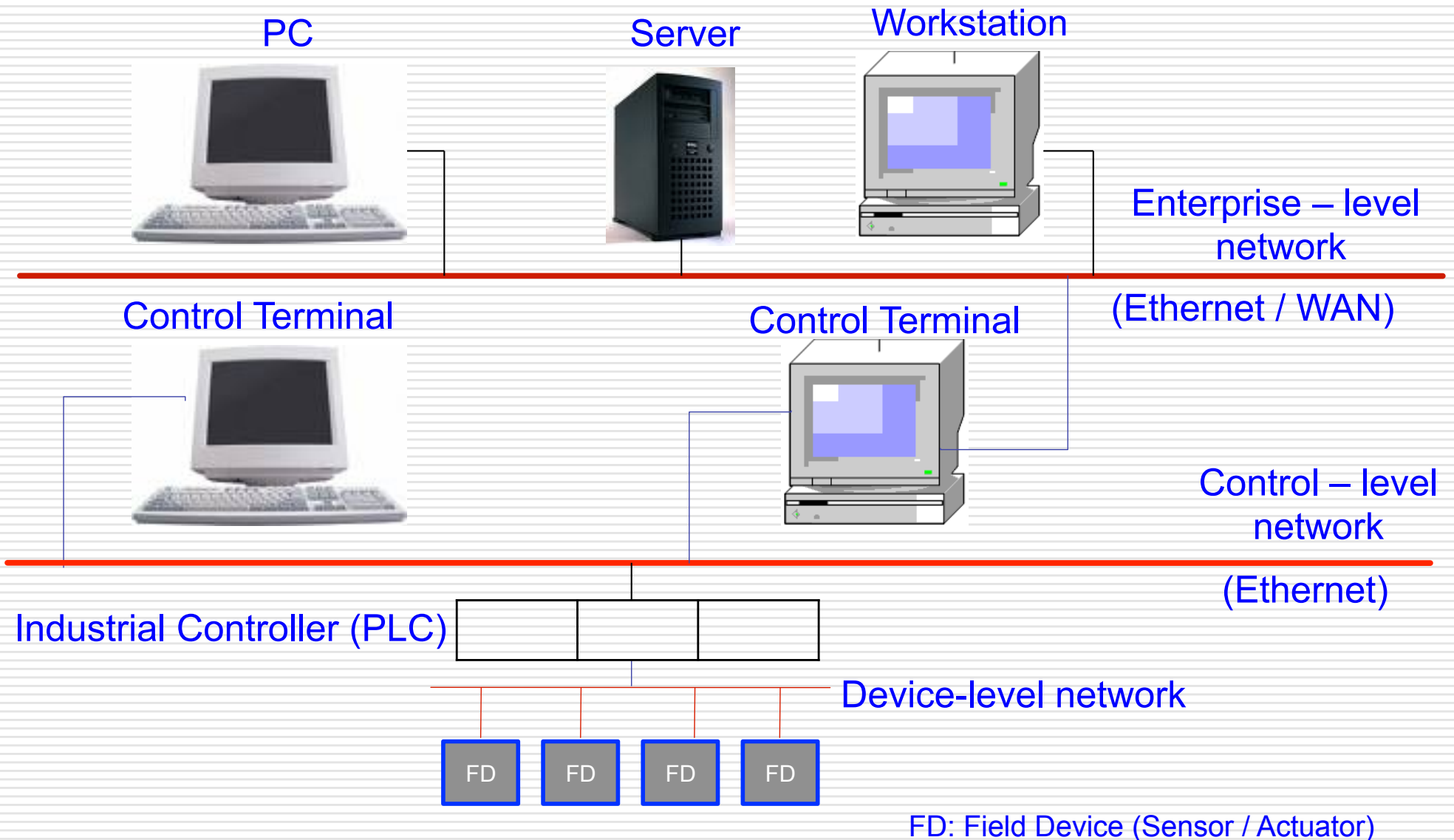


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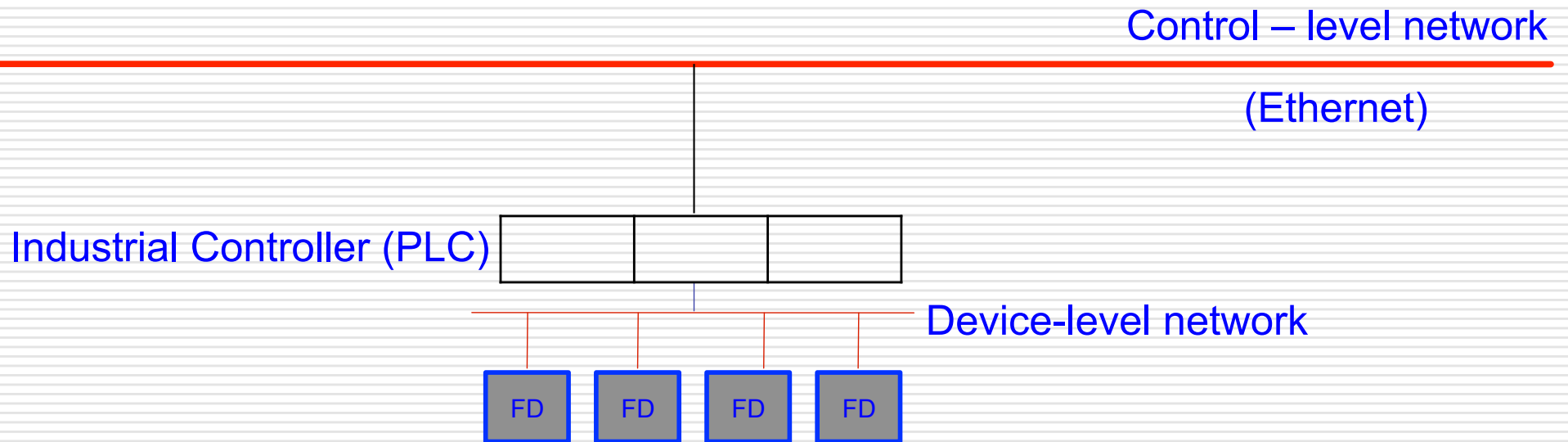
# *Part 4*

# *Sensor Networks*

# Hierarchy of Industrial Data Networks



# Device-Level Wired Network

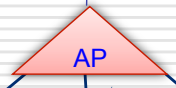
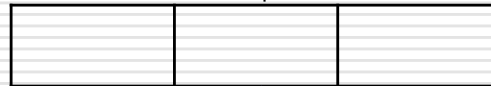


FD: Field Device (Sensor / Actuator)

# Device-Level Wireless Network

Control – level network  
(Ethernet)

Industrial Controller (PLC)



Device-level network



FD: Field Device (Sensor / Actuator)  
AP: Access Point or Wireless router

# Device Level Networks: Special Requirements

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- ❖ Low latency or end-to-end delay
- ❖ Low power consumption or long battery life
- ❖ High network reliability
- ❖ High data security
- ❖ Low bandwidth

# Device-Level Networks: Technologies/Protocols

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## Technologies/Protocols for Wired Networks

- ❖ RS422
- ❖ RS485
- ❖ MODbus
- ❖ Foundation Fieldbus
- ❖ HART
- ❖ CAN
- ❖ LON
- ❖ BACNet

## Technologies/Protocols for Wireless Networks

- ❖ Zigbee
- ❖ Wi-Fi
- ❖ Bluetooth
- ❖ Wireless Fieldbus

Wireless  
HART

# Networking of Sensors: Four Situations

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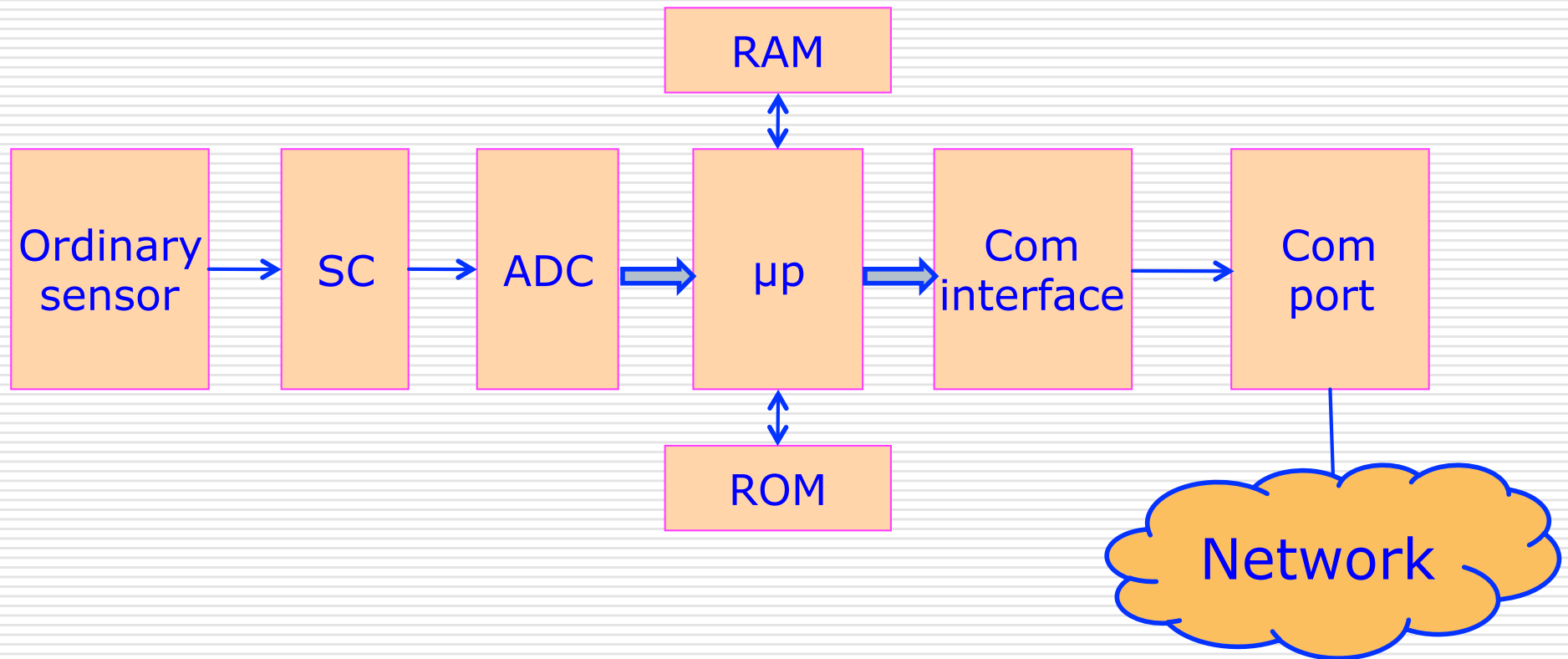
Situation A – Ordinary Sensor + SC + MPU + Interface

Situation B – Network Sensor

Situation C – Smart Sensor + Custom Interface

Situation D – Smart Sensor + IEEE 1451 Interface

# Situation A: Ordinary Sensor + SC + MPU + Interface



## Advantage

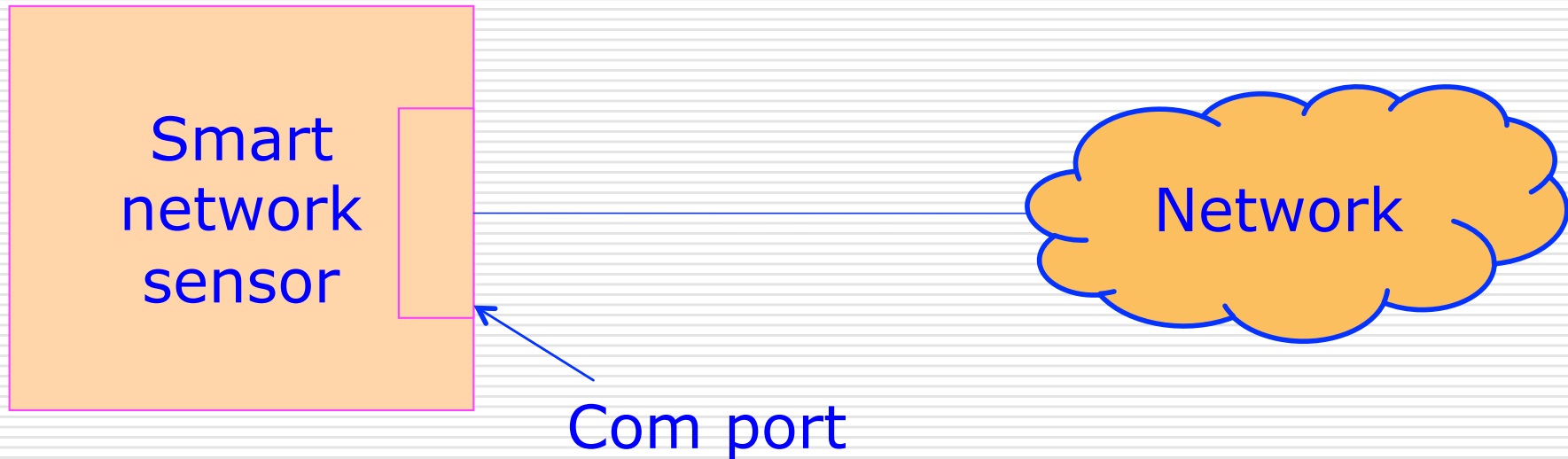
- ❖ Flexibility

## Disadvantages

- ❖ Cumbersome
- ❖ Only expert can do
- ❖ Expensive

# Situation B: Network Sensor

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## Advantages

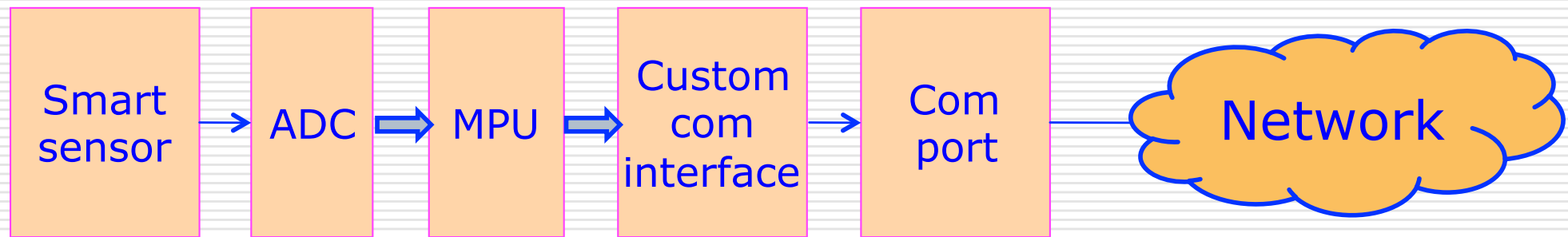
- ❖ Simple
- ❖ Fast
- ❖ No expertise required

## Disadvantage

- ❖ No flexibility of network protocol

# Situation C: Smart Sensor + Custom Interface

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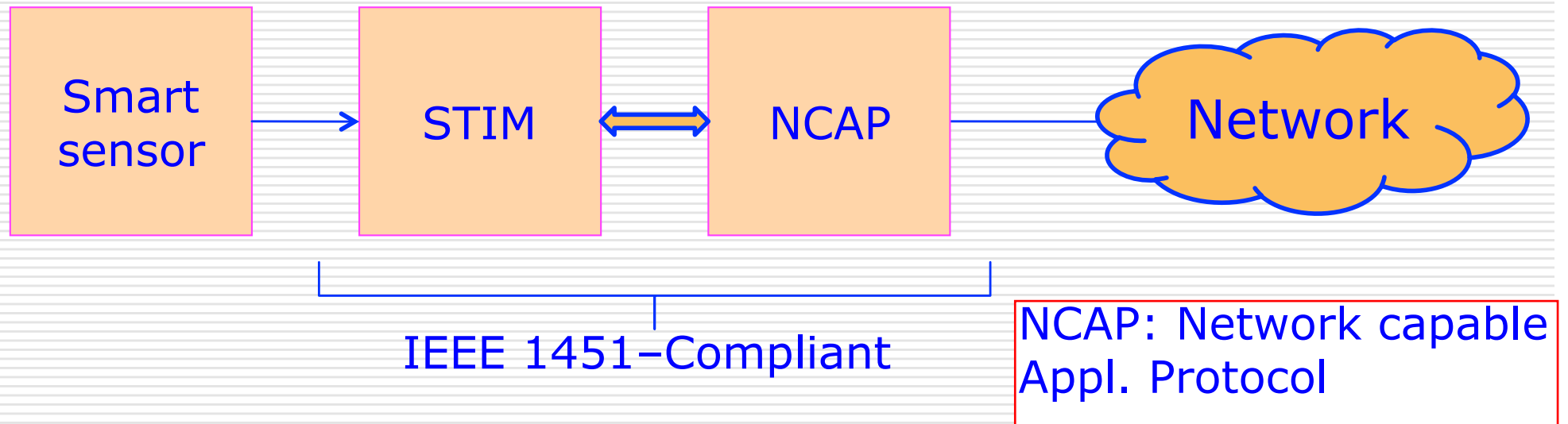
## Advantage

- ❖ No SC required

## Disadvantages

- ❖ Cumbersome
- ❖ Only expert can do

# Situation D: Smart Sensor + IEEE1451 Interface



## Advantages

- ❖ No SC required
- ❖ Flexibility of network protocol

## Disadvantage

- ❖ Needs STIM & NCAP