

ITU-T FG-ML5G

# Network Operations Intelligence

Evolving network operations by the power of intelligence

2018. 01. 29 | KT Infra R&D Laboratory

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**1 Future of Network Operations**

**2 Evolution with Intelligence**

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**3 KT's Experience**

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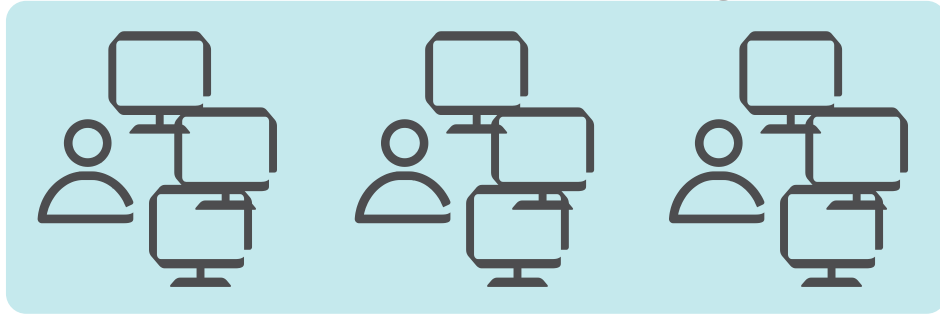
**4 Considerations**

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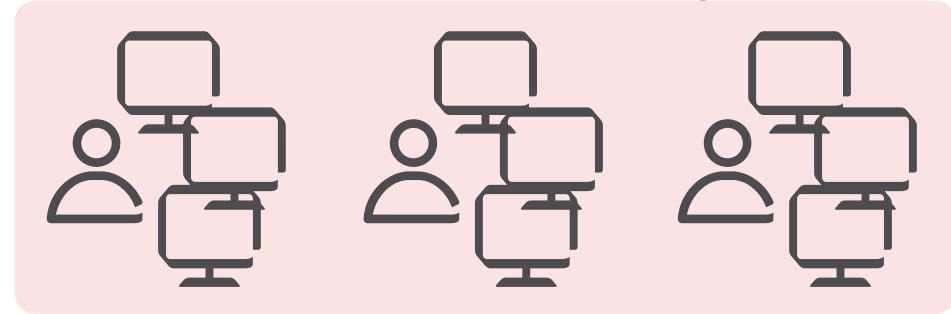
# 01 Current: An Operations Team for Each Domain

Intra-domain monitoring → Cross-domain analysis → Fault recovery

## IP or Wireless Domain Management



## Transport Domain Management



## Cable Domain Management



## Field Dispatch



## 02 Phase I: Intra-domain Integration

Intra-domain integration to achieve end-to-end management

IP or Wireless Domain Integration



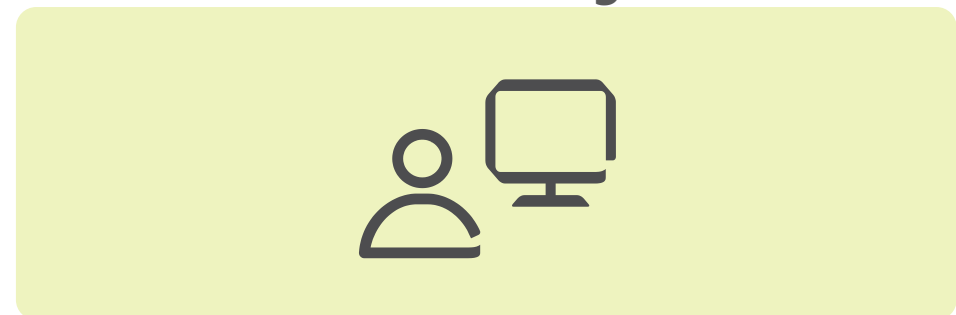
Transport Domain Integration



Field Dispatch

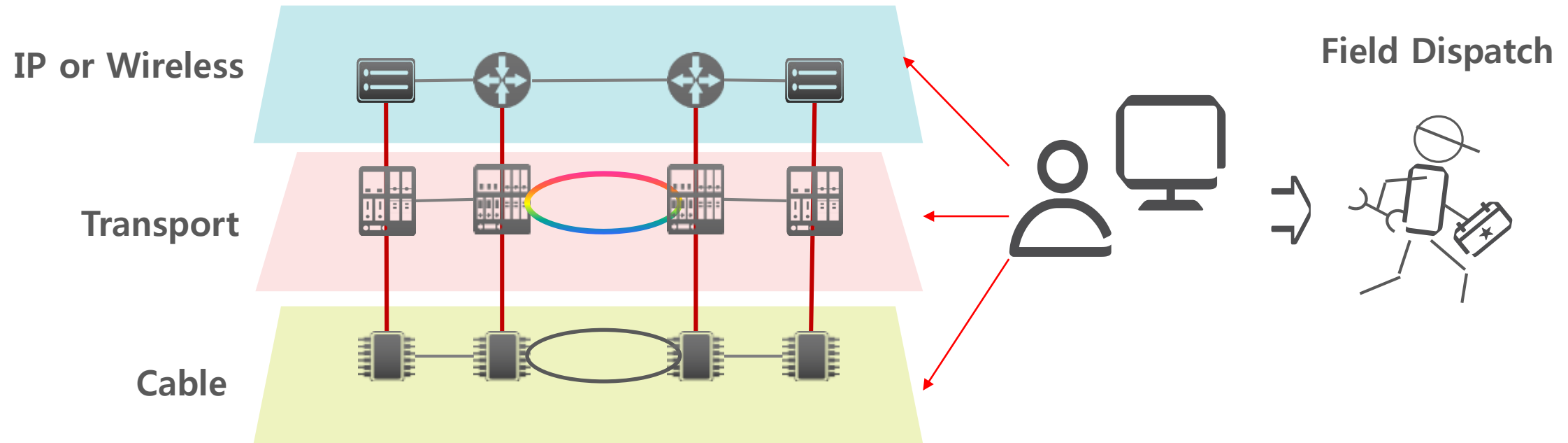


Cable Domain Integration



## 03 Phase II: Cross-domain Management

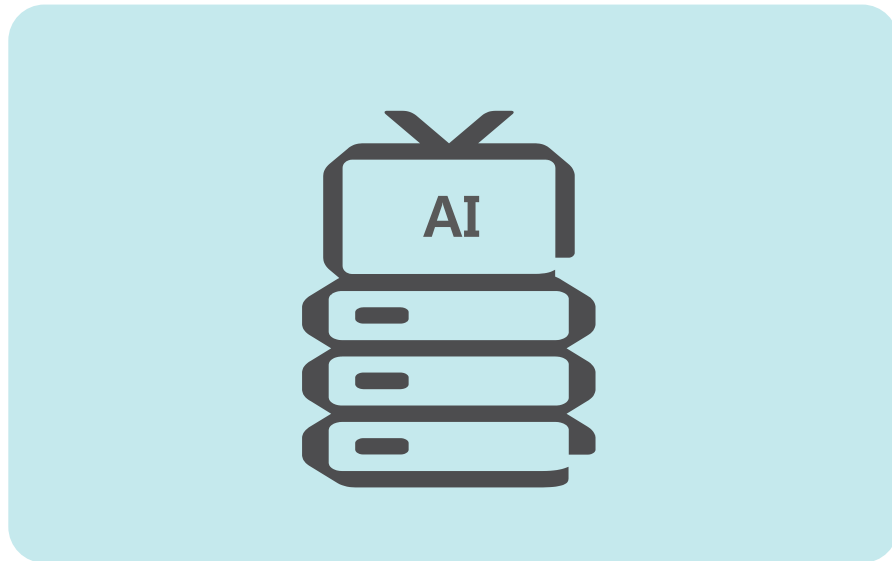
Cross domain integration to provide single view



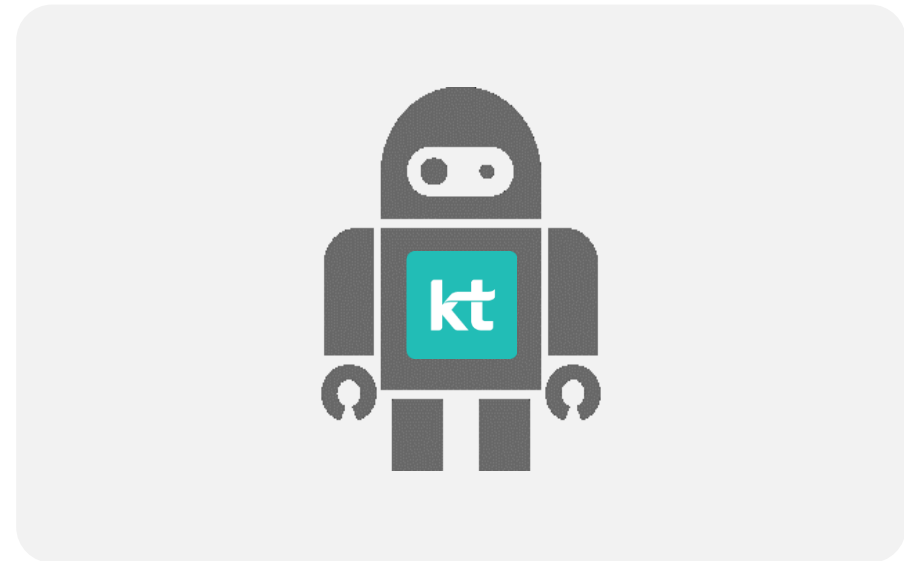
## 04 Future: Human-like AI Operator & Robot Engineer

Fault detection & analysis by human-like operation control master → Dispatching Robot engineer

Operation Control Master



Robot Engineer



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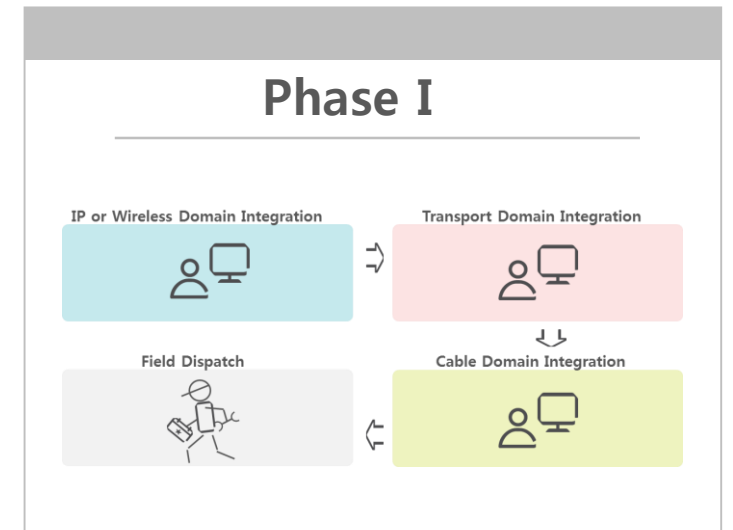
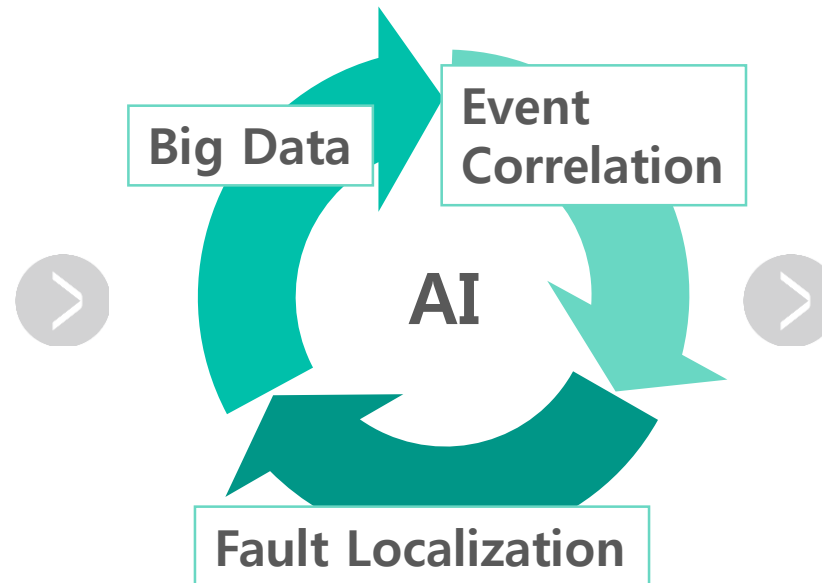
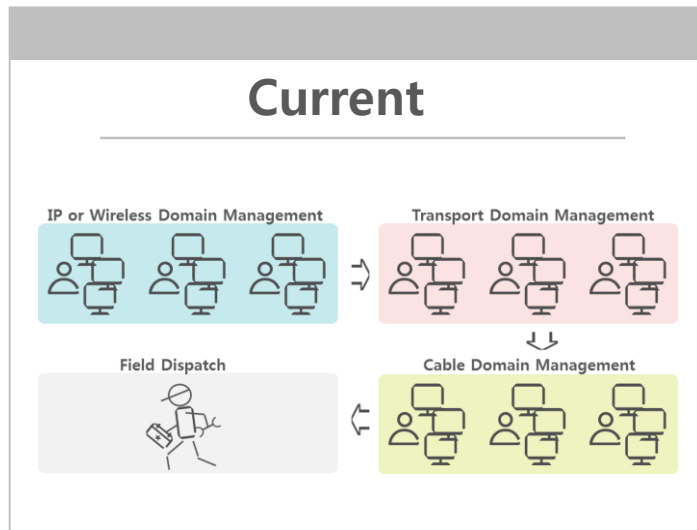
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4 **Considerations**

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# 05 Current → Phase I

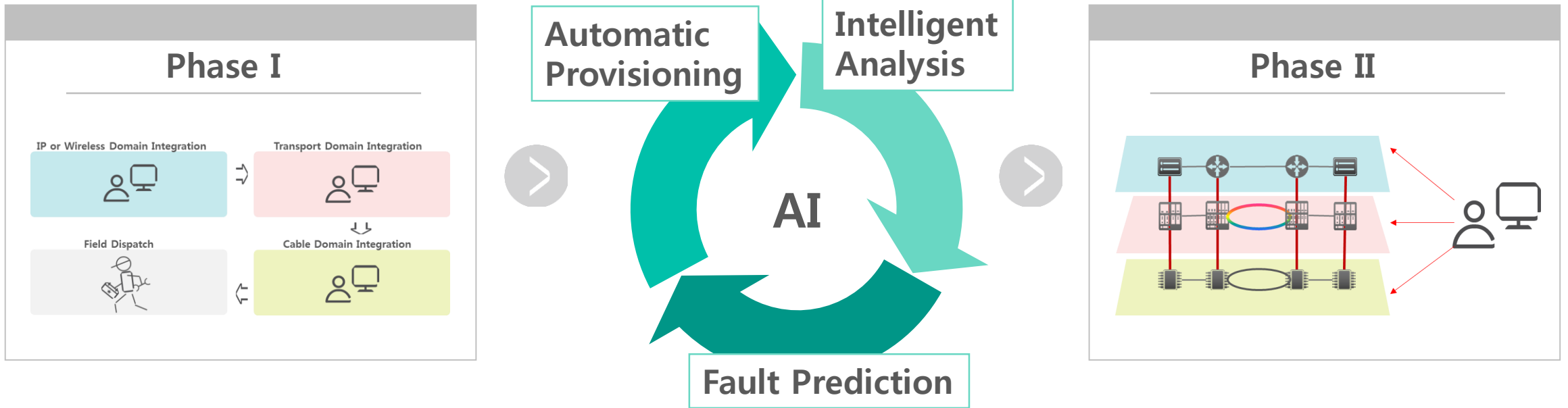
Gathering AI data from big data platform → Event correlation → Intelligent fault detection and localization





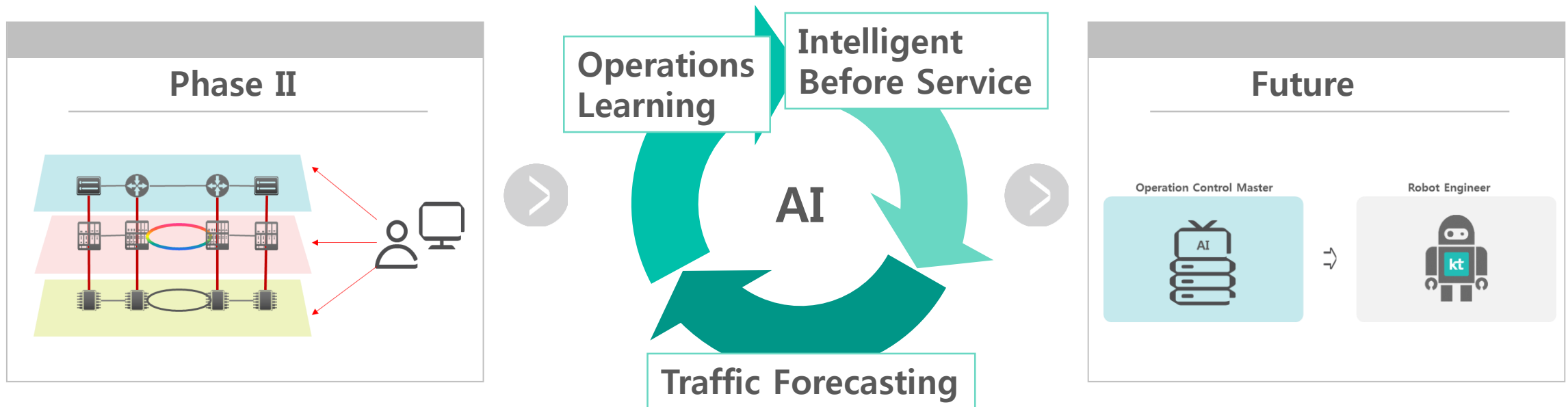
## 06 Phase I → Phase II

Network auto-configuration and auto-provisioning with Intelligent analysis and fault prediction



## 07 Phase II → Future

Reinforcement Learning-based operation → Fault preventive service → Auto-investment based on forecasting



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# 08 KT's Experience: Field Dispatch Classification

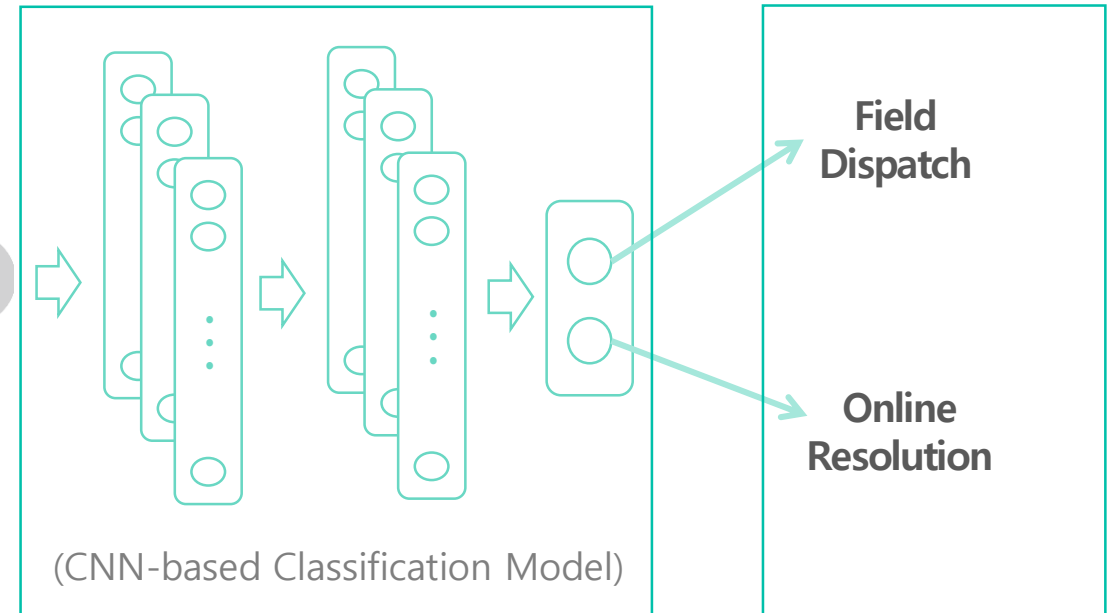
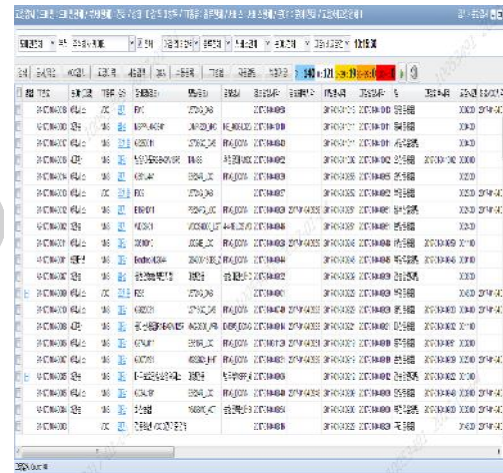
Decision making for field dispatch, based on CNN-based classification results using trouble tickets

① Alarm

② Trouble Ticket

③ Classification

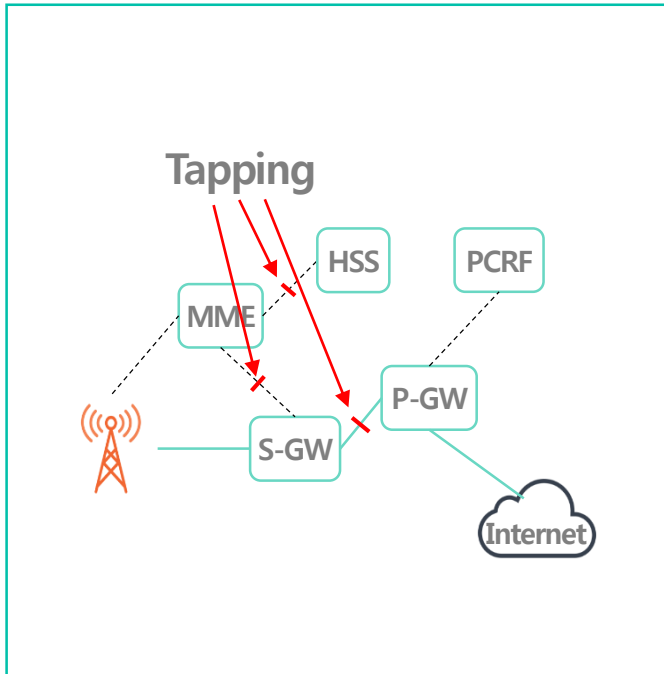
④ Decision



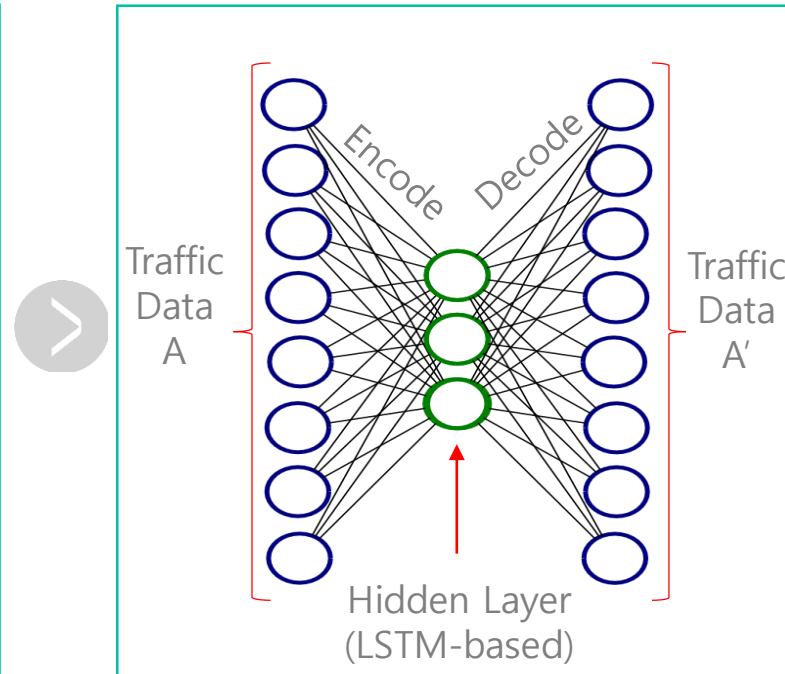
# 09 KT's Experience: Wireless Core Network Fault Prediction

- Using tapped signal data on wireless core network, train LSTM-based prediction model
- Predict future abnormal traffic based on current trend

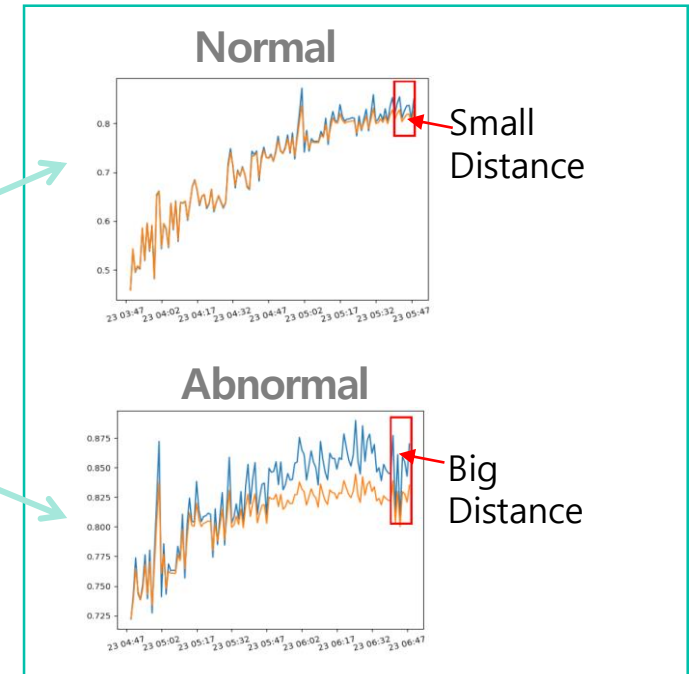
① Traffic Data Collection



② LSTM-based Autoencoder

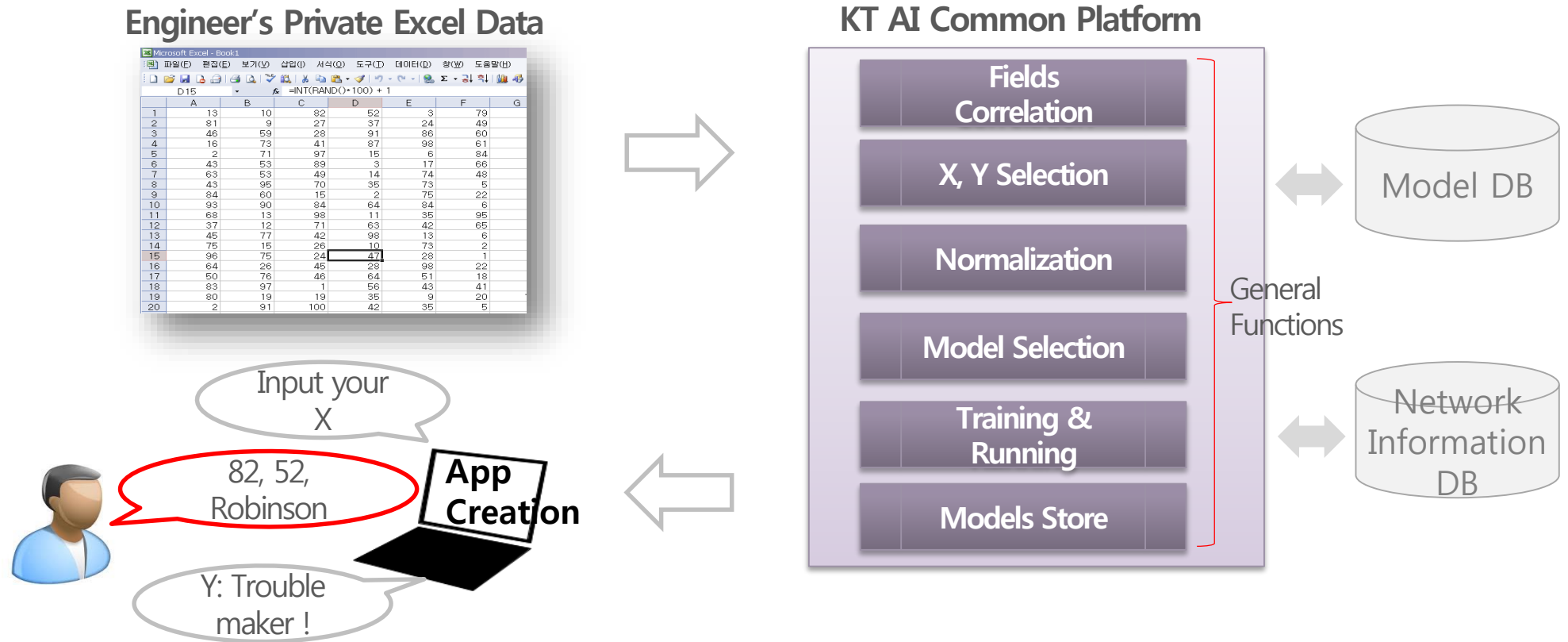


③ Abnormality Prediction



# 10 KT's Experience: AI Common Platform

- Field engineers maintaining private tables (mostly as excel files) for easy reference
- KT's AI common platform helps them to make their own AI applications using the excel files as training data



# 11 **KT's Experience: Guidelines and Standards Required**

- Unnecessary energy and time consumed for preliminary tasks
- Not sure how dependable the final ML application is

## **Urgent Standardization Items**

- **Categorization of ML technologies for network domains and phases**
  - Different MLs for different domains (Wireless, Wired, Core, Access)
  - Different MLs for different phases (Design-Deploy-Provisioning-Management-Services)
- **Requirements for Training Data**
  - Minimum size of data set
  - Characteristics of distribution
  - Fairness of the data
- **Cautions and limitations**
  - Criteria for the level of accuracy suitable for services
- **Guidelines for data normalization**
  - We have special types of files -- syslog, alarms, trouble tickets, etc
- **Guidelines for Hyper Parameters**
  - Desirable number of nodes, layers, training epochs, etc

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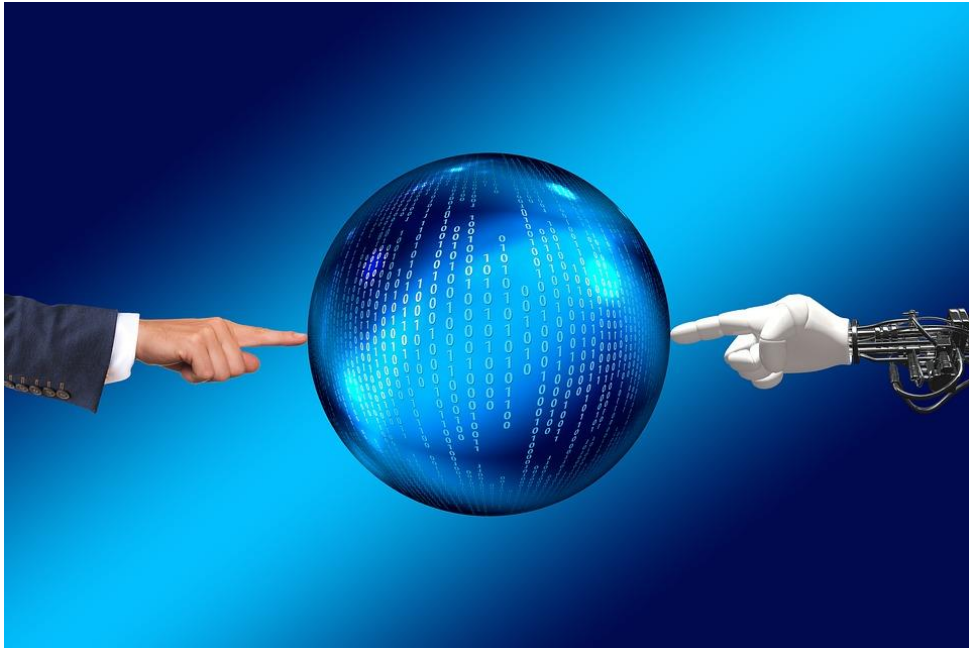
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4 **Considerations**



## 12 Human-less vs. Assistant-AI

Prefer AI-assisted operations system than human-less control room



vs.



## 13 Human-less vs. Assistant-AI

Comfortable with human engineer with helping robot, than robot only



vs.



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