

Confidential

Introduction of NTT DATA Corporation

October 30, 2014

NTT DATA Corporation.

Public Administration Systems Sector

NTT DATA

01 Corporate Overview

02 Aviation Domain Reference

03 Aviation Domain for overseas market



01 Corporate Overview

* The above figures are as of the end of Fiscal Year 2014.

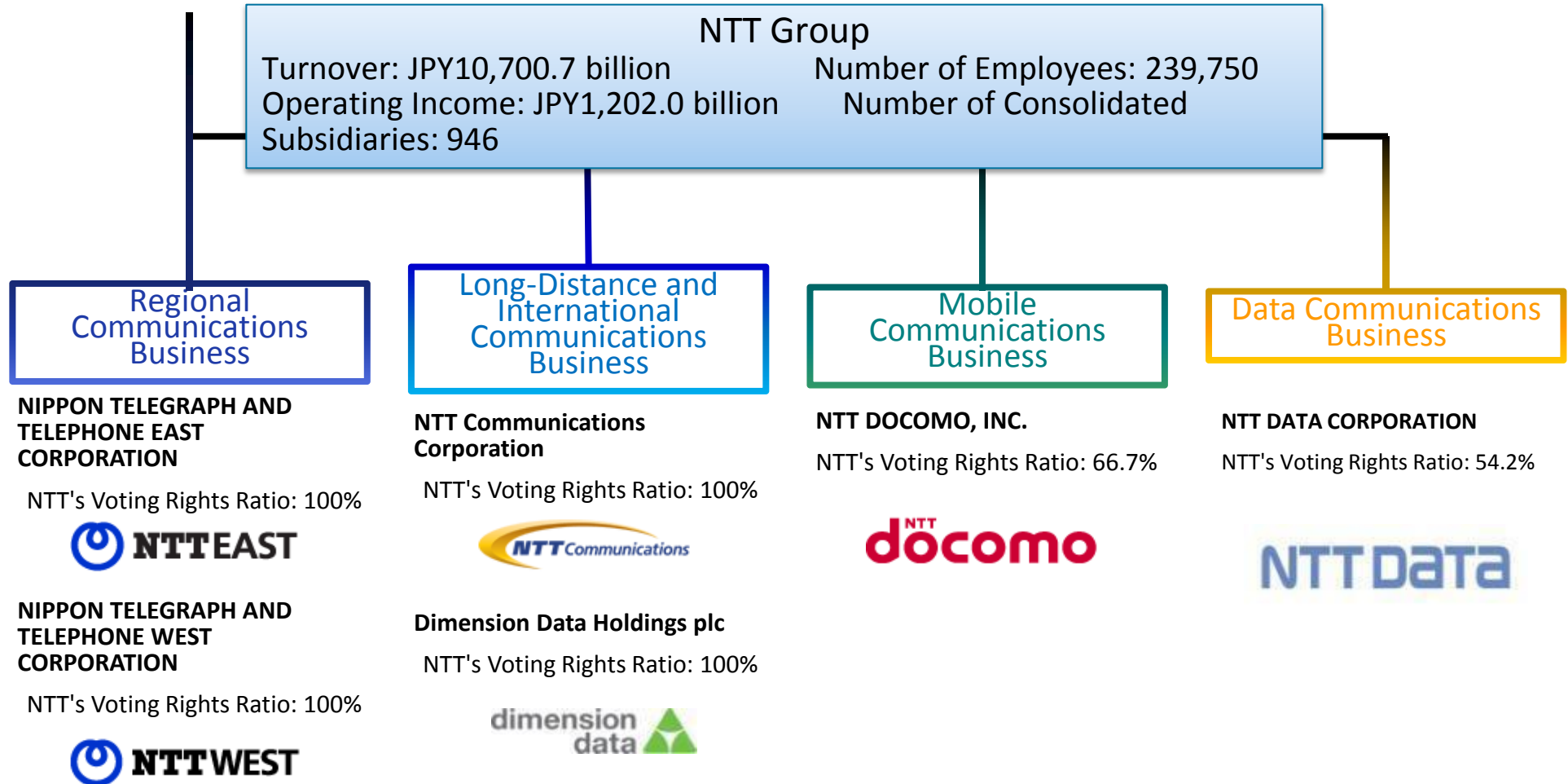
- Headquarters: Tokyo, Japan
- Turnover: JPY 1,425 billion.
(USD 13.3 billion, EUR 10.4 billion)
- Employees: 11,000 [Non-Consolidated]
75,000 [Consolidated]
- Business Areas:
Broad range of IT services including consulting, system integration and IT outsource.
Ex: Card and payment services,
Service platform for mobile phone (Development into LTE from 3G),
Big data analysis including social media.
- History:
1967 - Started as a division in NTT
Nippon Telegraph and Telephone Corporation
1988 - Separated from NTT (May 23, 1988)
1995 - Listed in Tokyo Stock Exchange (Code 9613)





- Planning management strategies for the NTT Group; Encouraging fundamental R&D efforts

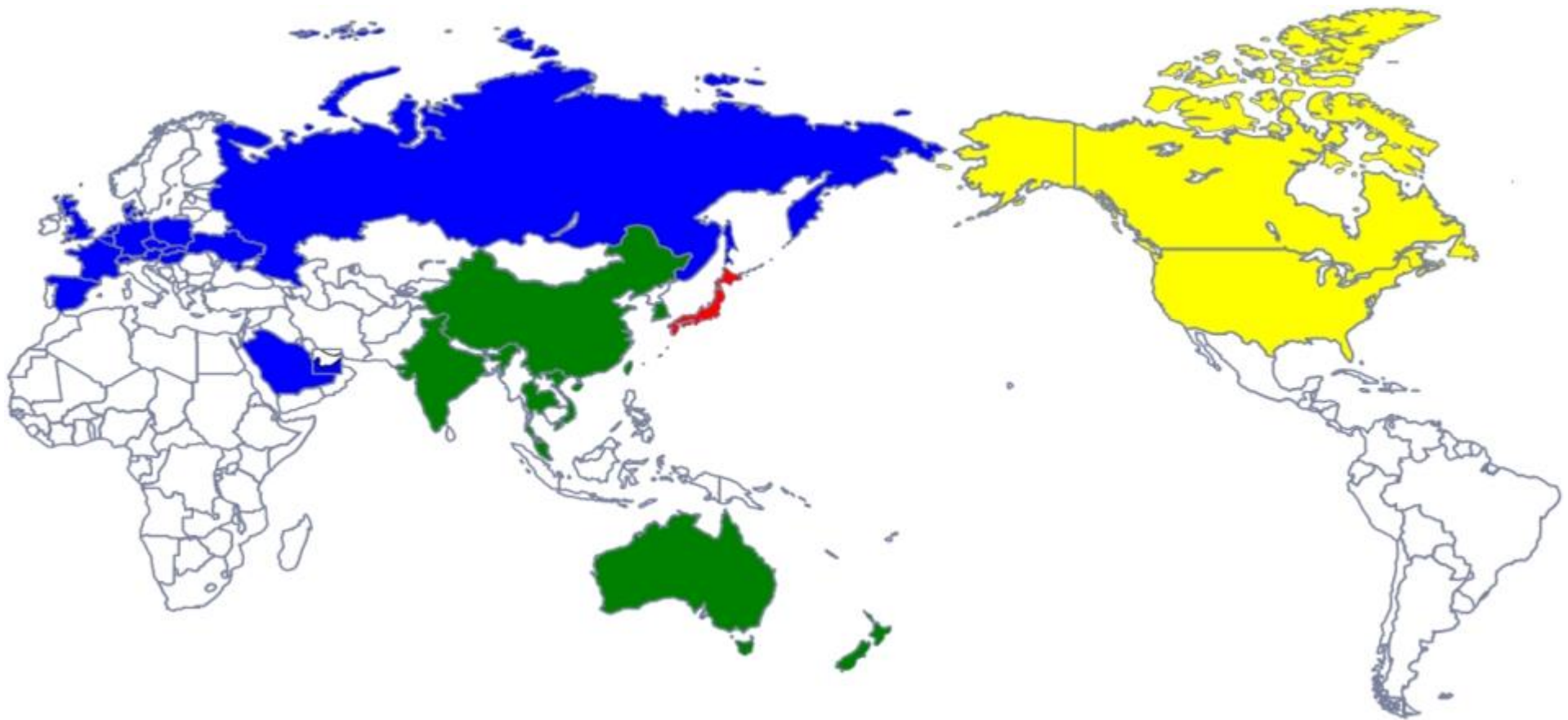
NIPPON TELEGRAPH AND TELEPHONE CORPORATION (Holding Company)



* The above figures are as of the end of FY2014.

58,000 employees in 41 countries

- Over 26,000 employees are working in overseas countries.
- Select suitable resources from all over the world.





02 Aviation Domain Reference

We have been developing and providing Air Traffic Control, Air Traffic Management and Air Space Management for **JCAB(Japan Civil Aviation Bureau)**. NTT Data also recently started sales and marketing to global market.

40 years of experience in the Aviation Domain.

ATM, RDP, ADS and many other systems were provided to JCAB.

We had unix-based **Flight Procedure Design system** for more than 10 years. With the professional expertise, PANADES was developed in 2009 as package product and has globally been sold since 2010.

We have **ICAO IFPP** (Instrumental Flight Procedure Panel) **advisor** and **ATM RPP** (Air Traffic Management Requirements and. Performance Panel) **advisor** in NTT DATA Group.

NTT DATA is **a member of CANSO (Civil Air Navigation Service Organization)** since 2011



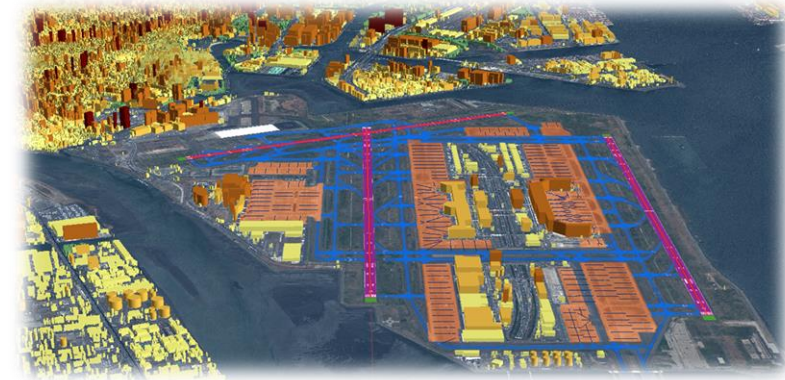


03 Aviation Domain for overseas market

Based on the experience in Japan, NTT DATA aviation domain expand its products to overseas market

1. Electric Terrain & Obstacle Data (eTOD)

DigitalGlobe, a leading provider of high-resolution earth imagery products, announced to develop a new eTOD solution jointly with the NTT DATA's 3D mapping technology.



2. Tower simulator

NTT DATA and technobrain will provide 3D simulator for tower control.



There will be some more products to be released in near future.

This is the end of presentation of NTT DATA's company introduction.

Ms. Yamashiro will explain what NTT DATA do for Air Traffic Flow Management.



Introduction of NTT DATA's ATFM solution

October 30, 2014
NTT DATA Corporation.
Public Administration Systems Sector

NTT DATA

We, NTT DATA Corporation, have been providing ATC, ATFM/CDM and ASM system to JCAB (Japan Civil Aviation Bureau) for more than 40 years.

1. NTT DATA's approach to ATFM
2. New Concept for the ATFM System
3. Future works



1. NTT DATA's approach to ATFM

- NTT DATA is **the leading company of ATM system** in Japan.
 - Support JCAB since introduction of ATFM system.
 - Provide ATFM system.
 - Provide any other ATFM relative systems as follows.
 - ✓ Fast-Time simulator
 - ✓ Dynamic Airspace Validation system
 - ✓ Spot-information Management and Planning system
 - ✓ RVSM safety validation system

1. NTT DATA's approach to ATFM

- Functions of ATFM

■ Flow control Function

- Target area: sector, airport, air way
- Target flight : domestic flight, Inbound traffic with neighboring coordination
- Method :
 - ✓ ground delay
 - ✓ assigning the control time of arrival at specific waypoints
 - ✓ sequencing at specific airways
 - ✓ departure interval

■ Flow control actual performance ✕ record from 2013 April to 2014 March

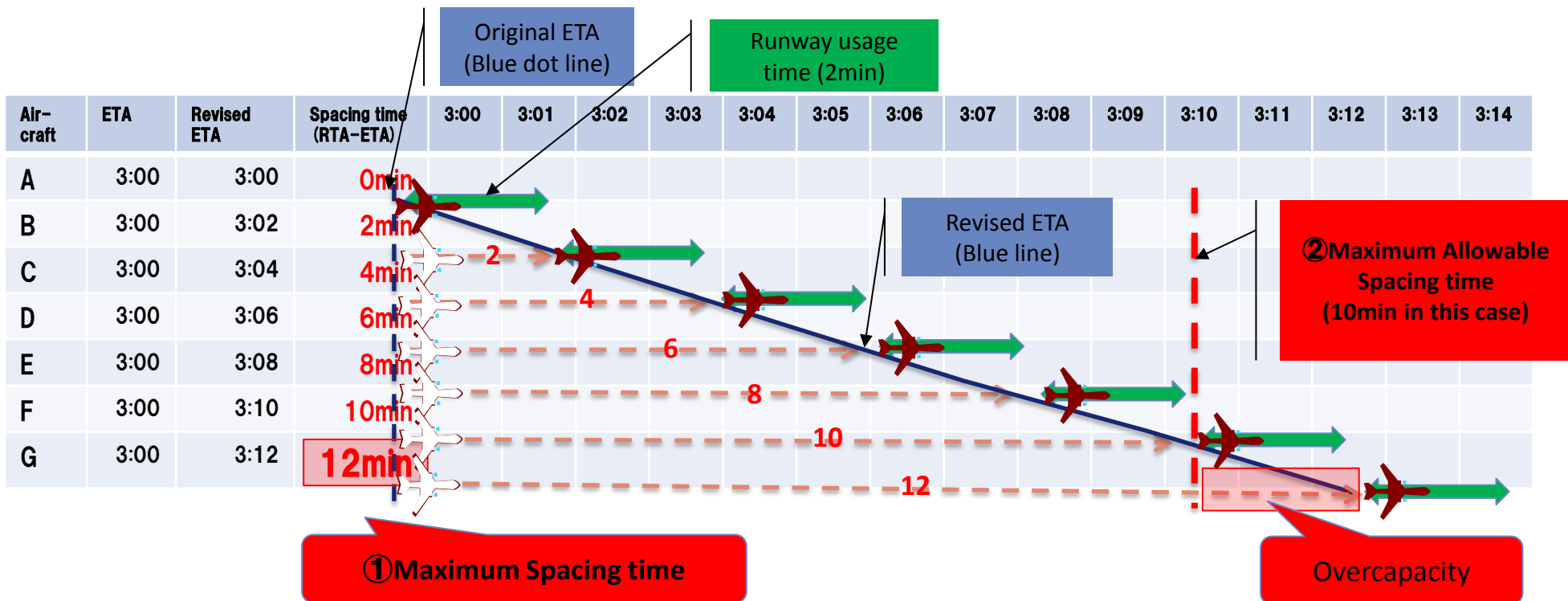
- Flow control executions: about 2,500 times/year
- Flights assigned to departure delay : about 25,000 flights/ year
(1.65% of total flight)
- Average delay time: about 8.66 min/flow controlled aircraft

1. NTT DATA's approach to ATFM

- Capacity of the airport

Capacity

- Capacity of the airport is measured by “Spacing Time”.
- Spacing time is the extent of the time that air traffic controller must delay the time of arrival at runway in the air so that all aircraft can land sequentially with keeping proper separation. (ex. Runway usage time)
- When Maximum Spacing time exceed Maximum Allowable Spacing time, the situation is overcapacity

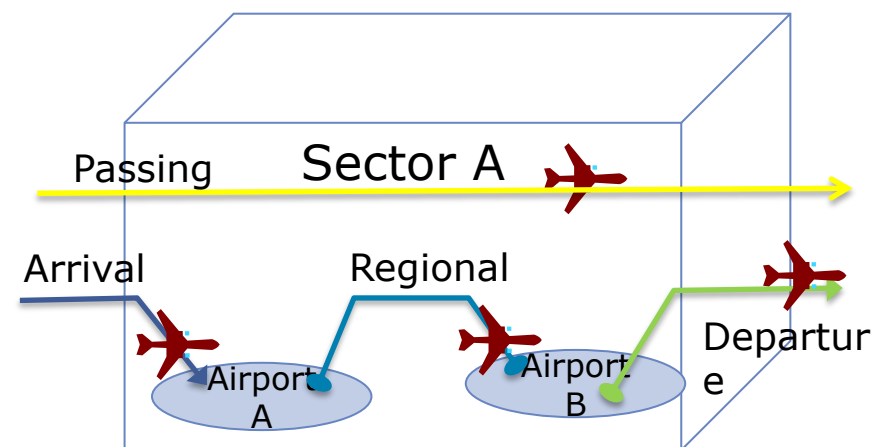
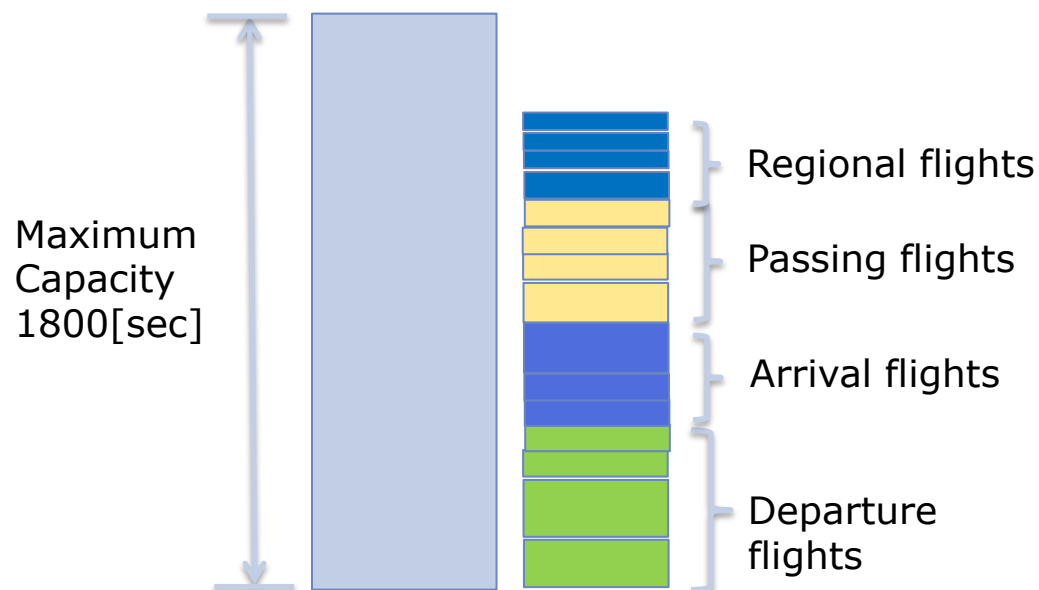


1. NTT DATA's approach to ATFM

- Capacity of the Sector

■ Capacity

- Capacity of the Sector is measured by “workload”
- Workload is the time that air traffic controller have to control aircrafts in every 30 minutes. (instruction, ATC system operation and time of judgment)
- Different value of workload factor is set to each type of flight. (Regional, Passing, Arrival, Departure)
- Workload factor is defined by the result of the simulation based on the operational data, and pre-set to the ATFM system.





2. New Concept for the ATFM System

Our new concept is “Collaborative Planning and Optimization”.
Under this concept, NTT DATA offers solutions for the congestion caused by the rapid air traffic growth, and it enables maximum use of the airspace.

2. New concept for the ATFM System①

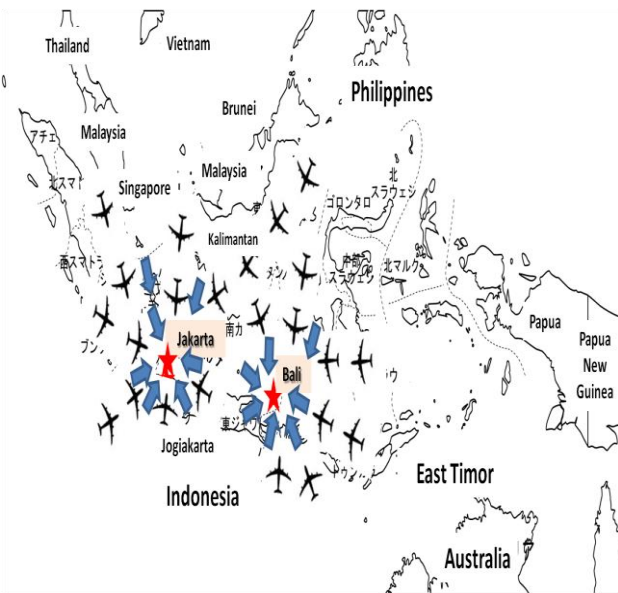
- solution for several kinds of air traffic flow congestion

Our ATFM system can solve several kinds of air traffic flow congestion in the followings.

【Domestic Air Traffic Flow】

Ex. : Indonesia

Feature: Congestion by excessive domestic air traffic flow in several area



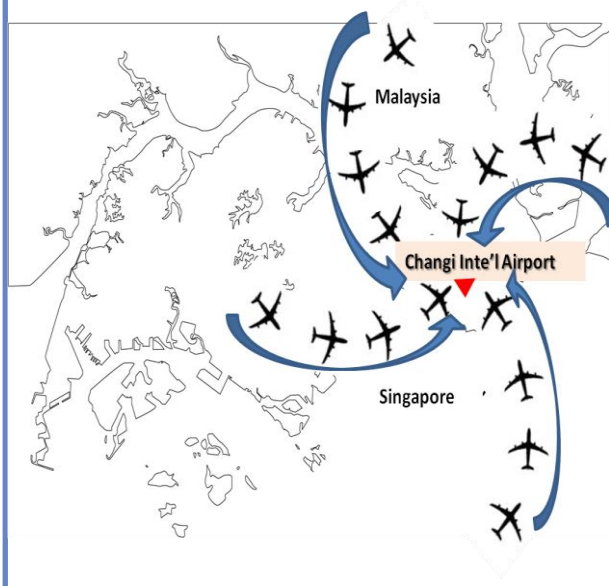
【System Needs】

Overall optimization of whole domestic air traffic flow

【Particular Airport】

Ex. : Singapore

Feature: Congestion by excessive air traffic flow around particular large airport



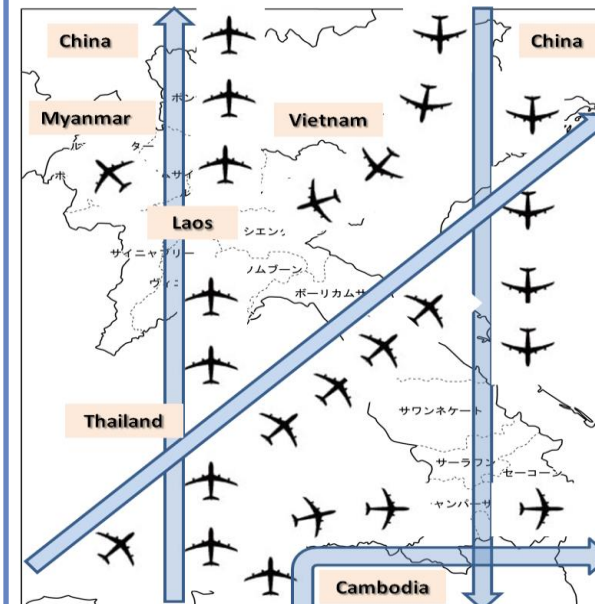
【System Needs】

Individual optimization around particular large airport

【International Air Traffic Flow】

Ex. : Mekong Region

Feature: Congestion by excessive air traffic flow among several countries



【System Needs】

Sharing air traffic flow among several countries and solve their congestion

2. New Concept for the ATFM System②

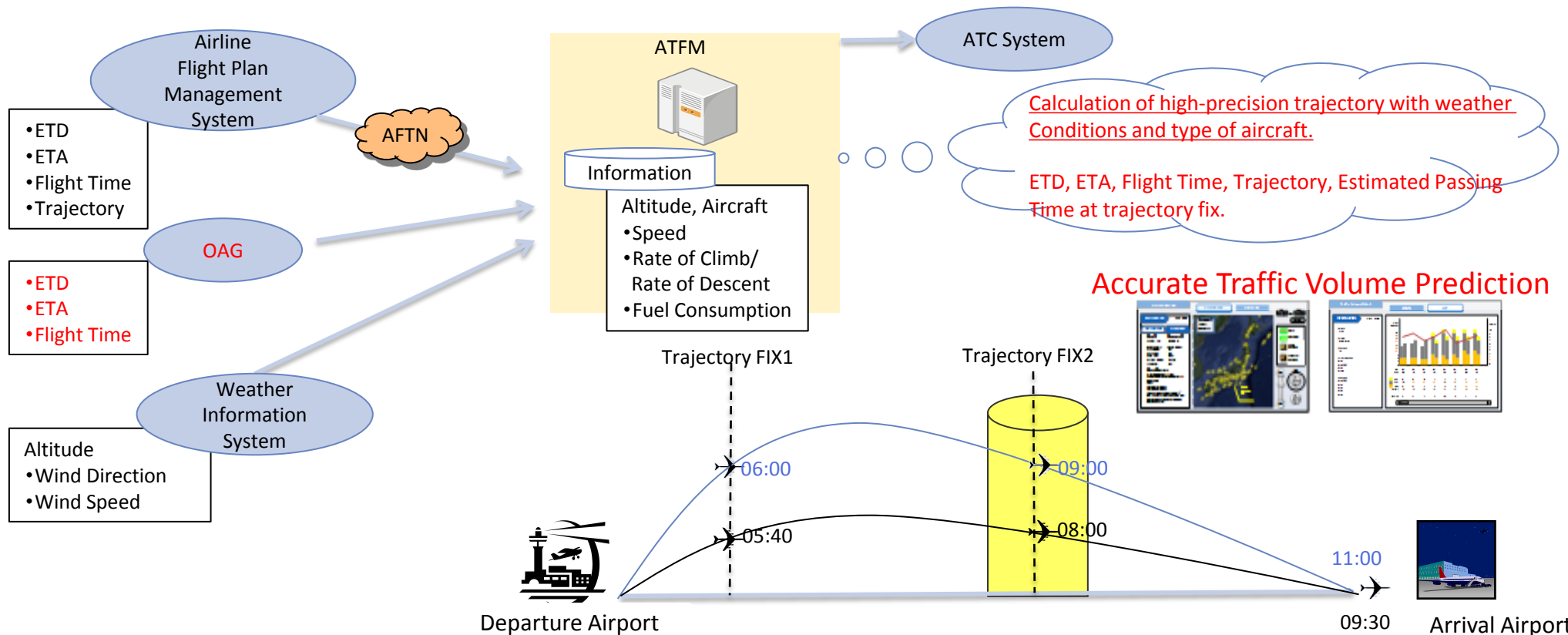
- Enhanced engine for air traffic flow calculation

① To generate trajectory from OAG data

When flight plan is not presented by airline or air traffic flow is verified before flight plan is presented, NTT DATA's ATFM system can show Estimated Departure/Arrival Time, Flight Time and generate trajectory from OAG data internationally available.

② To predict accurate traffic volume from high-precision trajectory

NTT DATA's ATFM system can calculate Estimated Passing Time at trajectory fix and Estimated Arrival Time with weather conditions and aircraft performance. The ATFM system can improve their accuracy with recalculation whenever flight plan and weather condition are updated.



2. New Concept for the ATFM System③

- Enhanced engine for a large volume of air traffic flow

① Selectable Coordination by Aircraft

- Only aircrafts from domestic airports
- Only aircrafts from overseas airports
- Exception special flight like VIP, etc.

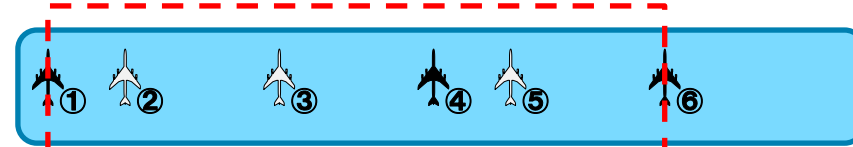


② Various Coordination Methods

- Trajectory Coordination: To avoid congested area by rerouting
- Time Coordination:

Before Flow Control

(6 aircraft throughput /50 minutes)



First Come
First Served

After Flow Control



- To keep moderate spacing time among aircrafts
- To reduce traffic volume unit time

Coordination Methods

1	FCFS (First Come First Served) <Scheduled Departure Order>
2	FCFS (First Come First Served)<Scheduled Arrival Order>
3	FCFS (First Come First Served) <Scheduled In-Bounding Order to Control Area>
4	OTFS (On Time First Served)

×

Delay Allocation Methods

1	Equal delay to all aircrafts → Focus on average delay time
2	Delay in specific aircrafts → Focus on on-time performance

×

Control Area

1	Runway
2	Airport
3	Fix
4	Sector
5	FIR Boundary

×

Control Methods

1	Ground Delay Program(GDP)
2	Ground Stop(GS)
3	Minimum Departure Intervals(MDIs)
4	Minutes-in-trail(MINIT)

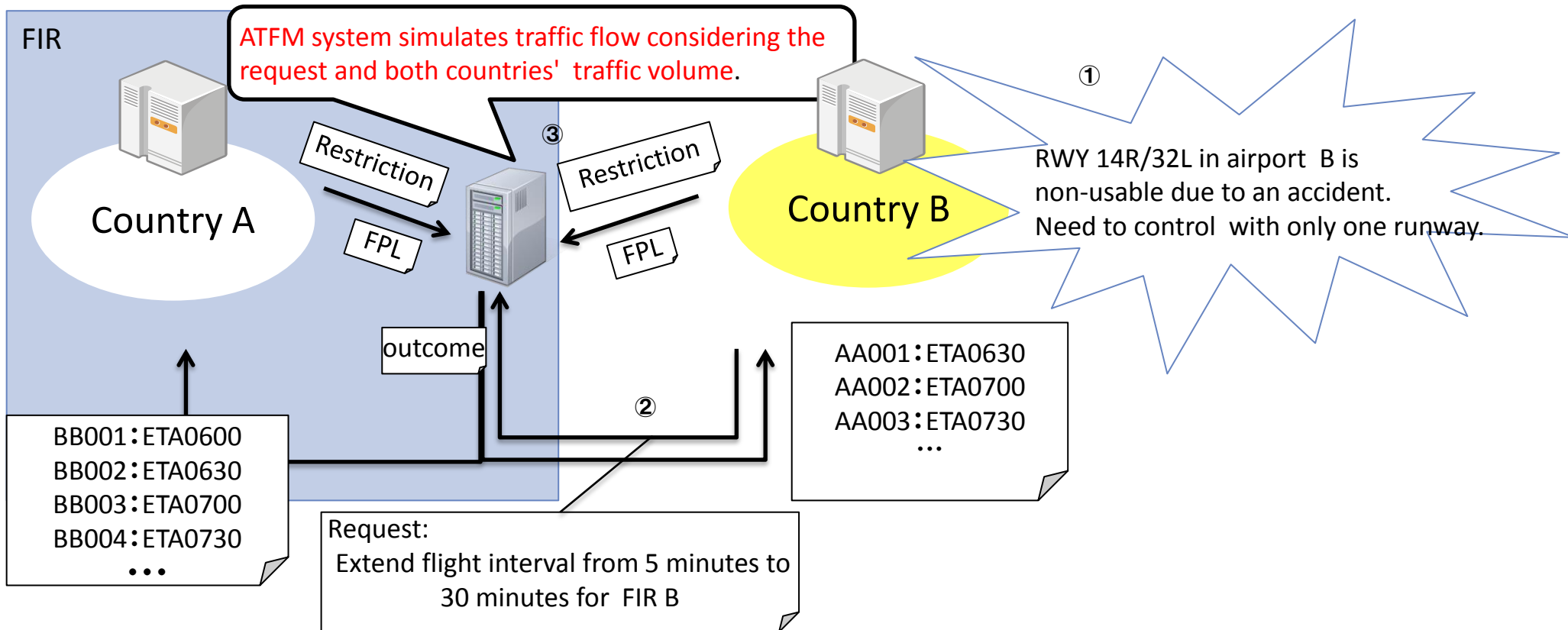
2. New Concept for the ATFM System④

- International flow management

This function handles Sub-Regional ATFM concept with CDM.

This method can reduce the workload of 2 countries' ATFMS and achieve efficient flights for both of the countries. Neighbor countries need same ATFM system. Main server coordinates harmonized air traffic flow between two countries. Both countries input restrictions for flow control before the calculation.

(ex. flight interval to their FIRs)

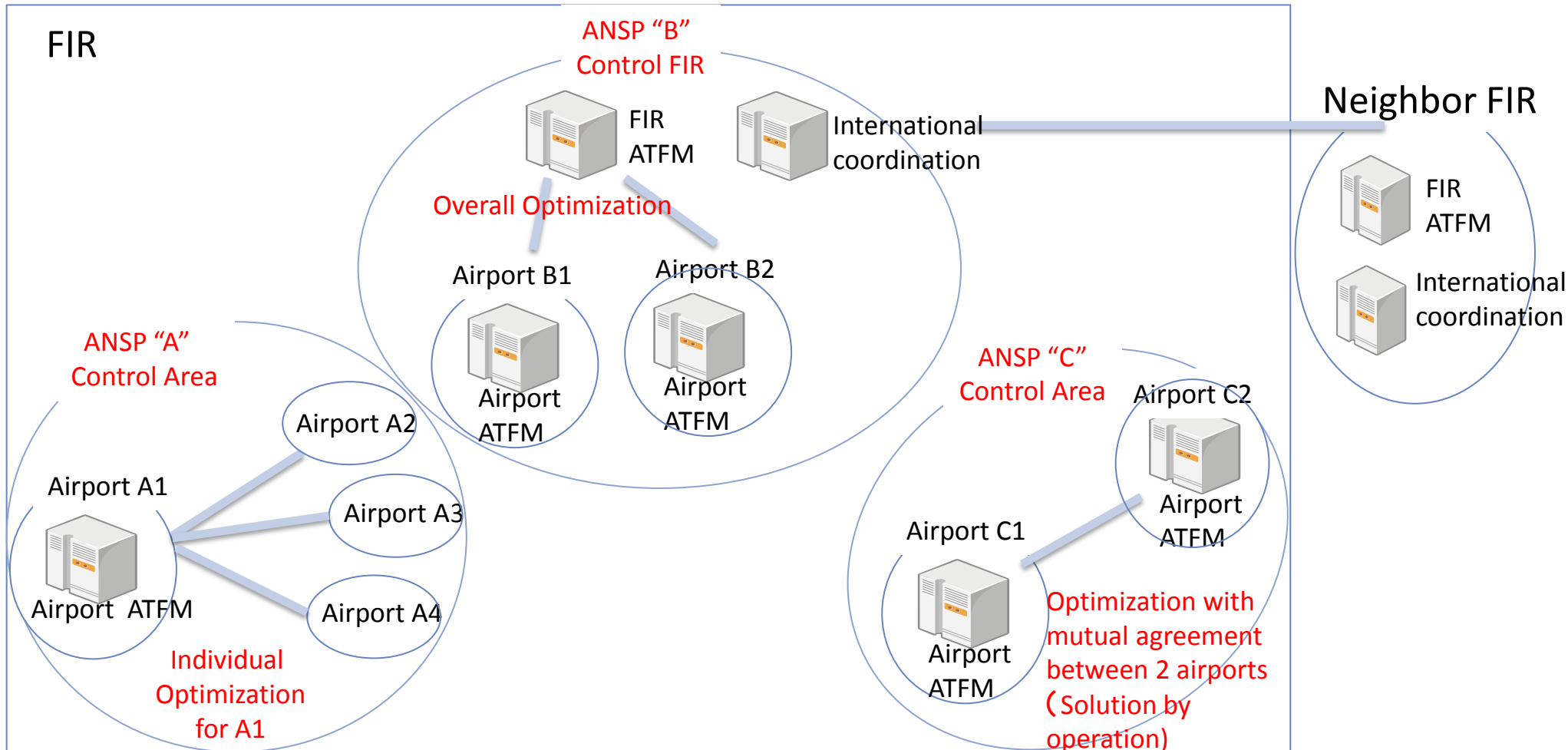


2. New Concept for the ATFM System⑤

- flexible Optimization

Our system can meet various kinds of requirements for air traffic flow management from individual optimization to overall one.

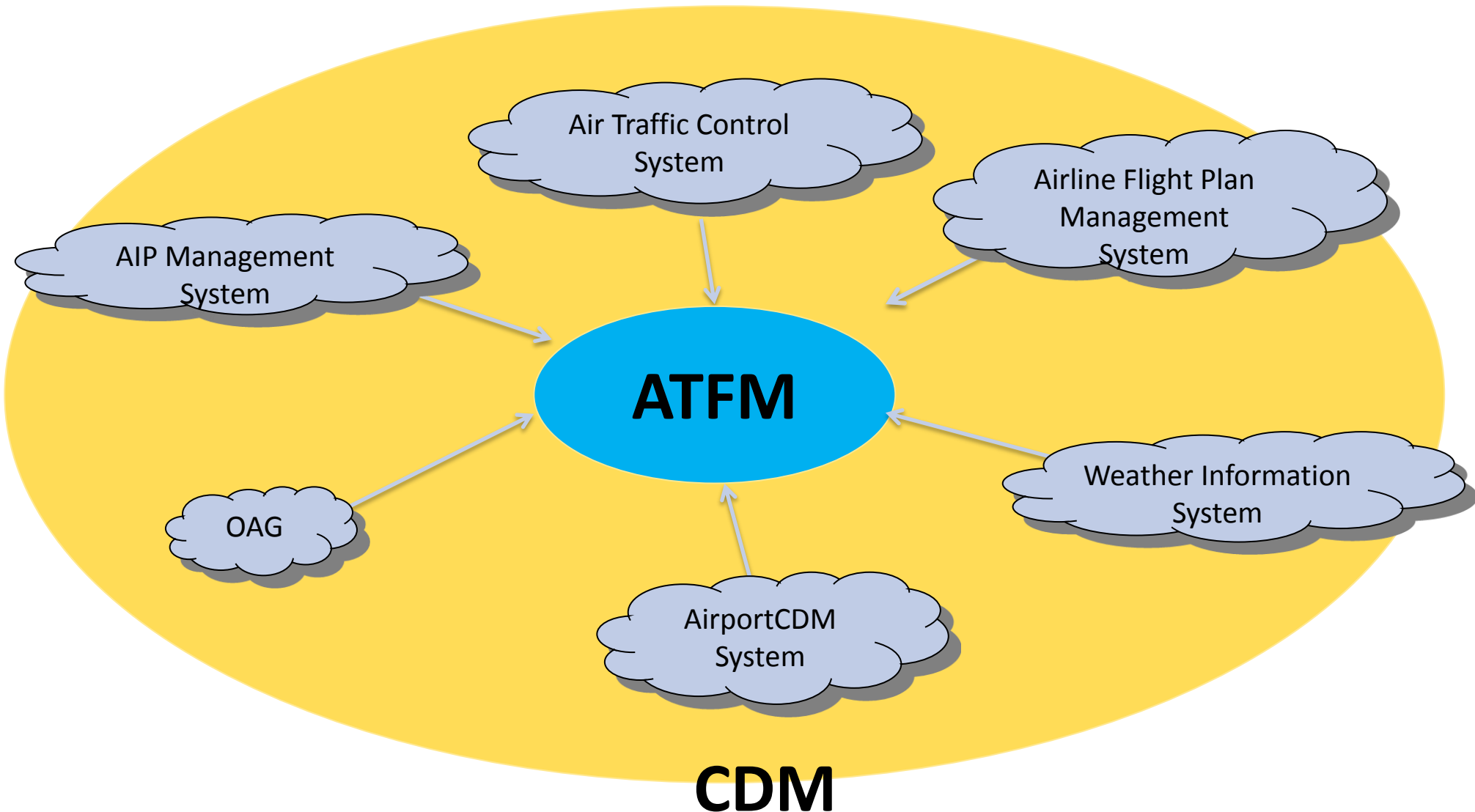
(Optimization for an airport and domestic FIR, International coordination with neighbor FIR)



2. New Concept for the ATFM System⑥

- Connection with other systems

Our ATFM system enables end user to make system integration and support CDM





3.Future works

3. Future works

NTT DATA will contribute to ASBU implementation supporting application for ATC/ATM

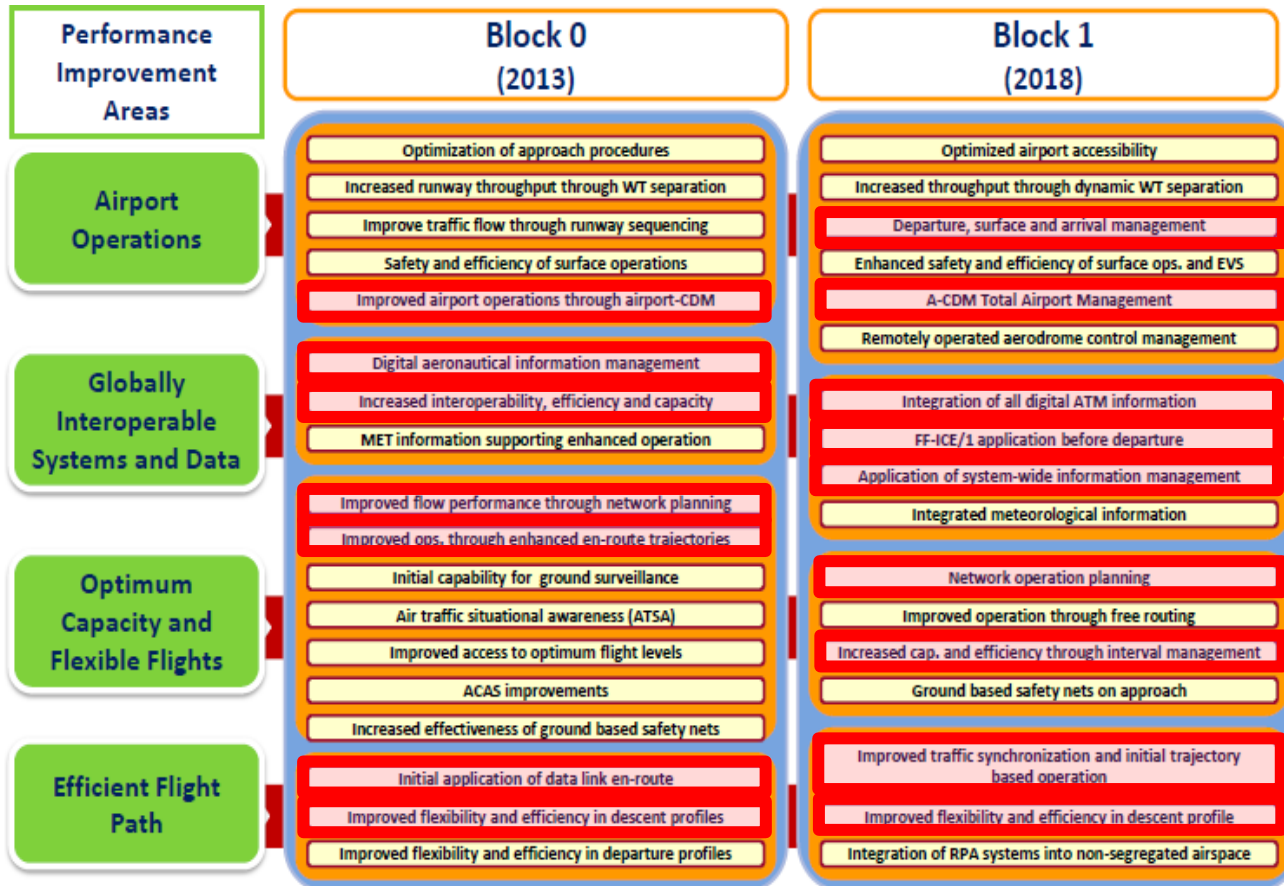
CNS technology

- ATS Interfacility Data Communications
- Surveillance Data Fusion
- Data exchange model standardization
-AIXM/FIXM,SWIM

Apply to ATC/ATM

- Trajectory based operation
- Optimum capacity
- Total optimization of air traffic flow
- Airport CDM

“Collaborative Planning and Optimization”





NTT DATA

Global IT Innovator