Architecture of the Next-generation Air Traffic Control System Based on Cloud Computing and Virtualization Technology

State Key Laboratory of Air Traffic Management System and Technology

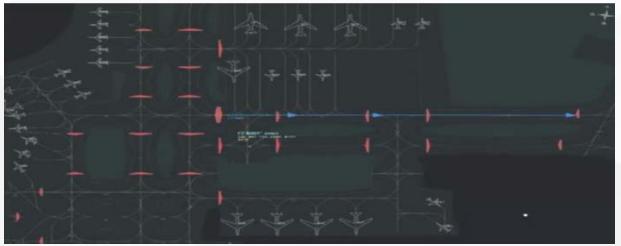
Contents

1. Introduction

Achievements in Chinese Aviation Industry

Beijing Daxing International Airport

Air Traffic Control System with 170 Seats (biggest in China)



Advanced Surface Movement Guidance and Control System (most advanced in the world)

Serves 10 million passengers per year, and the number will reach 45 million

1. Introduction

Problems of Current Air Traffic Control Systems

Architecture
inflexible, inextensible

Computing Resource
complex maintenance

Data
distributed, heterogeneous

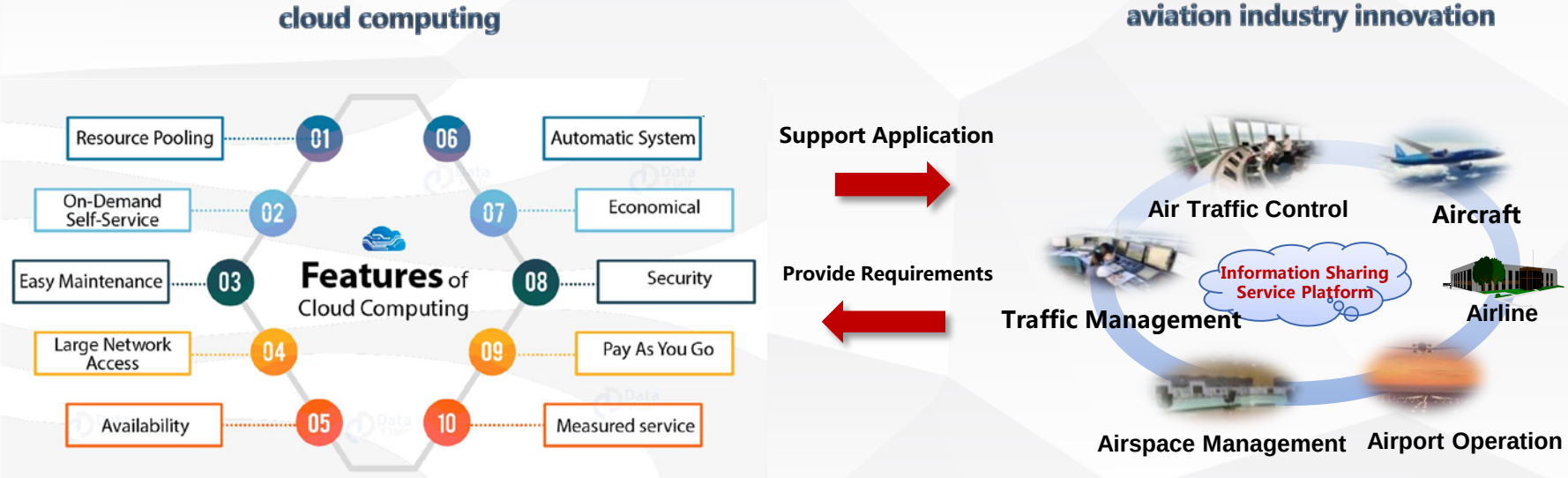
Software
unsmooth update

Key technical problems:

- ◆**Combining new technologies with the actual operation requirements of air traffic control**
- ◆**Exploring the development direction of the new generation air traffic control system**

1. Introduction

Cloud computing promotes aviation industry reform and innovation



- **The wide application of virtualization, data center, and microservices in different fields inspires the innovation in aviation industry.**

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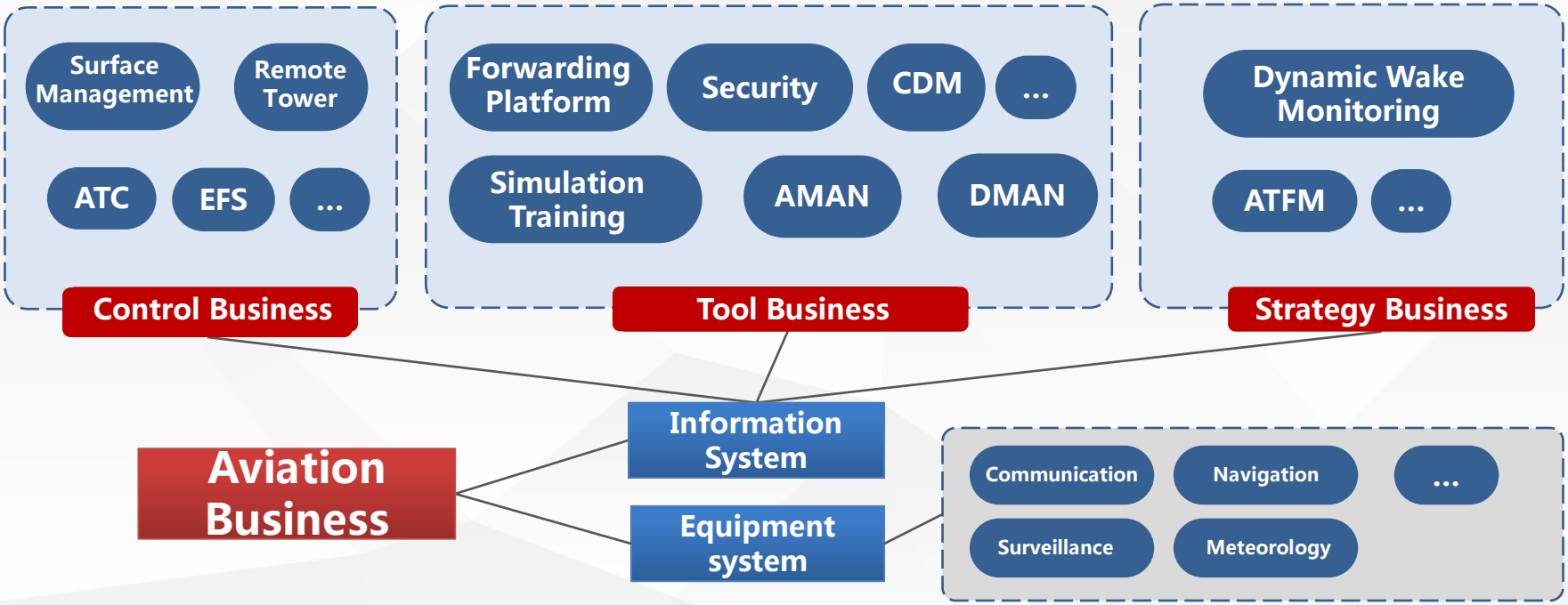
2. Framework



Business Scope of Air traffic Control

2. Framework

The importance of the business

Impact on flight safety

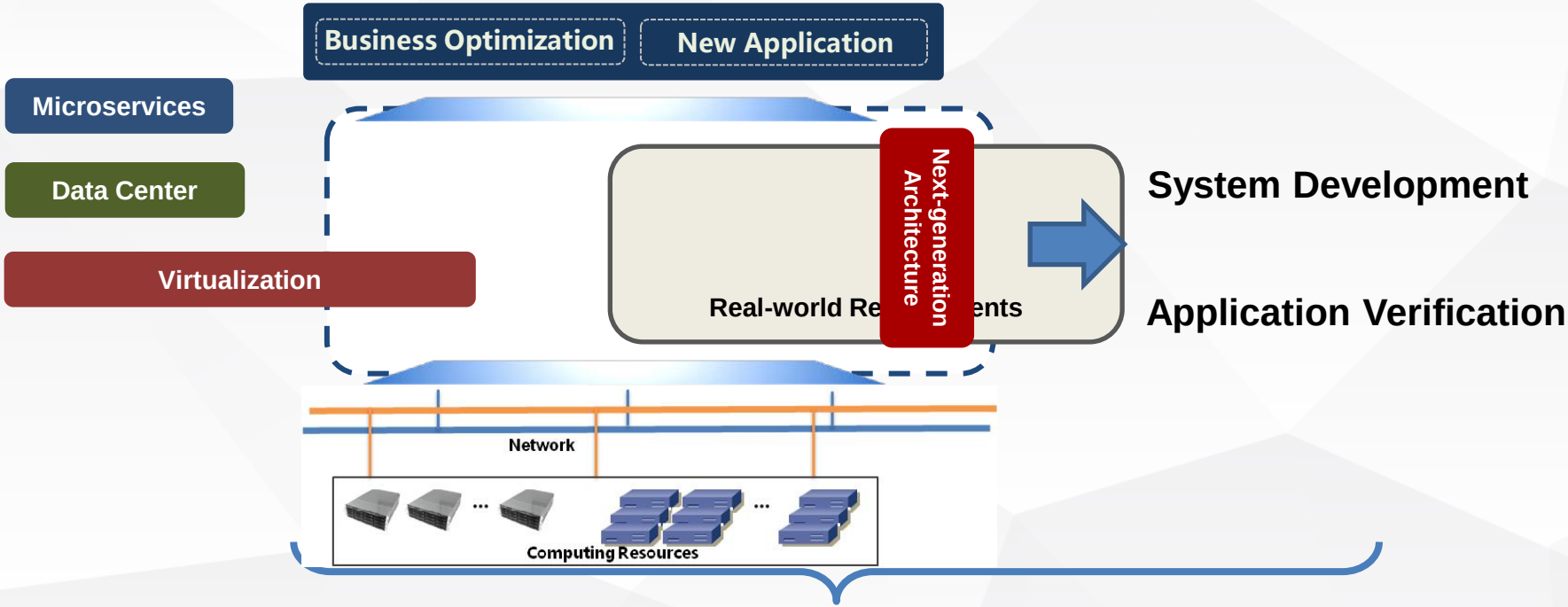
Dependence of the scope and quality of data

Real-time requirements

Reliability requirements

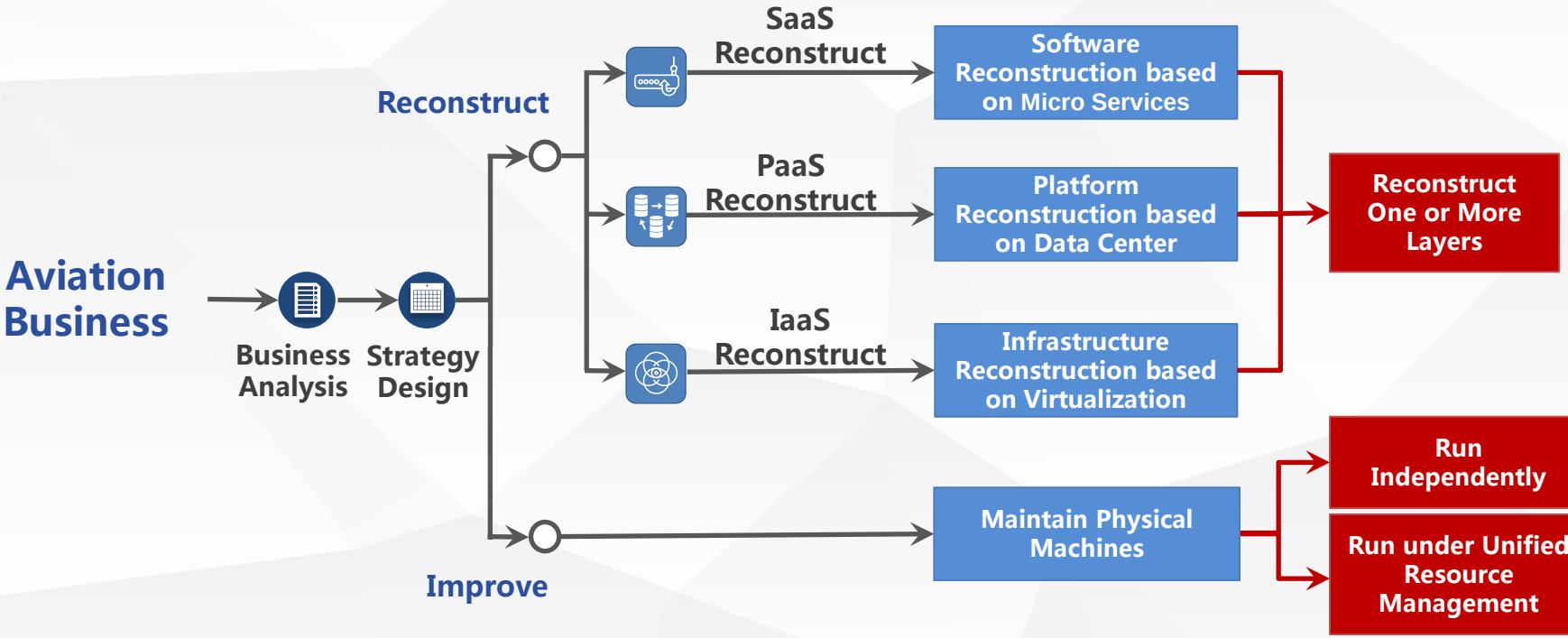
Uninterrupted requirements

2. Framework

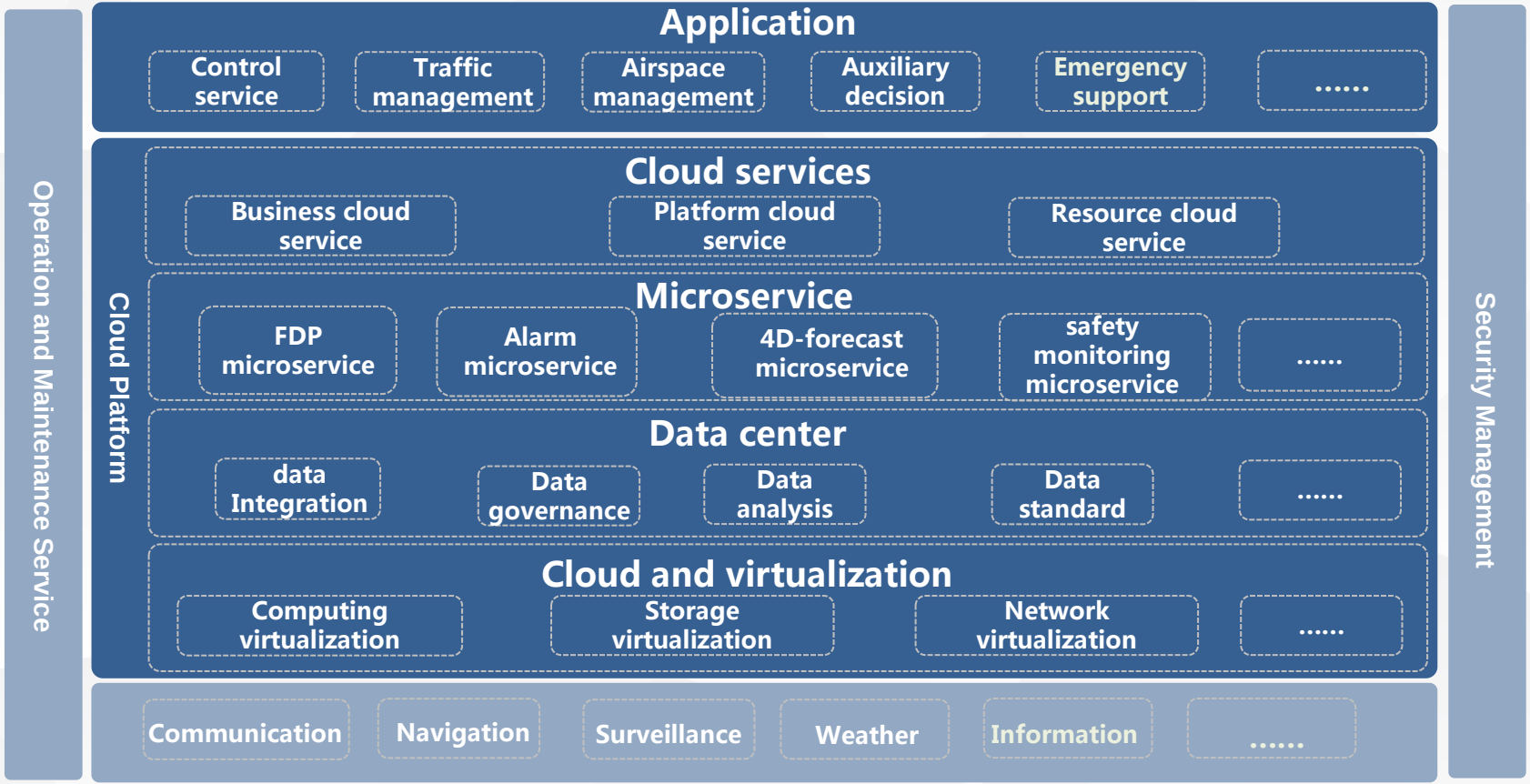


Air Traffic Control System Based on Cloud Computing

2. Framework


Aviation Business
Business Analysis
Strategy Design
Reconstruct
Improve
SaaS Reconstruct
PaaS Reconstruct
IaaS Reconstruct
Software Reconstruction based on Micro Services
Platform Reconstruction based on Data Center
Infrastructure Reconstruction based on Virtualization
Reconstruct One or More Layers
Maintain Physical Machines
Run Independently
Run under Unified Resource Management

2. Framework


Application
Control service
Traffic management
Airspace management
Auxiliary decision
Emergency support
.....
Cloud Platform
Cloud services
Business cloud service
Platform cloud service
Resource cloud service
Microservice
FDP microservice
Alarm microservice
4D-forecast microservice
safety monitoring microservice
.....
Data center
data Integration
Data governance
Data analysis
Data standard
.....
Cloud and virtualization
Computing virtualization
Storage virtualization
Network virtualization
.....
Communication
Navigation
Surveillance
Weather
Information
.....
Operation and Maintenance Service
Security Management

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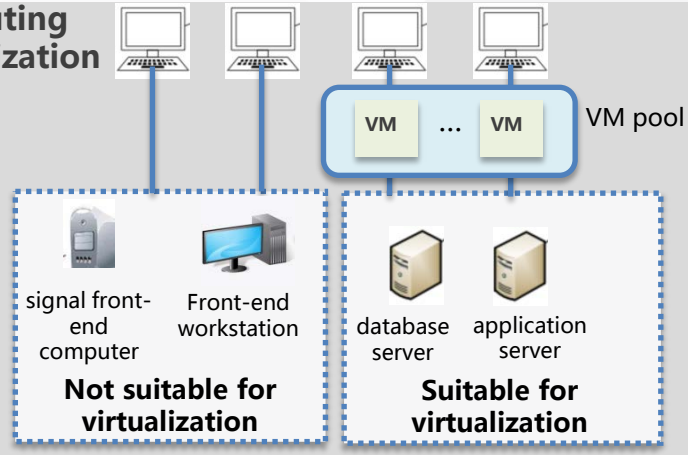
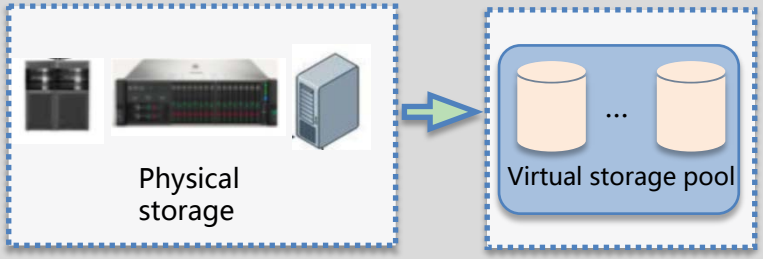
3. Key Technology --- Cloud and Virtualization

- Three aspects of air traffic control business virtualization transformation

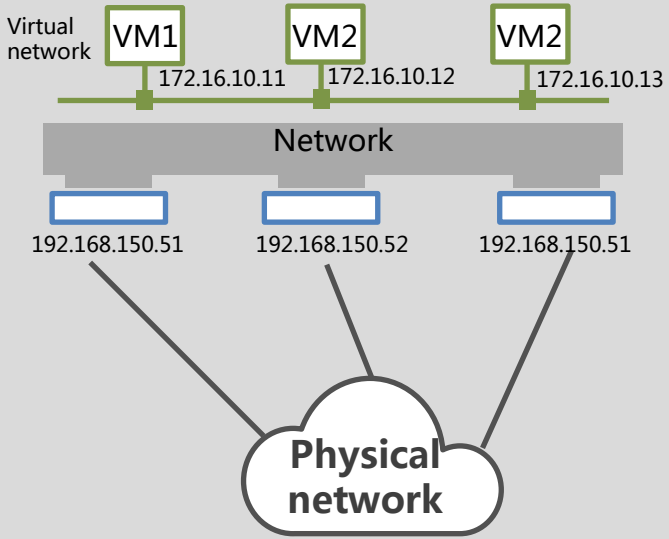
Computing virtualization



Storage virtualization

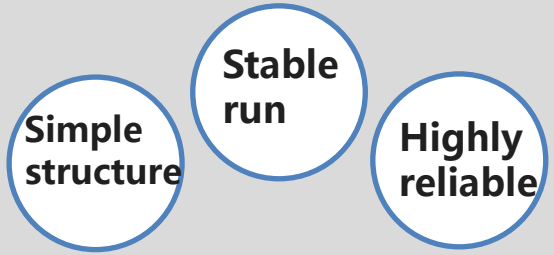


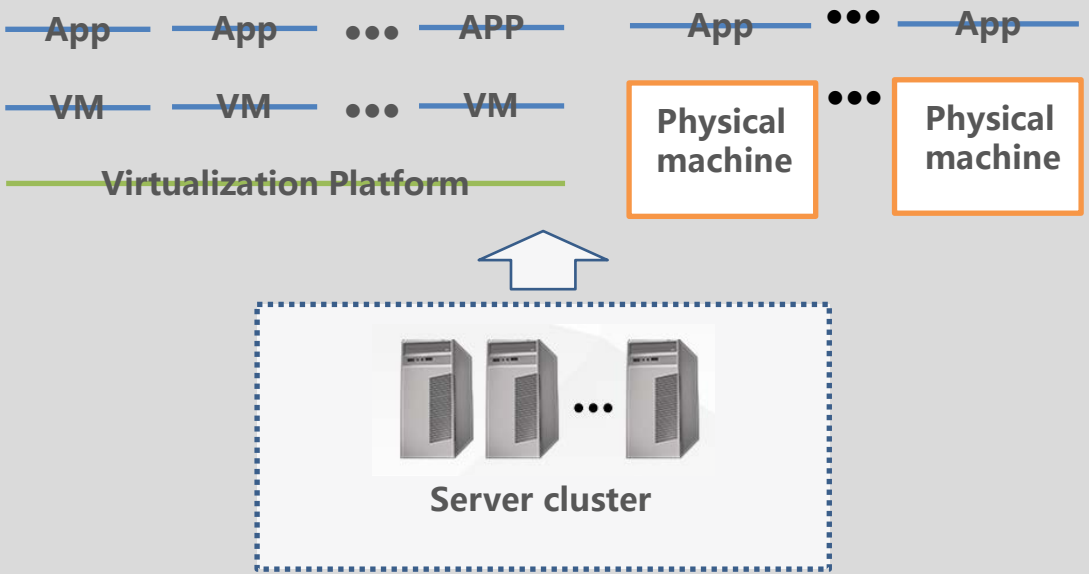
Network virtualization



3. Key Technology --- Cloud And Virtualization

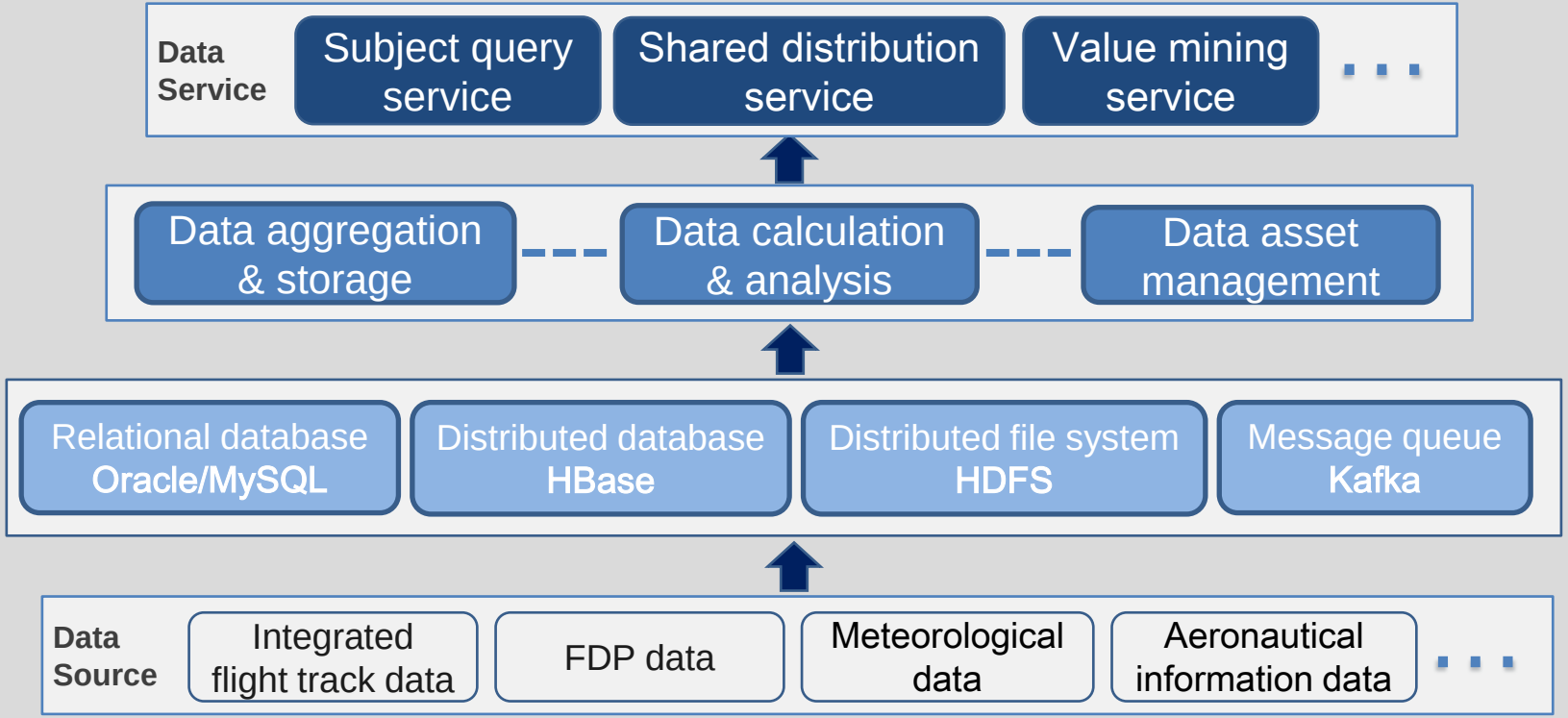
- High reliability service: unified resource management of physical machine





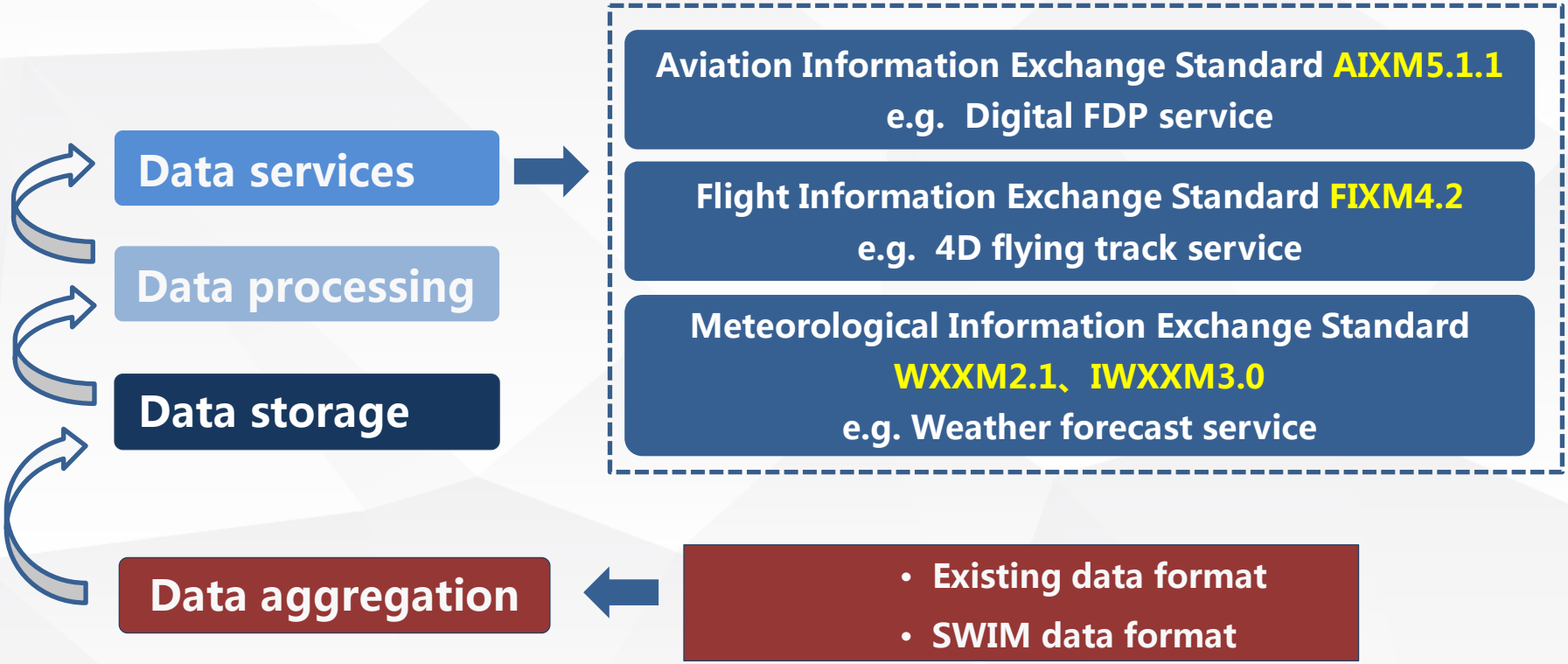
3. Key Technology --- Big Data Platform

ATC Data Service Platform Framework



3. Key Technology --- Big Data Platform

■ ATC Data Exchange Standard

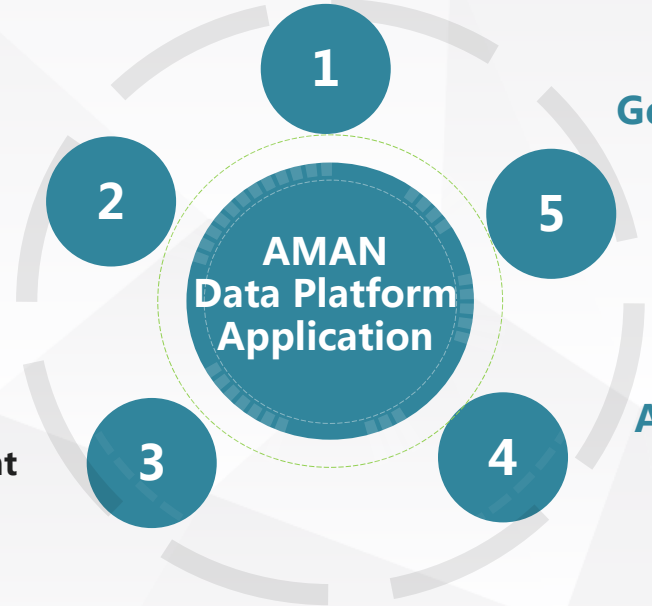


3. Key Technology --- Big Data Platform

ATC Data Service Platform Application — AMAN

Data collection & storage

Integrated flight track data , FDP data...



Data processing

Processing data into ATC data exchange standards

Generating data service

Generating the arrival flight sequencing service

Data subject construction

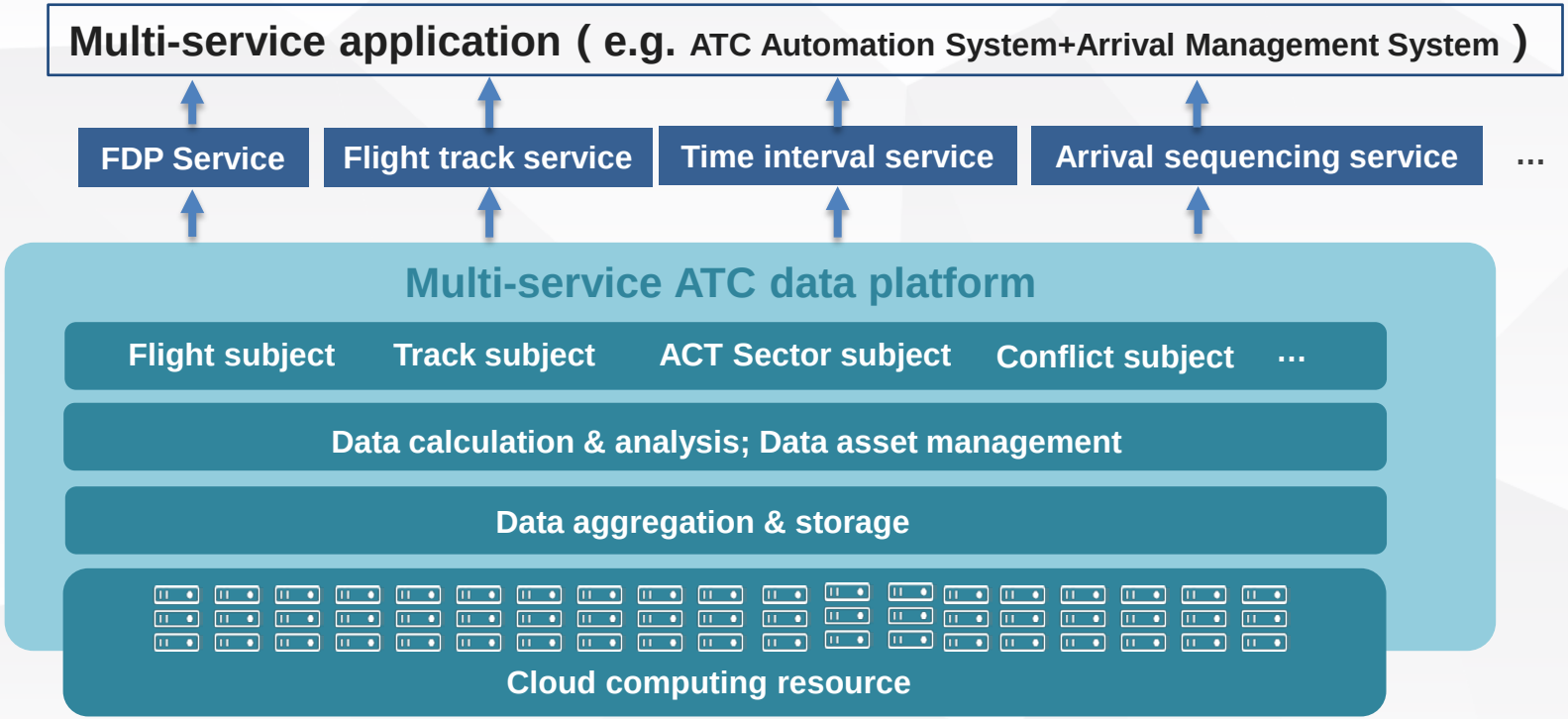
Generating the arrival flight sequencing subject data

Application data mining

Analyzing airport runways, flight sequencing, meteorological information to form the sorting decision suggestion data

3. Key Technology --- Big Data Platform

■ Multi-service ATC data platform

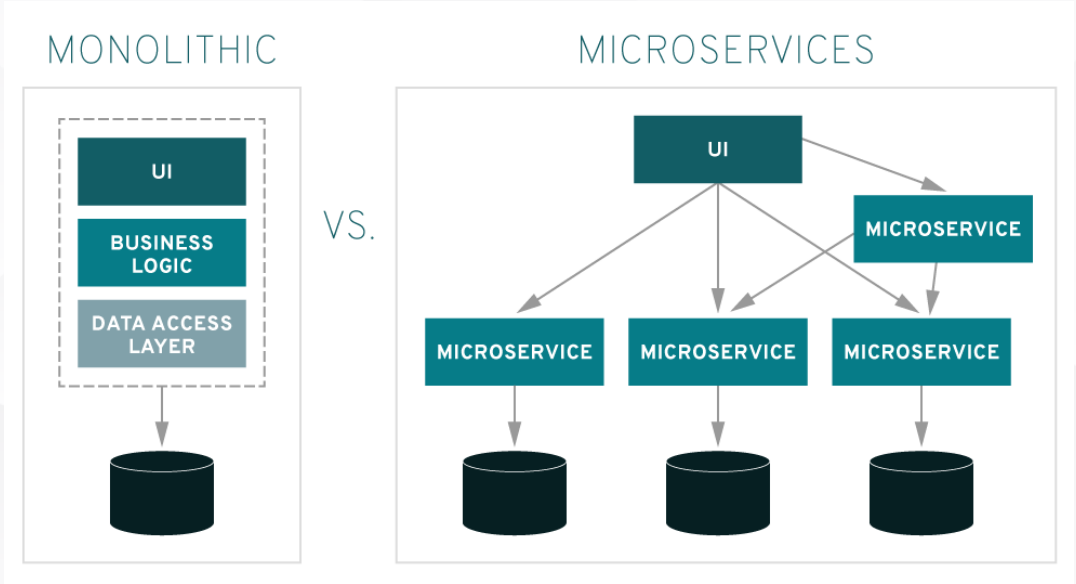


3. Key Technology --- Microservice Architecture

Microservice: main idea

Microservice is an emerging software architecture that splits a large single application into dozens of microservices to meet the business needs of complex systems.

High stability
High scalability



3. Key Technology --- Microservice Architecture

Microservice transformation of ATC system

FDP Microservice construction example

Service Orchestration	Shared service			Proprietary Service	
Application management	Schedule management	Message management	FDP management	Track management	Electronic progress sheet
Service separation	• Schedule of the day • Schedule of next day • Wrong schedule	• Message analysis • Misstatement management • Address management	• Plan management • State management • Secondary code management	• Route analysis • Trajectory prediction • Trajectory correction	• Format management • State management • digitalization
Data separation	Schedule DB	Message DB	Track DB	Weather DB	. . .
Process analysis	Plan generation → Plan management → Plan termination				

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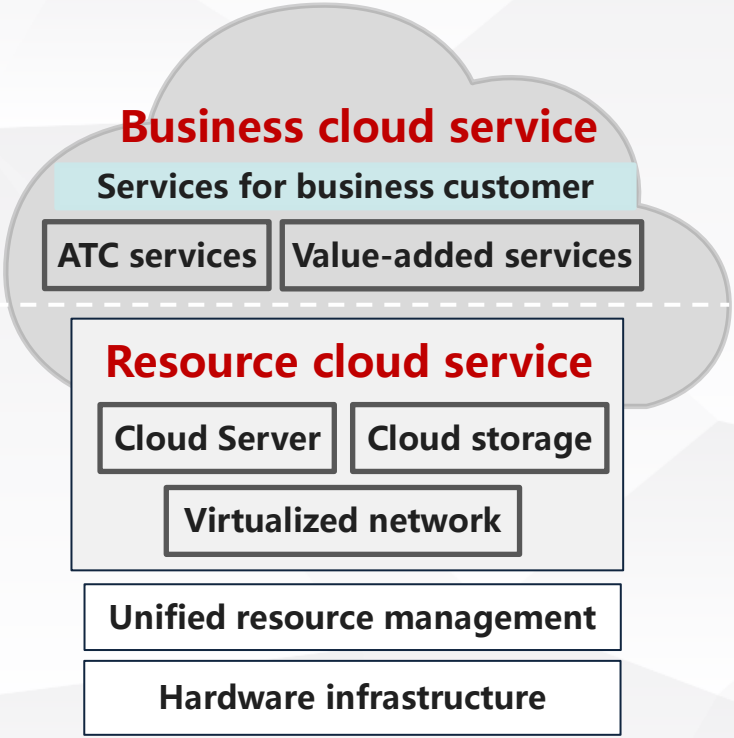
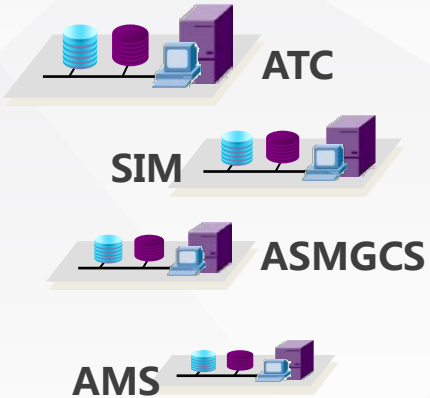
4. Conclusion & Prospects





Bring ATC automation system into the cloud era.

4. Conclusion & Prospects

- Resource management is more reasonable
- Business expansion is more convenient
- Data management is more scientific
- Services run more efficiently
- System runs more robust

For passenger

For airline

For ATC Agency

- In view of the current development and existing problems of the ATC automation system, we proposed a private cloud architecture for ATC automation system.
- The idea is based on technology application cases such as virtualization, data center and microservices, and is deeply integrated with typical ATC services.
- We believe that through this cloud enhancement concept, we can improve the efficiency and stability of ATC system, promoting long-term development of ATC business.


CETC LES Info
Thank You!