of interaction between various stakeholders*



## Mini Quiz

- **What are the 4 items that information standards should address?**

**Answer:**

- 1) Syntactic Interoperability**
- 2) Data Definition**
- 3) Update Requirements**
- 4) Information Quality**



## Re-cap

- **CDM is a process**
- **4 Phases:**
  - (a) Identification of Need
  - (b) Analysis
  - (c) Implementation
  - (d) Post Operations Evaluation
- **Can be applied across the timelines of:**
  - (a) Strategic
  - (b) Pre-Tactical
  - (c) Tactical
  - (d) Real-Time Flight Operations
- **Different types of CDM**
- **Harmonization of Data**
  - (a) What is the data required?
  - (b) By when is the data required?
  - (c) Who requires the data?



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# Chapter 3

Role of information exchange

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## Types of Information Exchange

- **Unstructured**



- **Structured like system-to-system**



- **This chapter focuses on information exchange**
  - A structured Collaborative Environment
  - Describing Data Standardization
  - Defining Quality of Information



## Expansion of Exercise 2

- **In the same groups, discuss:**
  - What are possible means of information exchange?
  - What information was exchanged?
  - When should the information be exchanged?

20 Minutes

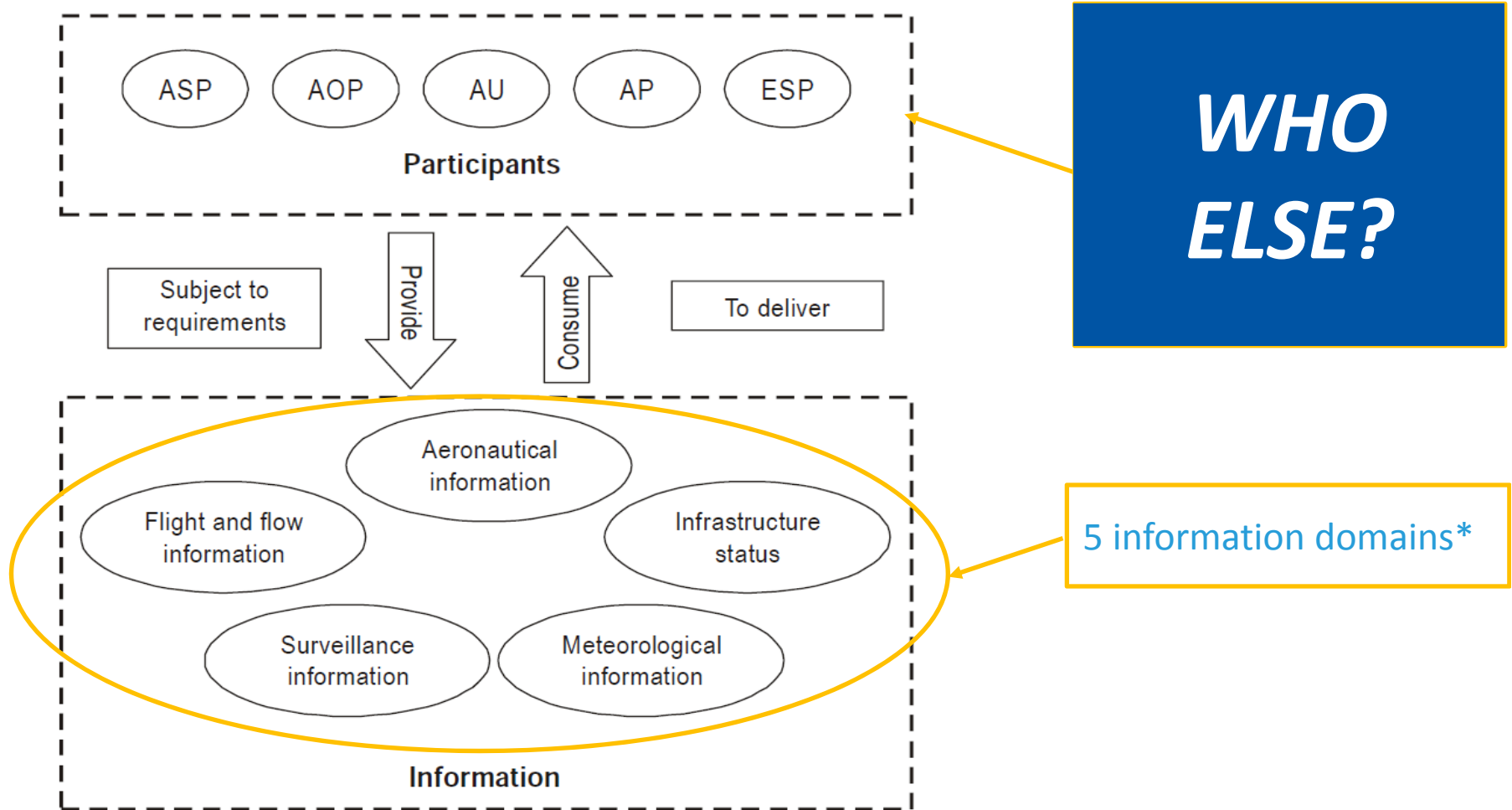


## Topics

- **The Future Collaborative Environment**
- **Data Standardization**
- **Defining Quality of information**



# Collaborative Environment



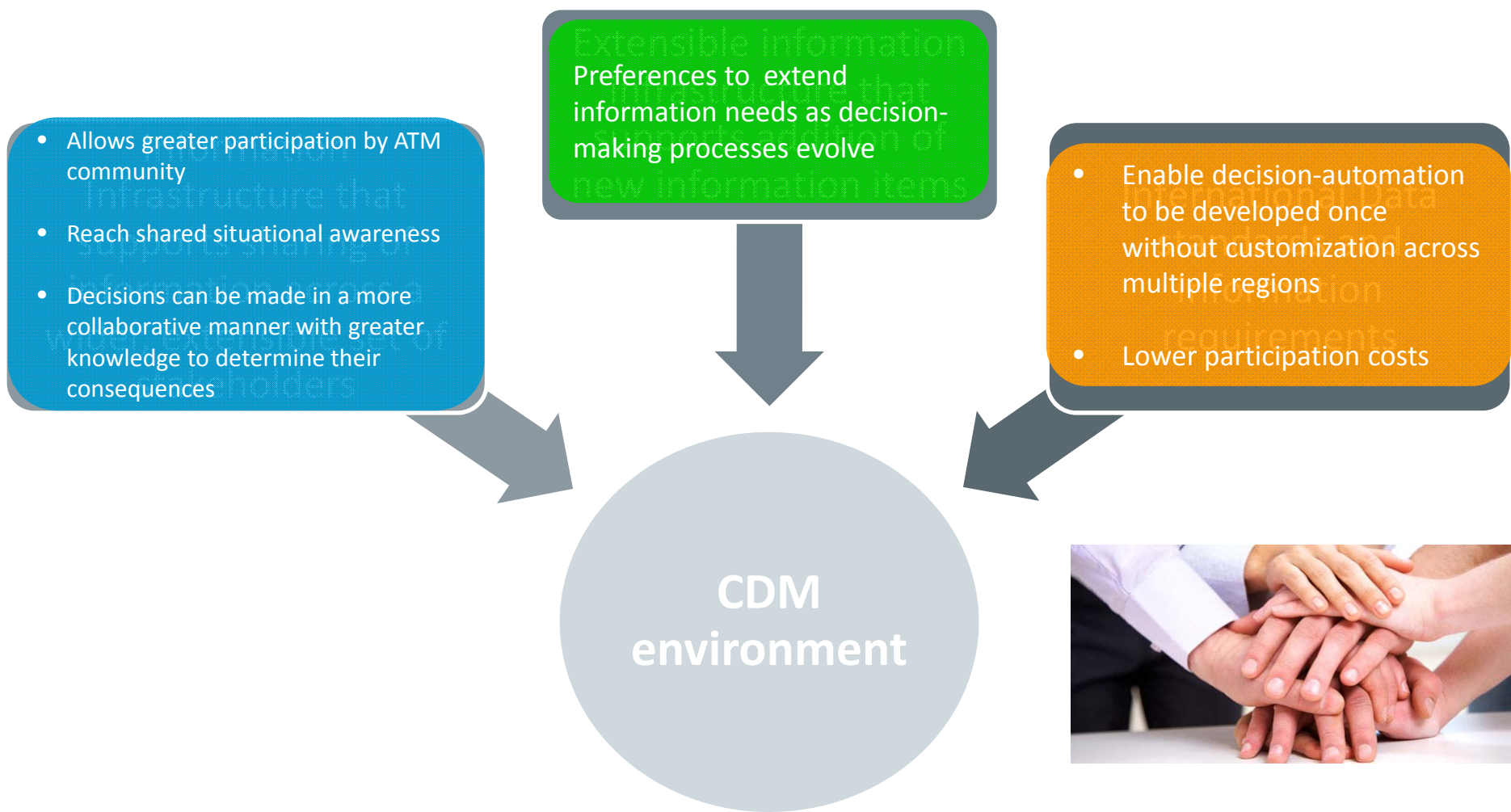


## Collaborative Environment

- **Each Information Domain is expected to be subjected to specific information requirements:**
  - Data Specification
    - Definition and Structure
  - Authorization Requirements
    - Ability to provide, modify and obtain data
  - Operational Requirements
  - System Checks

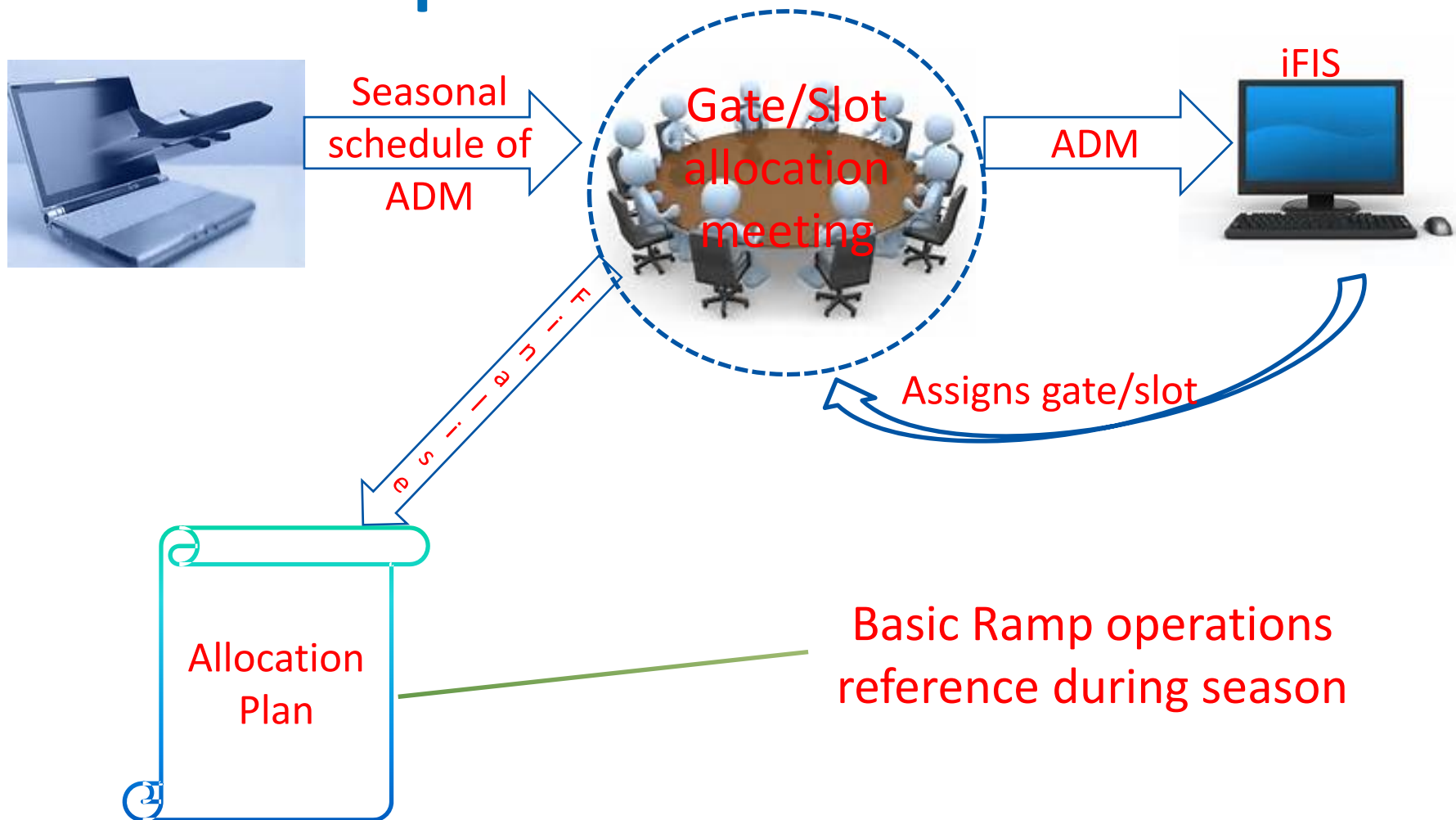


# Collaborative Environment





# Example of CDM Environment





# Example of CDM Environment

1 day before operations



Gate / Spot  
allocation  
plan



Gate/Slot  
allocation  
meeting

Update

iFIS



Abnormal Situation

Flight ops info sys

FLIGHT PLAN		Sample Flight Plan	
1. ICAO TYPE	2. ICAO AIRCRAFT TYPE	3. OPERATING TYPE	4. OPERATING TIME
5. ICAO AIRCRAFT REGISTRATION MARKING	6. OPERATOR	7. OPERATOR ICAO三字代码	8. OPERATOR ICAO四字代码
9. NAME OF FLIGHT			
10. DEPARTURE AIRPORT	11. EST. TIME ENROUTE	12. NUMBER	
13. ICAO AIRCRAFT EQUIPMENT	14. ICAO AIRCRAFT MODEL	15. ICAO AIRCRAFT WEIGHT & BALANCE	16. ICAO AIRCRAFT WEIGHT & BALANCE
17. ICAO AIRCRAFT TELEPHONE (OPTIONAL)			
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ATC





## Exercise 3

**Country B has received restrictions from Country A that aircraft has to be spaced 80NM apart.**

**Country B then to space overflights coming from Country C further apart (160NM) to allow for their own departures. This results in more than 4 hours delay for aircraft departing from Country C to Country A.**

**Country A, B and C decides to come together to establish a CDM process to improve traffic flow and manage delays from Country C.**



## Exercise 3

- **Task:**
  - Develop a simple CDM process which includes:
    - Identification of Shortfall – ie What are the potential constraints both on Country A and B?
    - Gap analysis – ie What information needs to be communicated and when?
    - Performance Case – ie What are the possible improvements?

40 Minutes



## Re-Cap from Chapter 1 - Where we are now

### Insufficient Collaboration

- **Between Various Stakeholders:**

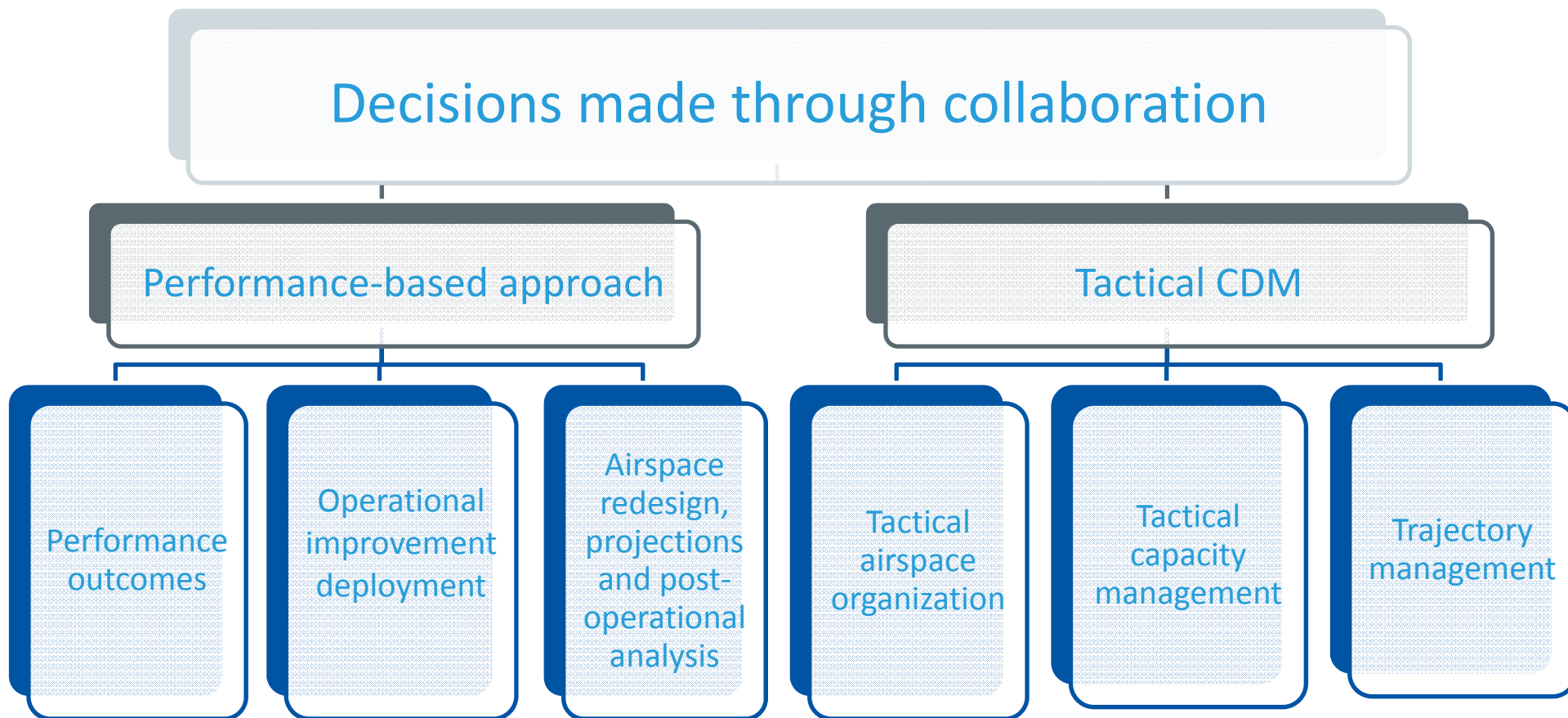
- Air Navigation Service Providers (ANSPs), airports, airspace users, manufacturers, regulators and ICAO
- **At local, regional and global levels**

- **Results:**

- A fragmented air navigation system
- Less than ideal interoperability and geographic differences in terms of performance and maturity
- Fragmented approach from an operational perspective
- Less than optimum flight and airport operations efficiency



# Data Standardization





# Data Standardization

- **Data item identification**
- **Definition**
- **Syntax**
  - Repeatable data types (eg integer, decimal, string, data etc)
  - Existing standards
- **Constraints on syntax**
  - Default values
  - Range and domain
  - Max and min levels of precision of data
  - Restrictions on order of appearance
  - Repeatability
- **Additional information about data items**
  - Approved Units
  - Accuracy and Information Quality





## Quality of Information

- **Low Quality Data could be due to:**
  - Accuracy of forecast or predicted information affected by foreseeable horizon
  - Location and infrastructure
  - Difference in “Provision-of-Intent” (possibly due to competitive interest) leading to
    - Misleading information
    - Essential information omitted
    - Information not provided in timeliest manner
  - ATM is dealt with in a dynamic environment
    - Information may change frequently and significantly



## Quality of Information

- **How to deal with Low Quality Data?**
  - Have metric indicating prediction accuracy together with information
  - Seek improvements in forecast ability
  - Ability to accommodate differences in infrastructure
  - Manage stability of information through:
    - Providing indications of stability of information
    - Requiring that decisions be stabilized by certain deadlines
  - **Providing additional technical quality details**
    - Accuracy of measured data
    - Fidelity or resolution of reported data
    - Frequency of events leading to updates
    - Basis for reporting the data



## Quality of Information

- **Data-sharing agreements can be documented in:**
  - Memoranda of Understanding
  - Data specifications
  - Data quality documents
- **Regular Reporting on data quality**





## Re-Cap:

# List the 5 Information Domain

1. **Aeronautical information** — Standards for aeronautical information would be described through the aeronautical information exchange model (AIXM)
2. **Flight and flow information** — Doc 9965 provides initial material to define standards for the flight information exchange model (FIXM)
3. **Surveillance information** — Based on current standards for ground-to-ground exchange of surveillance information
4. **Meteorological information** — Based on current standards for global dissemination of weather products. Further standards development work may be required for new aviation weather products and to make these applicable to aviation CDM (e.g. weather information exchange model (WXXM))
5. **Infrastructure status** — Standards for infrastructure status could largely be expressed using modified AIXM standards.



# Chapter 4

Articulating a CDM process



## What this Chapter provides

### Identifying what is necessary to describe a CDM process:

- Stakeholders — who is participating
- Roles and responsibilities — what functions do stakeholders perform and how they interact
- Information requirements — description of requirements and standards imposed on information exchanged as part of above interactions
- Making decision — how is decision made
- Rules — what are rules constraining behaviour



## Collaborative Process

- Goal is **not only** to achieve desired outcome
- Goal is to achieve desired outcome in the **most efficient** and **effective** way possible for **all** collaborative parties involved.



## **Articulating CDM process**

- **Understanding Objectives**
- **Identify Roles and Responsibilities**
- **Defining Information Requirements**
- **Making Decisions**
- **Rules and Accountability**



## Understanding Objectives

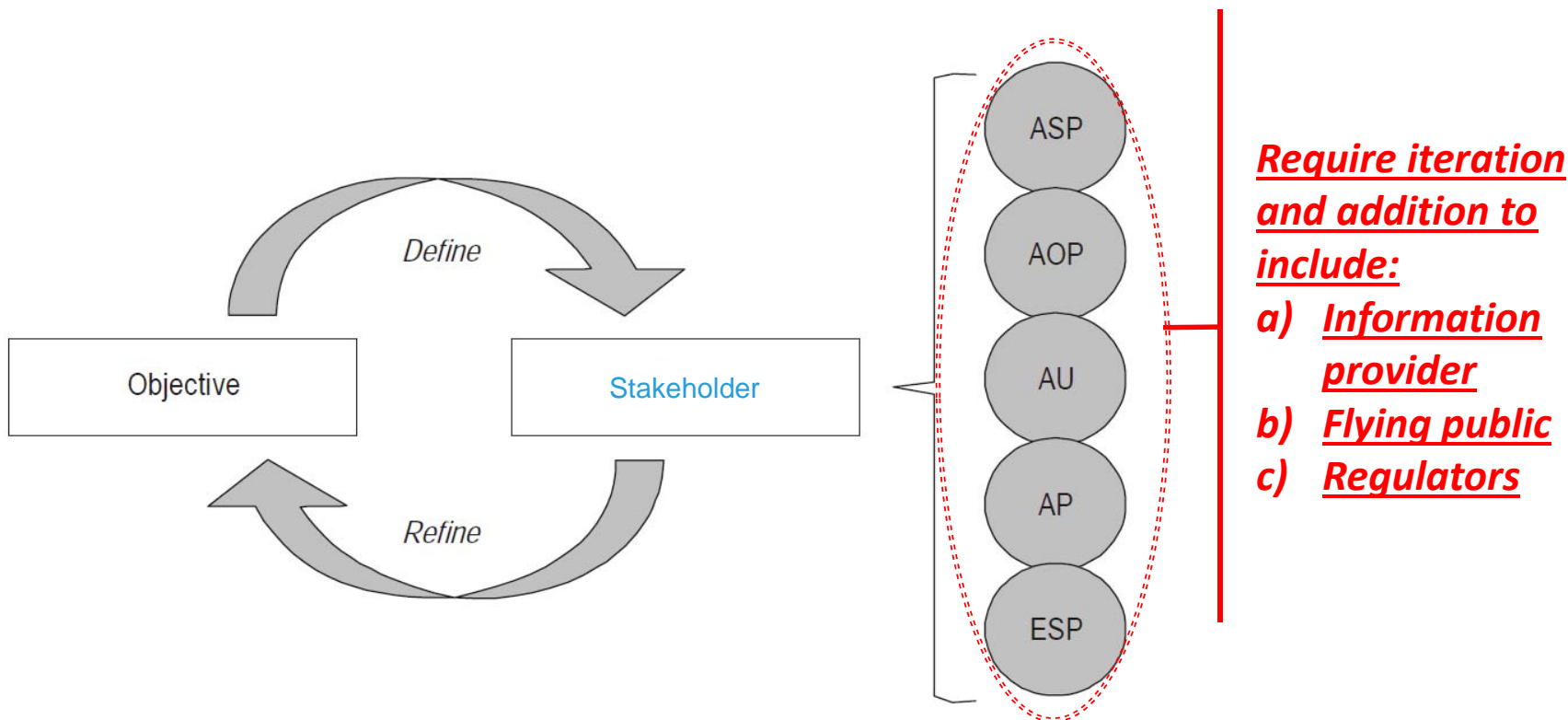
- **Set Initial High Level Objective:**
- **Define set of stakeholders**
  - Humans
  - Automation Systems





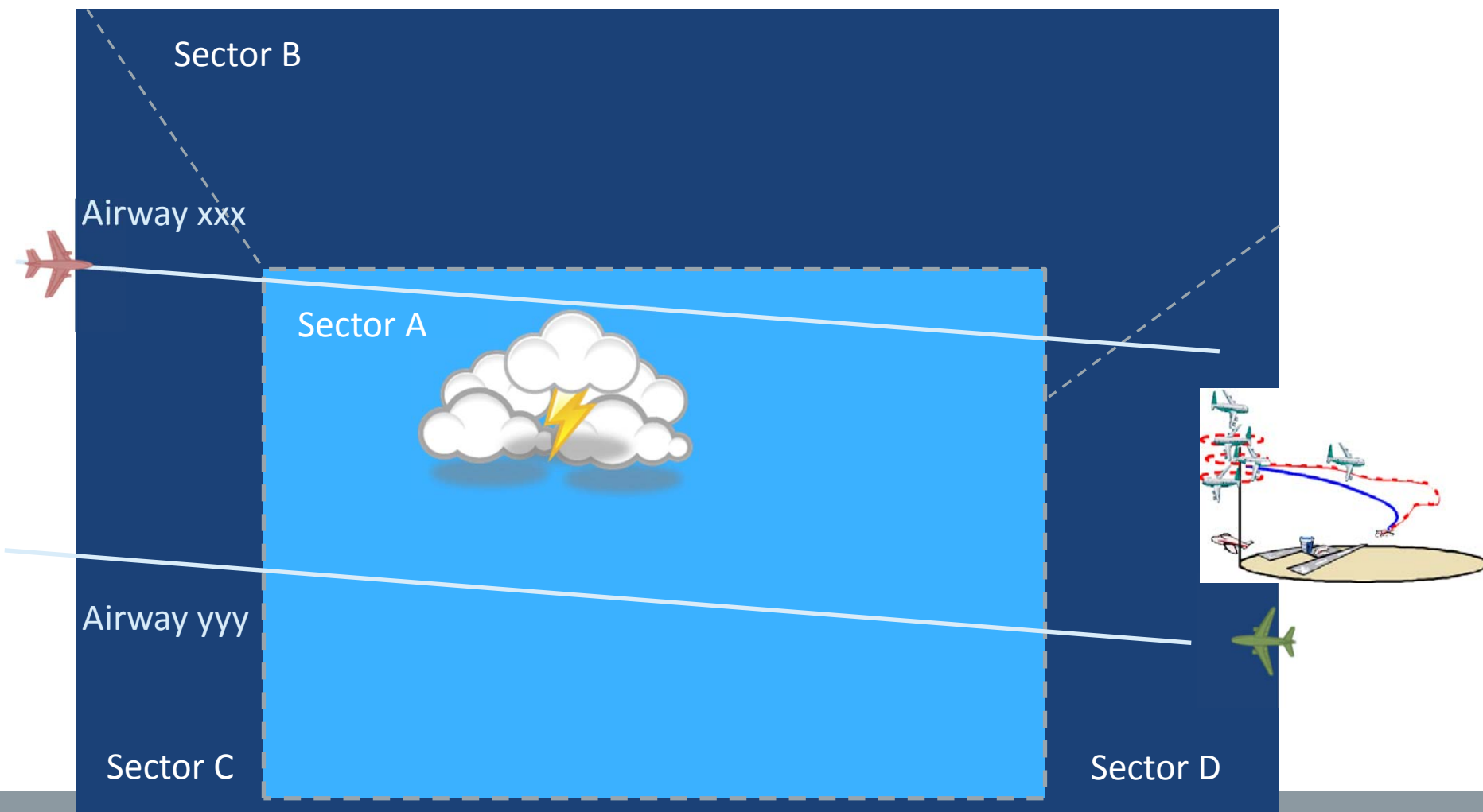
# Understanding Objectives

- Refine Objectives and Stakeholders





# Exercise 4 (Weather)





## Exercise 4

- **Task:**
  - Split into original 2 groups
  - Develop a CDM process which includes:
    - Listing out Stakeholders who will be impacted
    - Who will have first information of weather and possible delay and who needs to be informed?
    - What are the possible benefits if impacted Stakeholders are aware of this information?

40 Minutes



## Roles and Responsibilities

- **Consume and interpret information**
- **Provide information**
  - Updating and sharing of data triggered by received information
- **Making decision and sharing result of that decision**
- **Executing on a decision that has been made**
- **Providing a service consistent with decisions that have been made**





## Roles and Responsibilities

### Collaborative Process to describe:

- **Which stakeholders are providing and receiving what information and when**
  - Information may be provided based upon identified events, an update cycle or at discretion of provider
  - Identify compulsory versus optional interactions
  - Specify deadlines on provision of information
  - Standards for quality of information provision





# Roles and Responsibilities

## Collaborative Process to identify:

- **Stakeholders expecting to react to provided information**
- **What information is used for, e.g.**
  - Re-compute flight specific pushback times
  - Determine flights impacted by congestion
- **May lead to provision of additional information:**
  - Consider constraints governing application of information
- **May lead to a decision to act:**
  - Consider different stakeholders assigned responsibility to decide on different portions of problem areas



## Making Decisions

- **It is critical to determine and allocate the Best Decision-Maker**
  - Possible distributed decision-making to let unilateral decision-maker assign portion of constrained resources to stakeholders
  - Stakeholders can make decisions within the allocation as suitable for their own operations
- **Processes for Making Decisions**
  - Not expected to be static in all cases





## Making Decisions

- **As deadline approaches:**
  - Collaboration may not be quick enough to ensure convergence to a solution
  - Pre-collaboration to establish process for timelier decision-making
    - Identify a unilateral decision-maker
    - Define roles and responsibilities
    - Unambiguously specify a deadline for switching to unilateral decision-making
- **Once decision is made, mechanism for communicating these decisions to stakeholders must be defined. It is expected that execution of those decisions will be followed**



## Rules and Accountability

- **Rules to define:**
  - Stakeholders
  - Provision and consumption of information
  - Quality of information
  - Expected decisions
  - Times/events for those decisions
  - Constraints to be followed



## Rules and Accountability

- **COMPLIANCE** checks should be in place:
  - Validity of document (in XML parlance)
  - Compliance to standards and schemas
  - Where possible, real time monitoring is preferable



## Rules and Accountability

- **Establish consequences of not following rules**
  - Through collaborative process
  - Pre-collaborated penalties when stakeholder does not demonstrate accountability
  - Need for arbitrator as independent party to enforce rules



## Mini Quiz

**What are the 5 steps in articulating a CDM process?**

**Answer:**

- **Understanding Objectives**
- **Identify Roles and Responsibilities**
- **Defining Information Requirements**
- **Making Decisions**
- **Rules and Accountability**



## Mini Quiz

- **List the rules expected to be set during CDM process definition stage**
  1. Define stakeholders
  2. Provision and consumption of information
  3. Quality of that information
  4. Expected decisions
  5. Times/events for those decisions
  6. Constraints to be followed



## Conclusion and Summary

- **Concept of CDM**

- Aims to improve sharing of information between stakeholders and to pre-define procedures and rules for collaboration
- Enabler to reduce delays, improve predictability of events and optimize utilization of resources
- Allows stakeholders to optimize operations and decisions in collaboration with each other, knowing preferences, constraints and the actual and predicted situation



## Conclusion and Summary

- **Essential features of CDM process**
  - Pre-defined procedures and rules for collaborations agreed between stakeholders before start of operations
  - Procedures and rules describe how CDM stakeholders will cooperate, and how decisions will be taken in order to assure efficient operations and equity between the interests of the stakeholders
  - Decision-making is facilitated by sharing of accurate and timely information and by adapted procedures, mechanisms and tools



## Additional References

- **Doc 9965**
  - Provides concept for flight information-sharing of relevance to collaborative decision-making
- **Doc 9883**
  - Provides more guidance on CDM in the context of performance-based strategic planning
- **Doc 9854**
  - Provides eleven Key Performance Areas (KPAs)



## Additional Information

The following provides additional information on Airport-CDM:

- **European Airport CDM** <http://www.euro-cdm.org/>
- **European Community Specification EN303212**
  - [http://www.euro-cdm.org/library/airports/a-cdm\\_community\\_spec\\_doc\\_etsi.pdf](http://www.euro-cdm.org/library/airports/a-cdm_community_spec_doc_etsi.pdf)
- **Airport CDM Implementation “The Manual”**
  - [http://www.euro-cdm.org/library/cdm\\_implementation\\_manual.pdf](http://www.euro-cdm.org/library/cdm_implementation_manual.pdf)
- **Example airports** [http://www.euro-cdm.org/airports\\_cdg.php](http://www.euro-cdm.org/airports_cdg.php)
- **Flight Crew Briefing and Brief Description Document Frankfurt**
  - <http://www.cdm.frankfurt-airport.com> (library)
- **CDM in the US:** <http://www.flycdm.org/>



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