

The background of the entire slide is an aerial photograph of a city skyline, likely Chicago, taken during the "golden hour" of sunset. The sun is low on the horizon, creating a warm, orange glow that fills the sky and reflects off the city's surfaces. The dense cluster of skyscrapers is visible, with the Willis Tower (formerly Sears Tower) being a prominent feature on the right side. The city extends to the water's edge, where the city meets the lake.

# Connecting one million elevators and escalators to the cloud

DATA INNOVATION SUMMIT 2019

# KONE today

- KONE is a global leader in the elevator and escalator industry. We are here to make cities better places to live
- We provide value for our customers at every step of the way for the entire lifespan of a building
- We offer innovative and sustainable new equipment solutions, ensure the safety and availability of equipment in operation and offer modernization solutions for aging equipment
- Founded in Finland in 1910
- Over 55,000 employees
- Over 450,000 customers
- Net sales EUR 8.9 billion in 2017
- Listed on the NASDAQ Helsinki since 1967





# KONE maintenance solutions

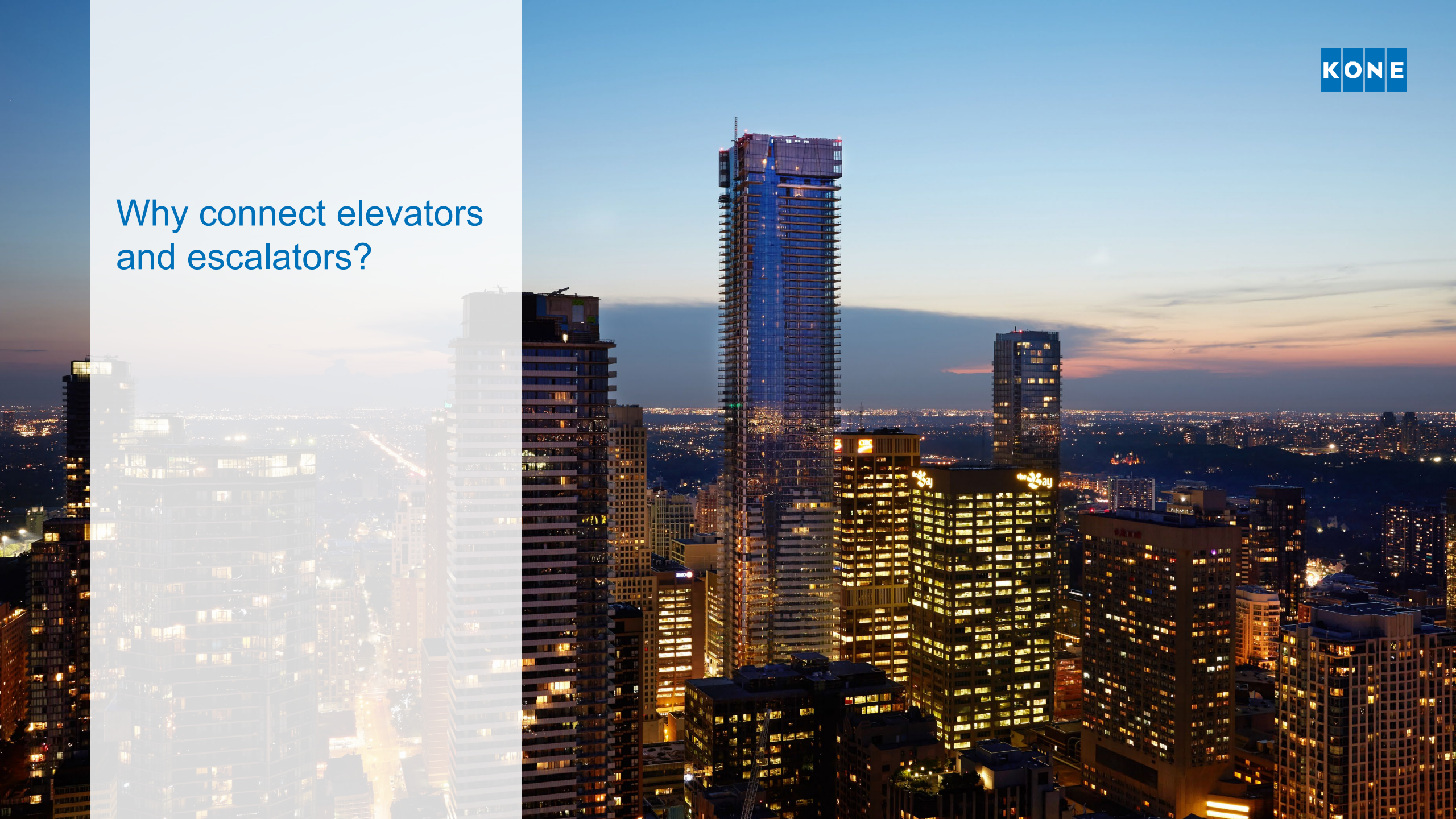
KONE has over 1,200,000 elevators and escalators in its maintenance base

- Flexible maintenance services for elevators, escalators and doors
- Modular Based Maintenance for uninterrupted People Flow in buildings
- KONE Care™ service contracts, KONE remote monitoring services and 24/7 Customer Care Centers





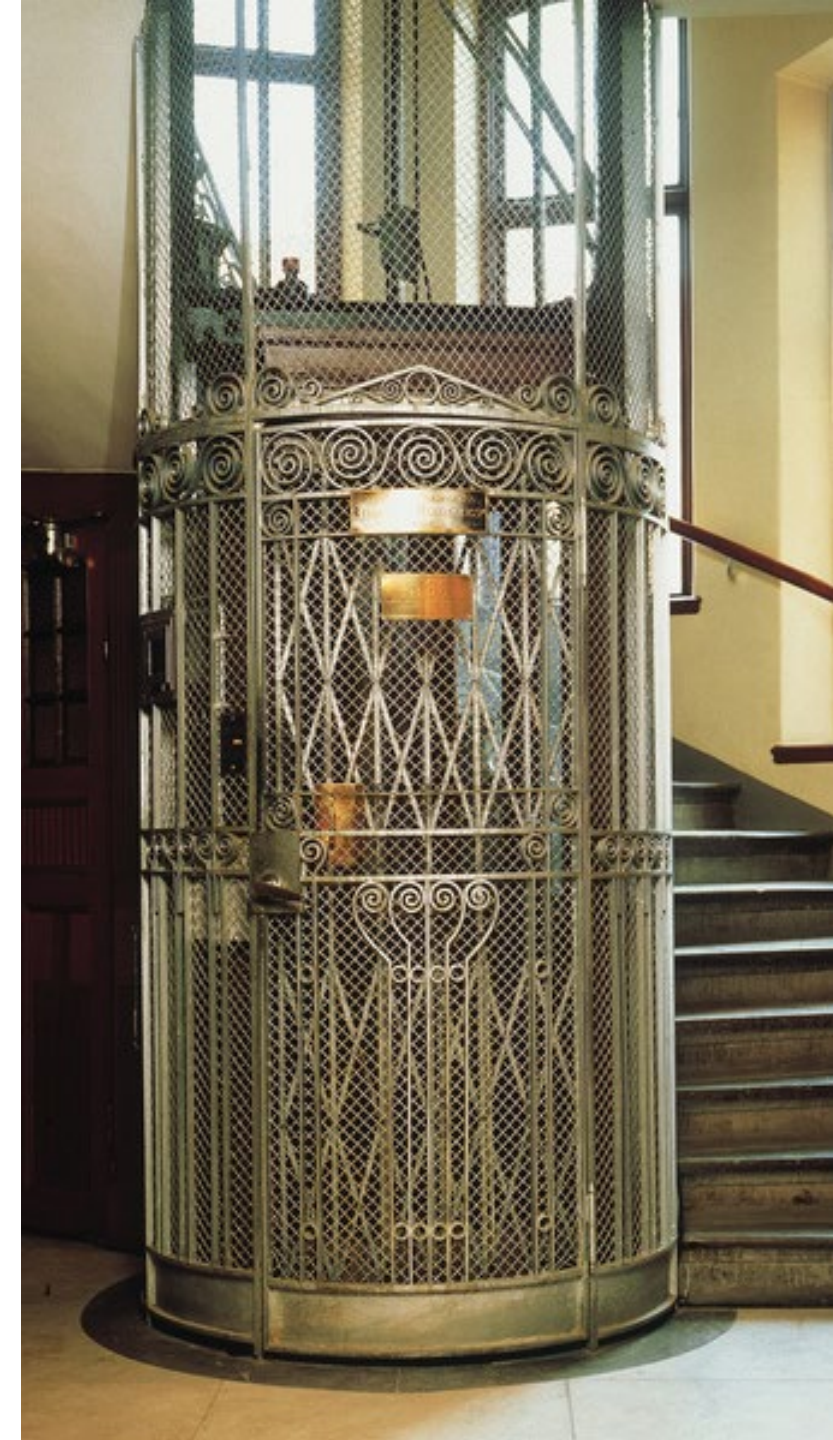
# Why connect elevators and escalators?





# Producing value from IoT

- One approach: Improve maintenance operations efficiency
  - Condition based instead of scheduled maintenance
  - Improved troubleshooting
  - Repair kit sales leads
- Alternative approach: Provide customer value
  - Faster response time to malfunctioning equipment
  - Improved availability
  - Provide insights to the equipment usage
  - Forecast future costs





A nighttime city skyline, likely New York City, with numerous skyscrapers illuminated. Overlaid on the image are several data points and icons connected by thin white lines. These include a sound wave icon with '82 DB', a water drop icon with '72.2 %', a weight icon with '322', a ruler icon with '11 mm', a clock icon with '3.7 S', and a weather icon with '34.3'. There are also circular callouts pointing to specific buildings. The text is presented in a clean, modern font on a semi-transparent white background.

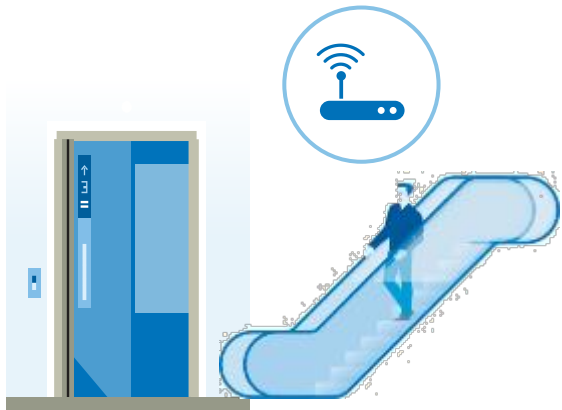
## Intelligent services for elevators and escalators are here

KONE is revolutionizing elevator and escalator maintenance with new KONE 24/7 Connected Services that are based on real-time data and analytics. For customers it means improved safety, full transparency and more value.

# 24/7 Connected services is a full chain process and service to customers



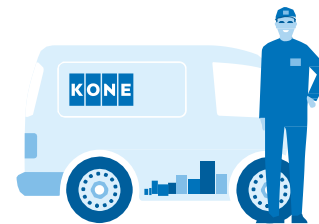
The system keeps a constant eye on critical parameters



Intelligent technology analyzes maintenance needs and predicts faults



Our technician gets the right information at the right time



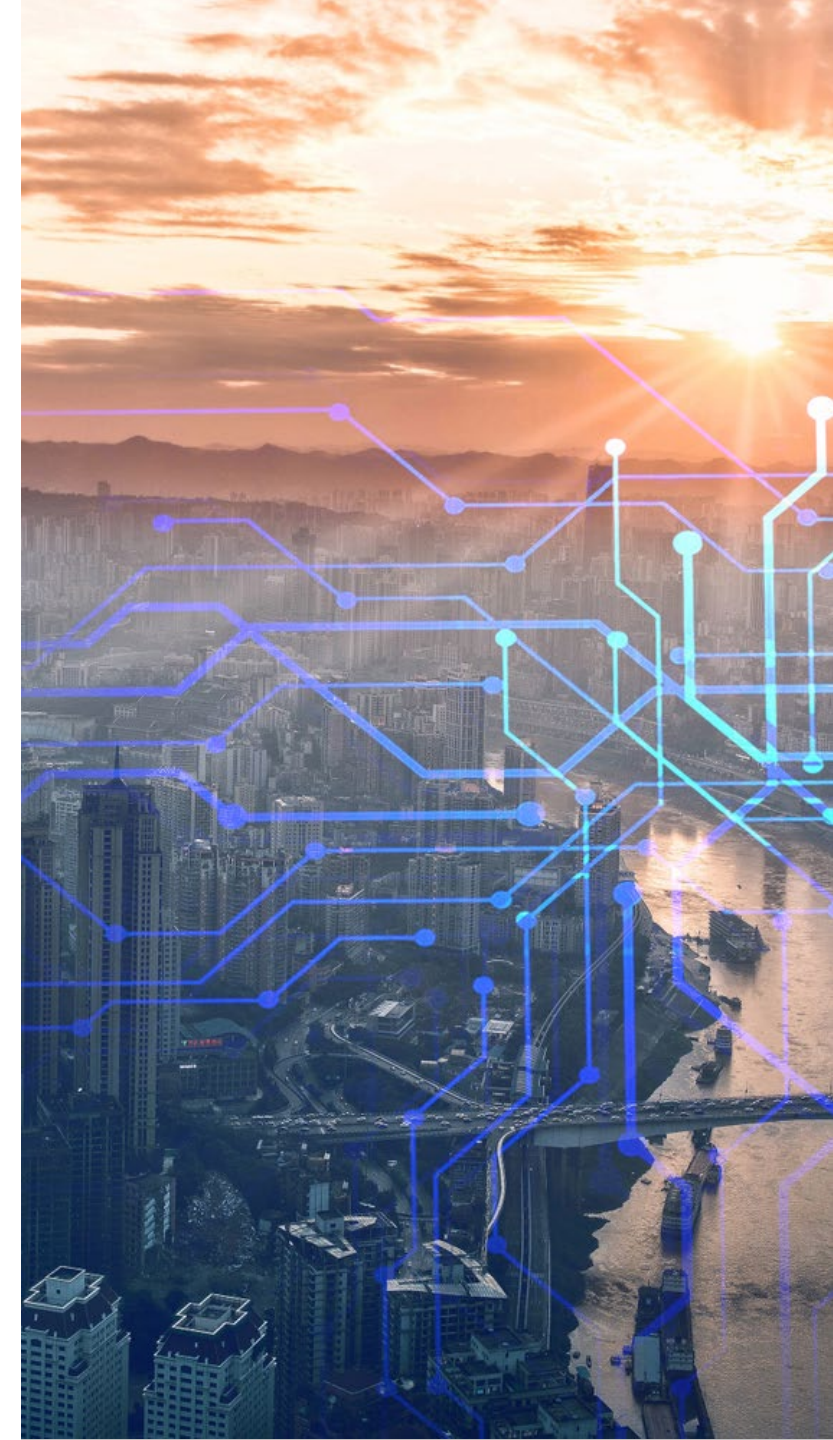
You get trustworthy insights into the health of your assets and proposals for the future





# Smart buildings and cities

- Connected elevators and escalators are an important part of smart buildings
  - Indoor navigation
  - Access control
  - People flow analytics
- Connecting elevators and escalators is an investment to the future, both for KONE and for our customers





How do we do it?



# Equipment connectivity

- Cellular network (2G, 3G, 4G)
- Our equipment is all over the world
  - Globally roaming SIM cards
  - Restricted data volumes
  - Slow network speeds
- Not possible to send raw data at hundreds of datapoints per second
  - Except for R&D purposes in special cases
- Data processing and analytics at the edge is crucial
  - Send carefully selected aggregates which add value
  - Plan for rapid development and updates of the edge capabilities





# Example data

## Escalator

- Vibration and noise levels
- Passenger counts
- Operation time
- Power consumption
- Operating environment



## Elevator

- Door movement statistics
- Travel statistics
- Travel distance and time
- Stopping behavior
- Ride comfort
- Passenger presence
- Operating environment



# Evolution of data architecture

To better serve our customers we need to improve our reaction speed, and the data architecture needs to evolve to accomodate this.

## FROM

- Time-based data
- Data warehouse
- Scheduled batch processing

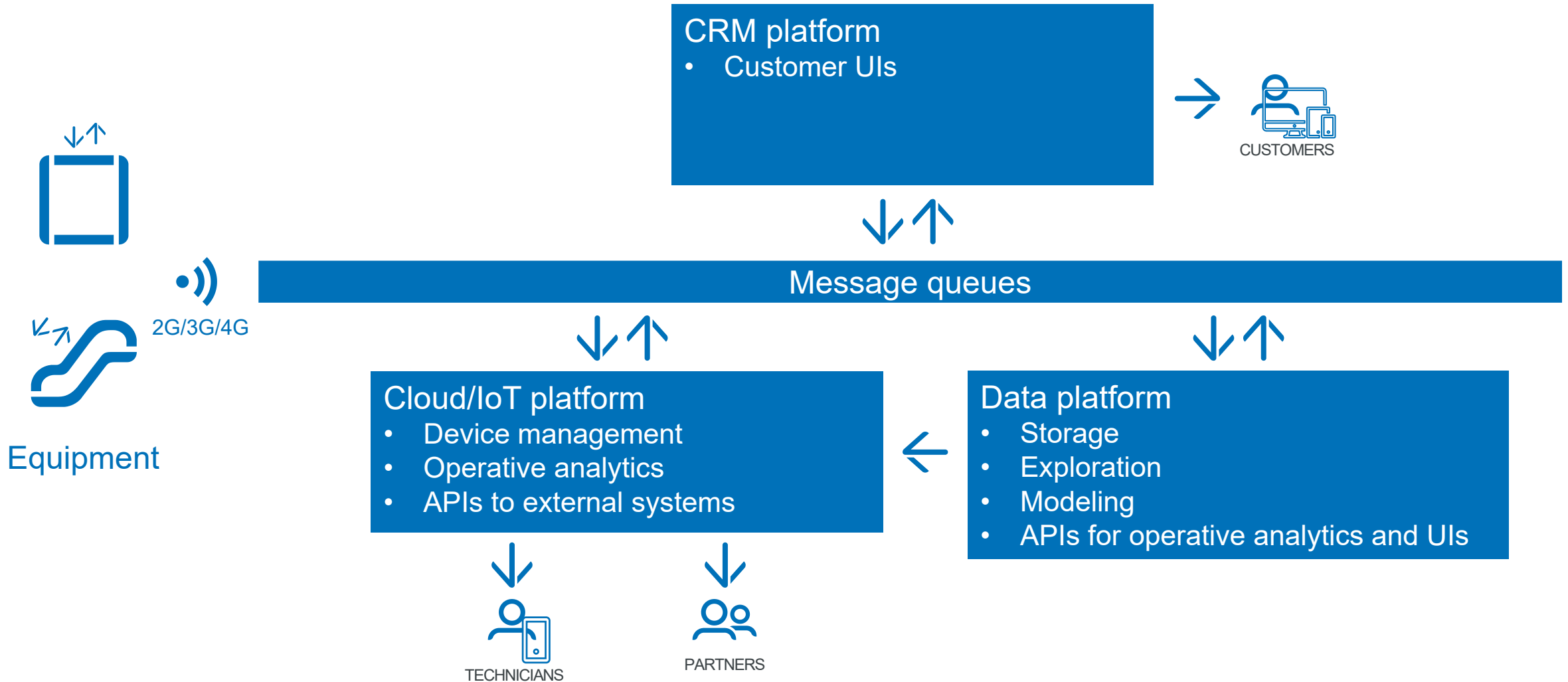
## TO

- Event-based data
- Data lake
- Real-time stream processing





# High-level cloud architecture



# Wrap up

- Large volumes of IoT data enables not only predictive maintenance but also other novel services
- Edge processing is crucial when the number of connected equipment grows large
- Platform capable of real-time reaction to important events needs to be designed for this from the start

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