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中国民用航空局
空中交通管理局
Air Traffic Management Bureau, CAAC

The Solution to the Centralized FDP Risks of Large ATM Automation System

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ATMB of CAAC, CHINA 2020/10

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- Part2: Deployment and Operation
- Part3: Key technologies
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Part1: Overview

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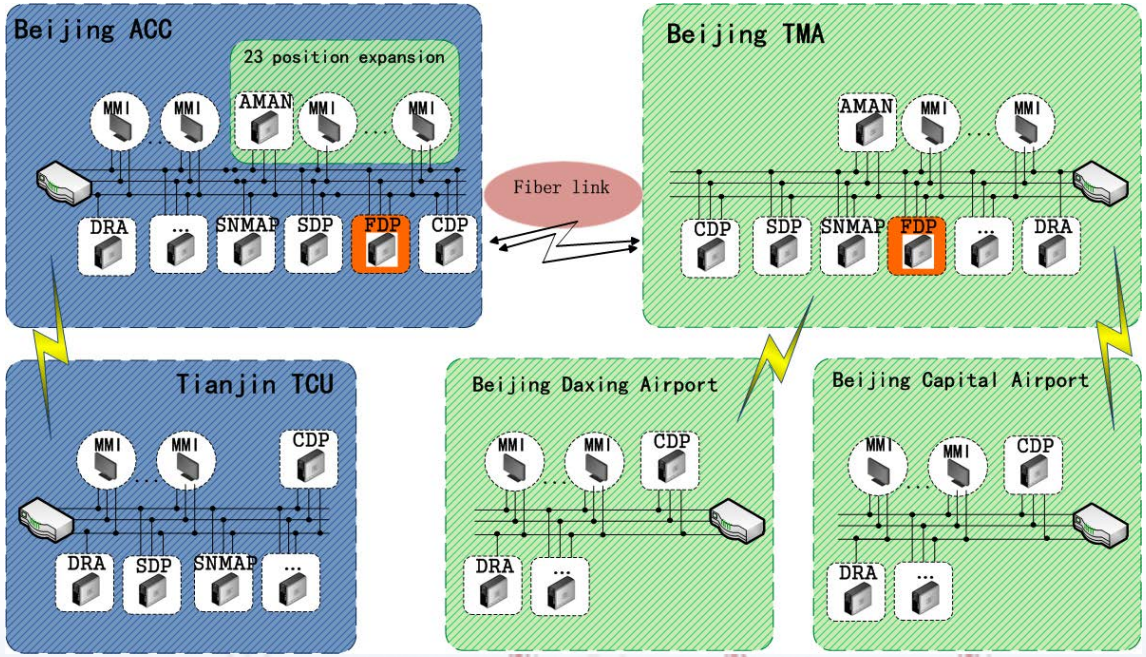
1 Overview:

Beijing Daxing International Airport

- Opened in Sep 25th 2019
- Four runways + Two control tower.
- Another hub airport in Beijing.
- The passengers to handle annually:
  about 45 million by 2022,
  about 72 million by 2025.
- It is considered as **a new power source for national development of China.**

1 Overview:



Beijing ATM Automation System, the largest system in the world.

◆ Meeting the requirement of heavy traffic flow of two hub airports in Beijing and Tianjin Binhai International Airport.

◆Provision ATM services for two cities, three airports, and five facilities.

◆There are 230 MMIs, 360 nodes.

◆ Five sub-system **share flight data through the central Flight Data Processor.**

1 Overview:

Capital Airport

Beijing TMA

Beijing

9KM

8KM

25KM

Tian An Men

Beijing ACC

67KM

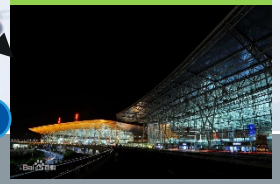
46KM

Daxing Airport

Tianjin

85KM

Binhai Airport



1 Overview:

Risk

Centralized FDP

ACC

TMA

Fallback FDP (TFDP)

How to solve it?

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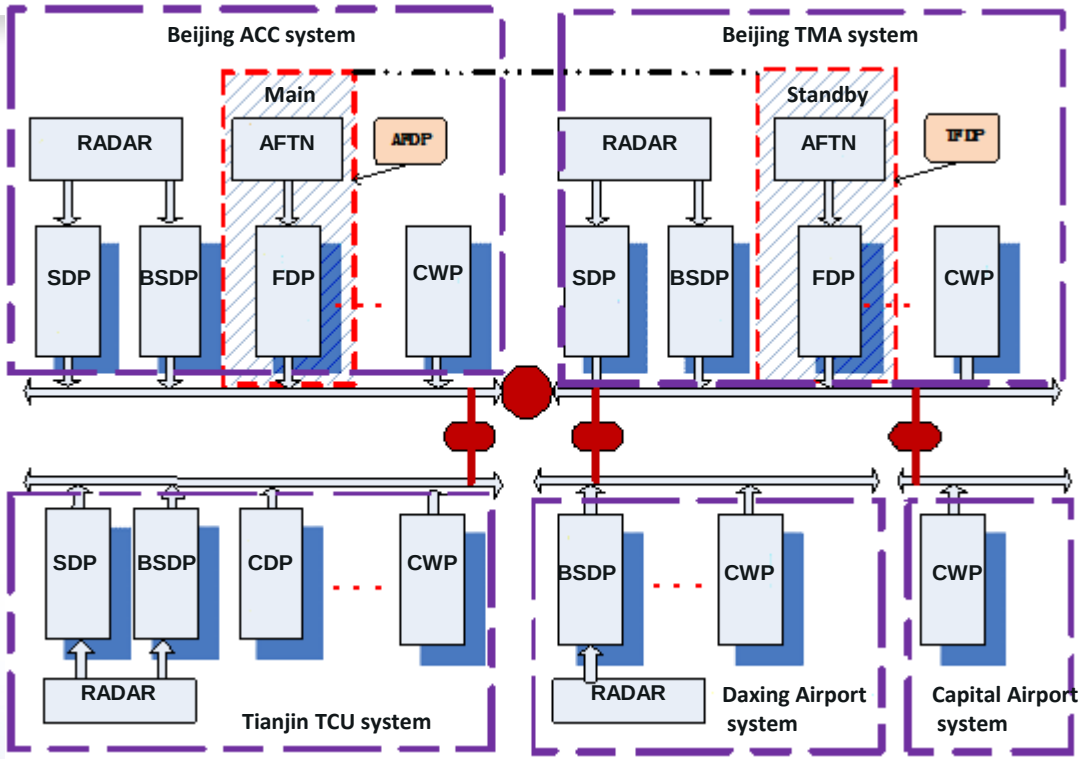
2.1 Deployment scheme:

- AFDP is deployed in ACC while TFDP is in TMA.
- Normally, AFDP is active, which processes AFTN and distributes flight data, TFDP is standby.
- Once AFDP fails, TFDP can be activated manually.

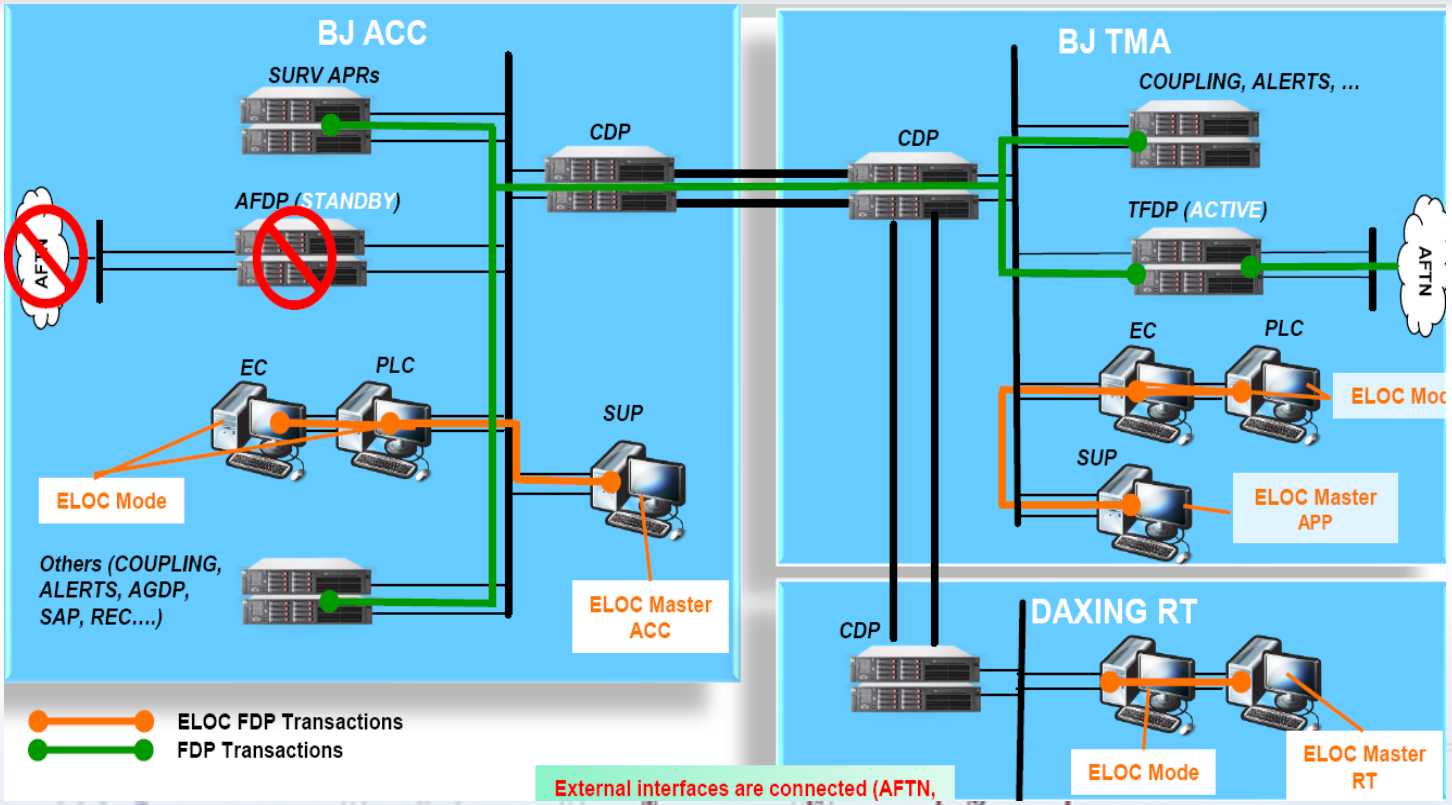


2.2 Operating mode:

Use Case1: AFDP failure

- **Step1:** In case of AFDP failure, position will be degraded to ELOC.
- **Step2:** Disconnect interfaces from AFDP and connect them to TFDP.
- **Step3:** Activates TFDP at SUP, all system software is connected to TFDP.
- **Step4:** Clicks the data SYN button in SUP, position changes to LOC.
- **Step5:** The position can be upgraded from LOC to NORM after check.

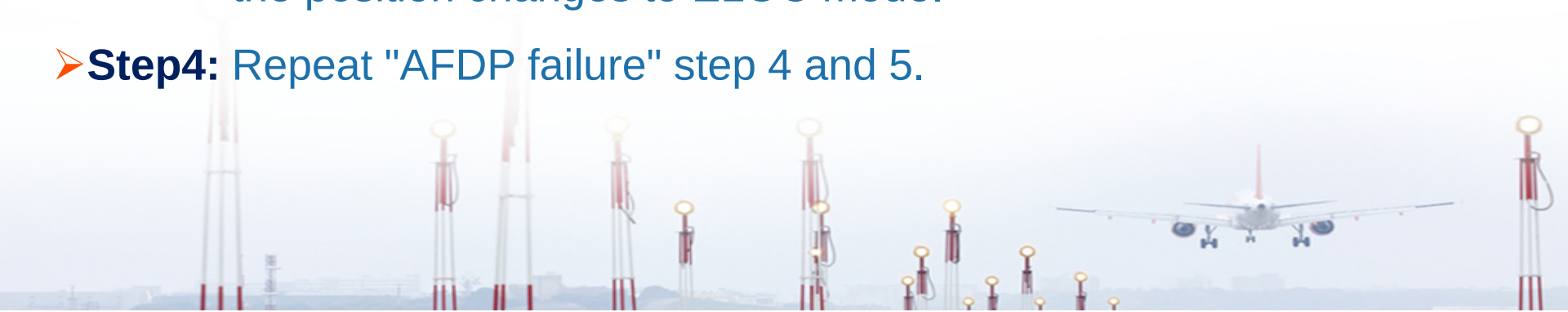
2.2 Operating mode:



2.2 Operating mode:

Use Case2: AFDP recovery

- **Step1:** After AFDP is recovered, it is standby.
- **Step2:** Disconnect interfaces from TFDP and connect them to AFDP.
- **Step3:** Activates AFDP, all system software is connected to AFDP, the position changes to ELOC mode.
- **Step4:** Repeat "AFDP failure" step 4 and 5.

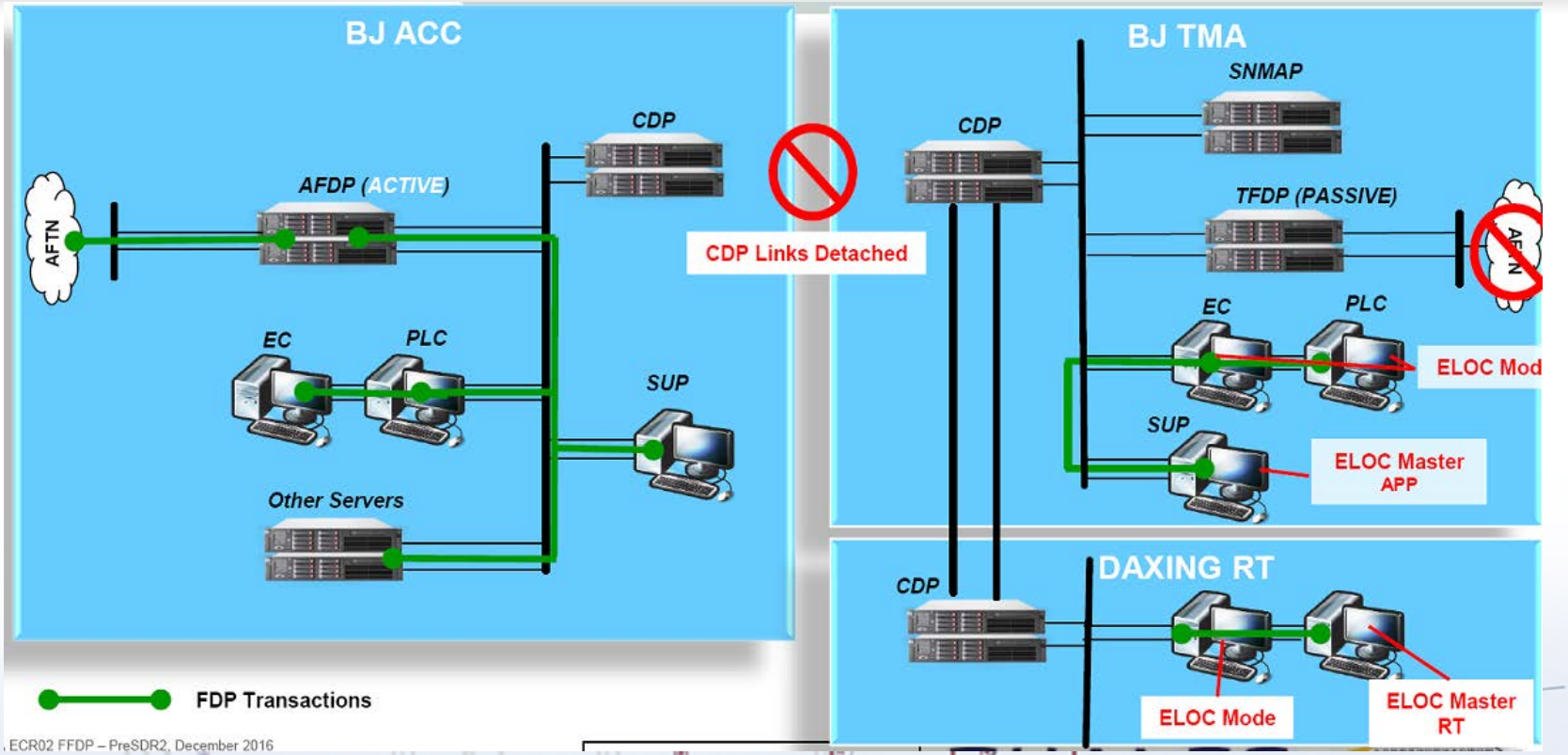


2.2 Operating mode:

Use Case3: The link between AFDP and TFDP is interrupted

- **Step1:** AFDP and TFDP provide flight plan processing for their own partition respectively.
- **Step2:** After the link is restored, AFDP or TFDP data shall be chosen for manual synchronization.
- **The recommendation is to use the backup system.**

2.2 Operating mode:



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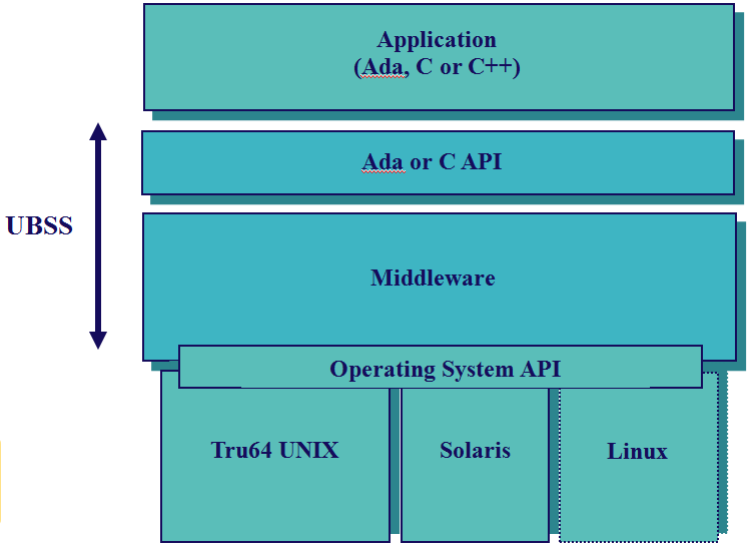
3.1 Basic concepts of UBSS:

The system uses UBSS technology, which can solve the differences in OS layer and provide a unified API.

- **BNS (Basic Name Service)**
- **FIFO (Inter-process Communication)**
- **CDC (Consistent Data Copy)**



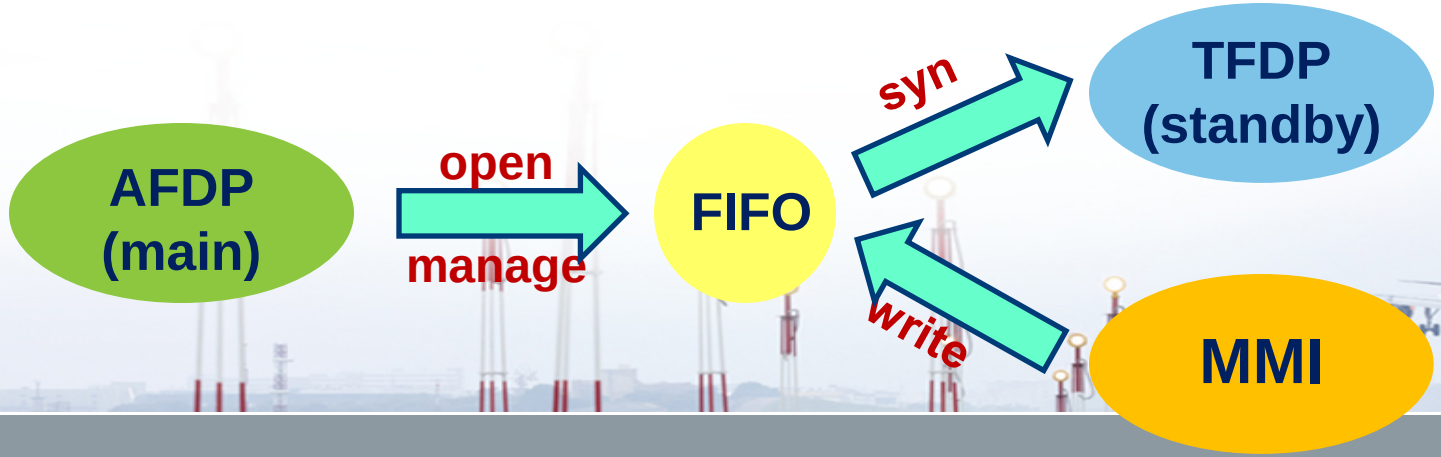
3.1 Use BNS to manage FDP

- Add new BNS values (CURRENT_FDP_MODE, PARTITION_FDP).
- Management of FDP main and standby status.
- Avoid the logical error of the system without main FDP.

3.2 Use FIFO feature to minimize software modification:

FIFO feature -- whoever opens the FIFO and manages it:

- Synchronizes the data stored in the FDP disk through FIFO.
- MMI creates the flight plan and writes it into the COMMAND FIFO.
- AFDP is the main and manages this FIFO.
- Uses the MAIN_TO_BACKUP_SYN FIFO to synchronize data to TFDP.

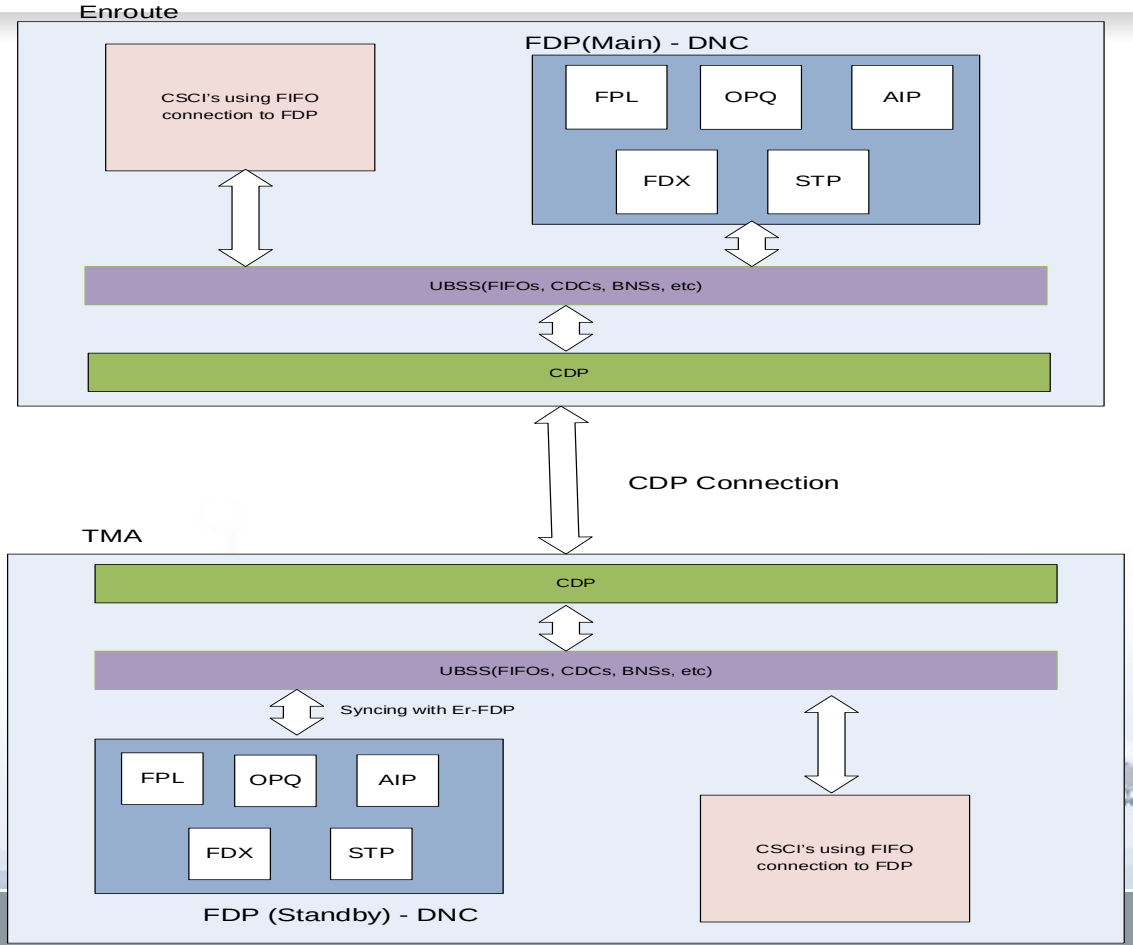


3.2 Use FIFO feature to minimize software modification:

After switching:

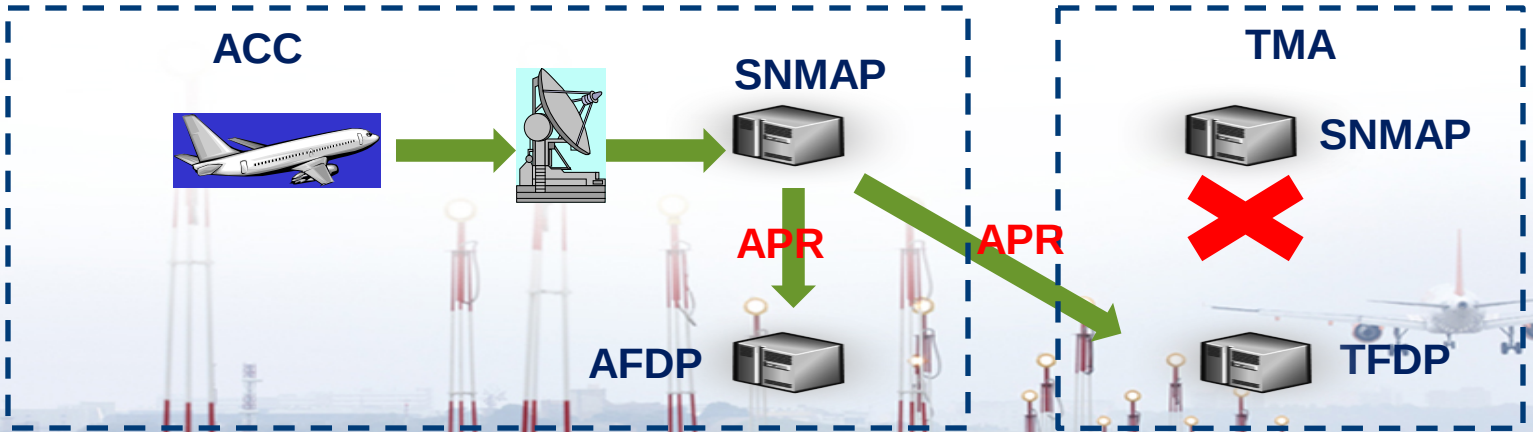
- TFDP is main and re-open the above FIFO.
- MMI will still use COMMAND FIFO to create flight plan.
- Software does not care about which FDP processes the flight plan.
- Minimize the modification of the MMI and FDP.

3.2 Use FIFO feature to minimize software modification:



3.3 Use APR to reduce the radars in TMA:

- APR is used to updates the flight 4D profile.
- TFDP is activated, it receives the APR from SNMAP in ACC.
- Reduce the radar numbers in TMA.



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4 Future and outlook

- Strengthen TFDP training and organize the rehearsal
- Study the solution to AIDC dedicated lines when TFDP is activated
- Promote the research and application of new flight data exchange standards
- Provide the reference for the next-generation ATM automation system

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Thank You for attention!