

# The 1st Network Verification Workshop

## Ultra-Scale AIOps Lab @ Cloud & AI Research and Development

Gartner predicts that large enterprise exclusive use of AIOps and digital experience monitoring tools to monitor applications and infrastructure will rise from 5% in 2018 to 30% in 2023

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Munich/Dublin Research Center

2021.07.29

# HUAWEI CLOUD

## Planet-scale Landscape

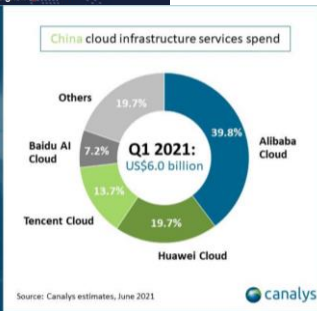
The screenshot shows the Huawei Cloud website with a navigation bar at the top containing links like 'About Us', 'Products', 'Solutions', 'Pricing', 'Marketplace', 'Learn', 'Partners', 'Careers', and 'More'. The main banner features a night view of a city with mountains in the background, with the text 'Go Africa' and 'Cloud Products in Discount to Lift Enterprises in Africa to the Cloud'. A 'Learn More' button is present. Below the banner, there are three featured products: '10 Hot Products for Free' (12-Month Free Packages), 'Elastic Cloud Server S3' (As Low as 1 USD/Month), and 'ModelArts New Use' (Get a 40-Hour ModelArts). At the bottom, there is a section titled 'Why HUAWEI CLOUD' with two columns: 'Leading Technology' (Leading full-stack AI capabilities, Diverse cloud architecture and unparalleled performance) and 'Future-oriented' (World-class hybrid cloud, Open ecosystem that harnesses chip-device-pipe-cloud synergy).

### ... a few numbers...

- worldwide, Huawei Cloud has **45** availability zones across **23** regions (June 2019)
- more than **180** cloud services and 180 solutions for a wide range of sectors
- Customers include European Organization for Nuclear Research (CERN), PSA Group, Shenzhen Airport, Port of Tianjin, ...



Q1 2021  
cloud infrastructure  
spend in mainland  
China grew 55% to  
US\$6.0 billion, driven  
by economic growth  
and a focus on digital  
transformation



# HUAWEI CLOUD

## Success Stories



Transportation

### Huawei Desktop Cloud Helps Hong Kong Airlines Flies High

HKA purchased Huawei's proven cloud-desktop technologies to reduce operating costs, improve work...

[Learn More](#)



Internet Service Provider

### Serverius Data Centers Get Huawei AntiDDoS

Huawei enables Netherlands Serverius data centers to protect customers against DDoS attacks.

[Learn More](#)



### New Large Data Center in Sweden with Decreased Environmental Footprint

Huawei helps Binero raise its infrastructure reliability and lower its environmental footprint by...

[Learn More](#)



Transportation

### Qatar Airport Adopts Secure Cloud Storage

OceanStor 9000-based video cloud solution securely managed video for Hamad International Airport.

[Learn More](#)



Manufacturing

### Huawei CloudCampus Helps Honda Agency Grow

Huawei CloudCampus Solution enables Dongfeng Honda to lower cost of network, expand dealerships

[Learn More](#)



Manufacturing

### Huawei Helps COFCO Coca-Cola Build an Enterprise Private Cloud Platform

You probably didn't know that, in China, when you drink Coca-Cola, produced by COFCO Coca-Cola...

[Learn More](#)



Government

### Huawei Cloud Streamlines Beijing Services

Huawei's Distributed Cloud Data Center helps Beijing government speed services for citizens

[Learn More](#)



Government

### NHS in the UK Constructs an End-to-End Private Cloud Data Center

Huawei helps Avon and Wiltshire Mental Health Partnership NHS Trust (AWP) build an End-to-End (E2E)...

[Learn More](#)



Media Entertainment

### TF1 Finds Performance in Secure Cloud Media

With Huawei's media cloud, TF1 gets secure, high-performance video editing on low-cost terminals.

[Learn More](#)



Internet Service Provider

### Huawei Data Center Network Solution Assists Ikoula for Cloud Hosting Services

Huawei Data Center Network Solution reduces service deployment complexity, improves system reliability...

[Learn More](#)

# Worldwide Trends

## Clouds, transformations, edges, scale and complexity

Constantly changing infrastructure that is heavily virtualized

### Distributed Cloud

HC Public Cloud – HC Stack Online -- Edge cloud/CDN

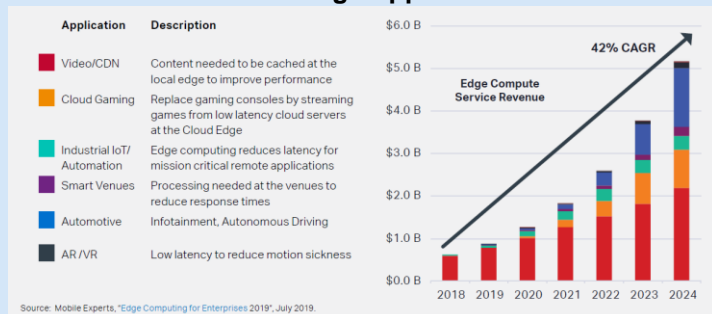
O&M challenge will not be about replication, but about:

1. Automation
2. Integration
3. Reuse
4. Abstraction
5. Upgrade



**Trend: 5 big clouds (GAAVI), 100+ industry clouds, 500+ regions, 5000+ edge sites.** The average business runs 38% of workloads in public cloud and 41% in private cloud

### Cloud Edge Applications

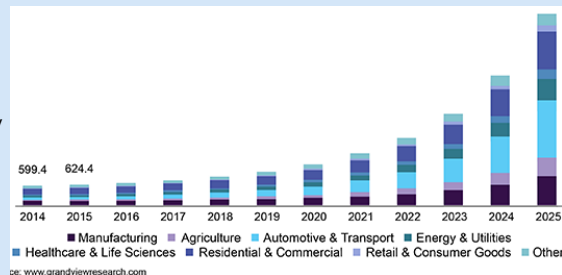


**Trend: Video/CDN, Cloud Gaming, Industrial IoT, Automotive, AR/VR**

### Digital Transformation

As digital transformation initiatives start to be implemented, IT infrastructure has become exponentially more complex.

1. Real-time monitoring
2. Prediction optimization
3. Control and decision making



**Trend: digital transformation** initiative is expected to growth **20%/year** until 2025. **Intelligent monitoring** market is expected to growth b/year until 2025

Overwhelming number of alarms and monitoring data, makes it impossible to know where to focus during incident resolution.

### Ultra-scale and Complexity

Not only monitoring tools are important, the velocity of code deployments also becomes key

- Automation of 10k deployments/year
- >50 monitoring tools
- Trillions metrics/day
- Service availability?

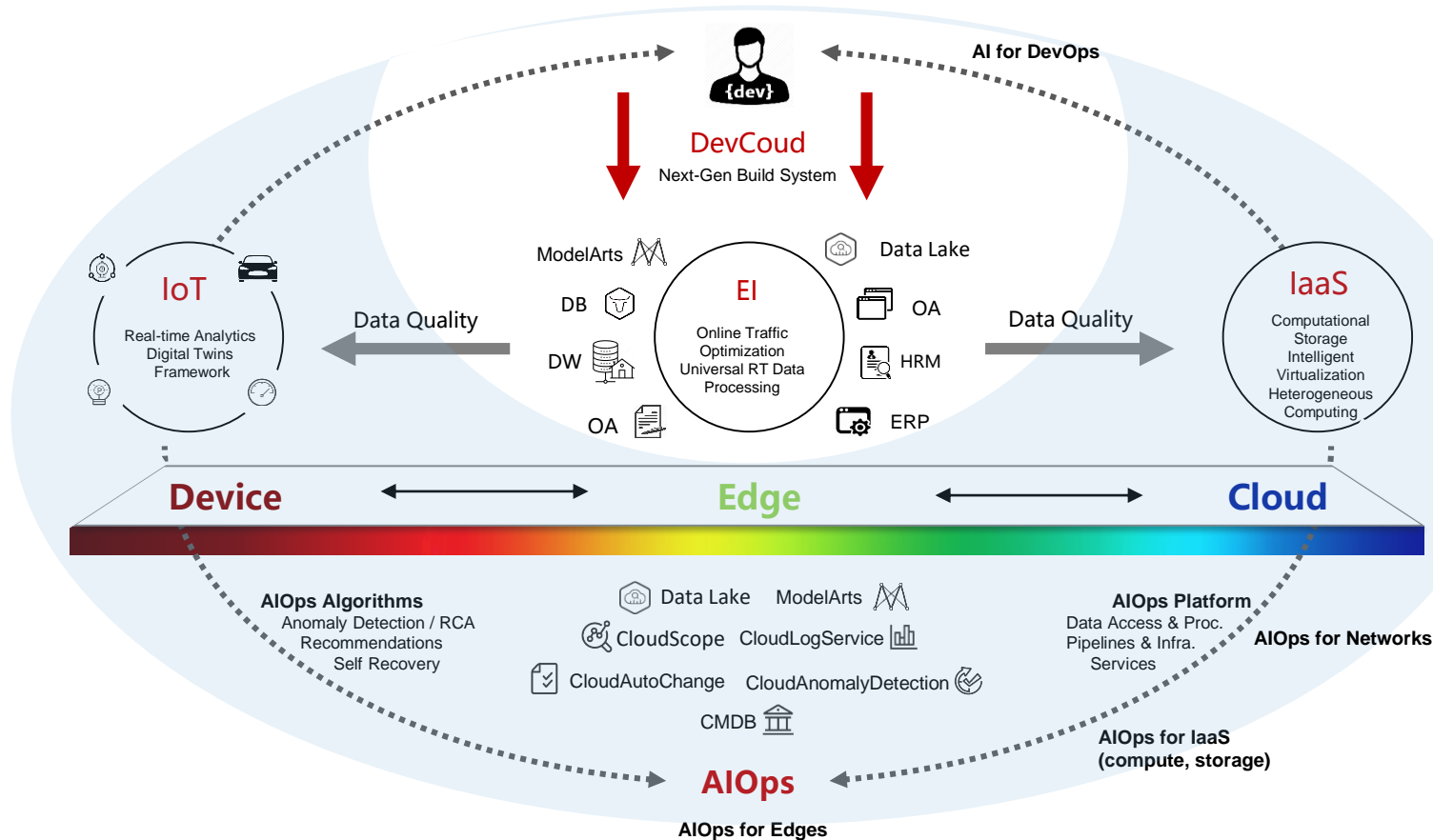
	Stone Age	Last Century	Last Decade	This Decade	Today	Tomorrow
<b>Technology Trends</b>	Mainframe	Client Server	Distributed	Virtualization	Cloud	Digital Business
Server Count	1	10s	100s	1,000s	10,000s	100,000s
Deployments/Year	1	2	10s	100s	1,000s	10,000s
Monitoring Tools	1	3	5	10	25	50+
Events/Metrics/Day	100s	1000s	100,000s	Millions	Billions	Trillions
Organizational Silos	1	10	15	25	50	100
Humans Ability to Cope	Yep	Yep	Kind Of	Not Really	Nope	HELP!
Service Availability	100%	99.999%	99.99%	99.9%	99%	?

**Trend: Digital Transformation** increases the number of **managed servers 10x**, **10k deployments/year**, **>50 monitoring tools**, **trillions metrics**



# Intelligent Cloud Technologies Lab

## R&D Direction: The Cloud-Edge-Device Continuum

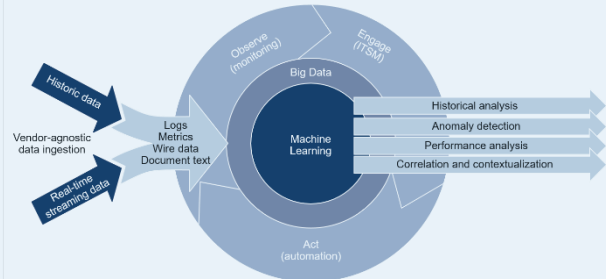


# Research Fields

## AIOps for SRE, Edge AI and AI for Networks

### AIOps for SRE

#### AIOps Platform Enabling Continuous ITOM

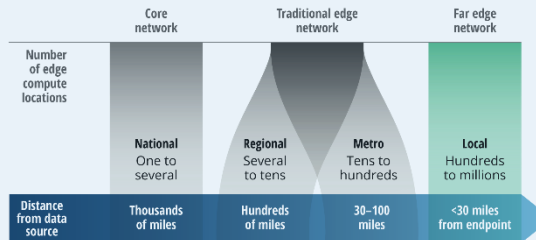


### Edge AI

FIGURE 2

Telecom edge compute, or the “far edge network,” brings computing to within 30 miles of its data source

Telecom edge compute taxonomy

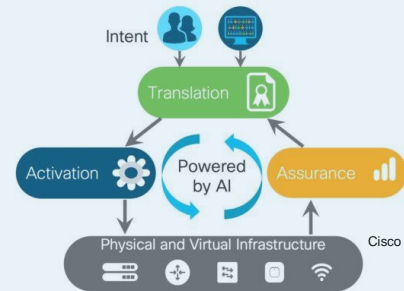


Source: Technology Business Research, Inc., “Telecom edge compute market landscape,” accessed December 2, 2019.

Deloitte Insights | deloitte.com/insights

### AI for Networks

#### AI in Intent-Based Networking



# R&D Direction

## AI-driven autonomous systems

Business Driver: high reliability, high automation, low cost of IT operations

### Objective

Use AI/ML to transform the cloud, IT operations and infrastructure by processing massive amounts of data to trigger **automated actions 24/7**, with **higher reliability**, **higher operational efficiency** and **cost savings**

### RESEARCH AND DEVELOPMENT

#### Research Fields

AI for IT Operations

Edge AI

AI for Network

AI for DevOps

#### Methods

Anomaly detection

Root-cause analysis

Security of Operations

Failure Prediction

Intelligent Container Tracking

Computing Models

Software Framework

Federated Learning

Formal Verification

SmartNICs & Troubleshooting

P4 Network Programming

Intent-Based Networks

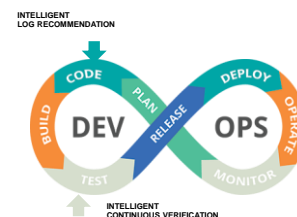
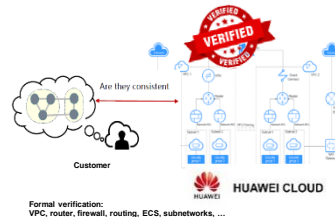
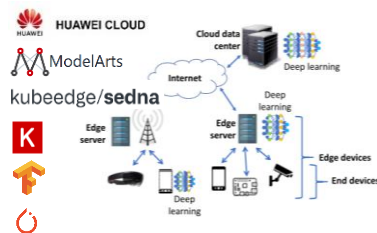
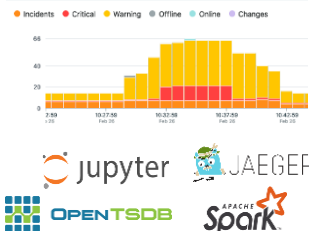
Log Recommendation

Code Analysis

Continuous Verification

Structured Logging

#### Scenarios



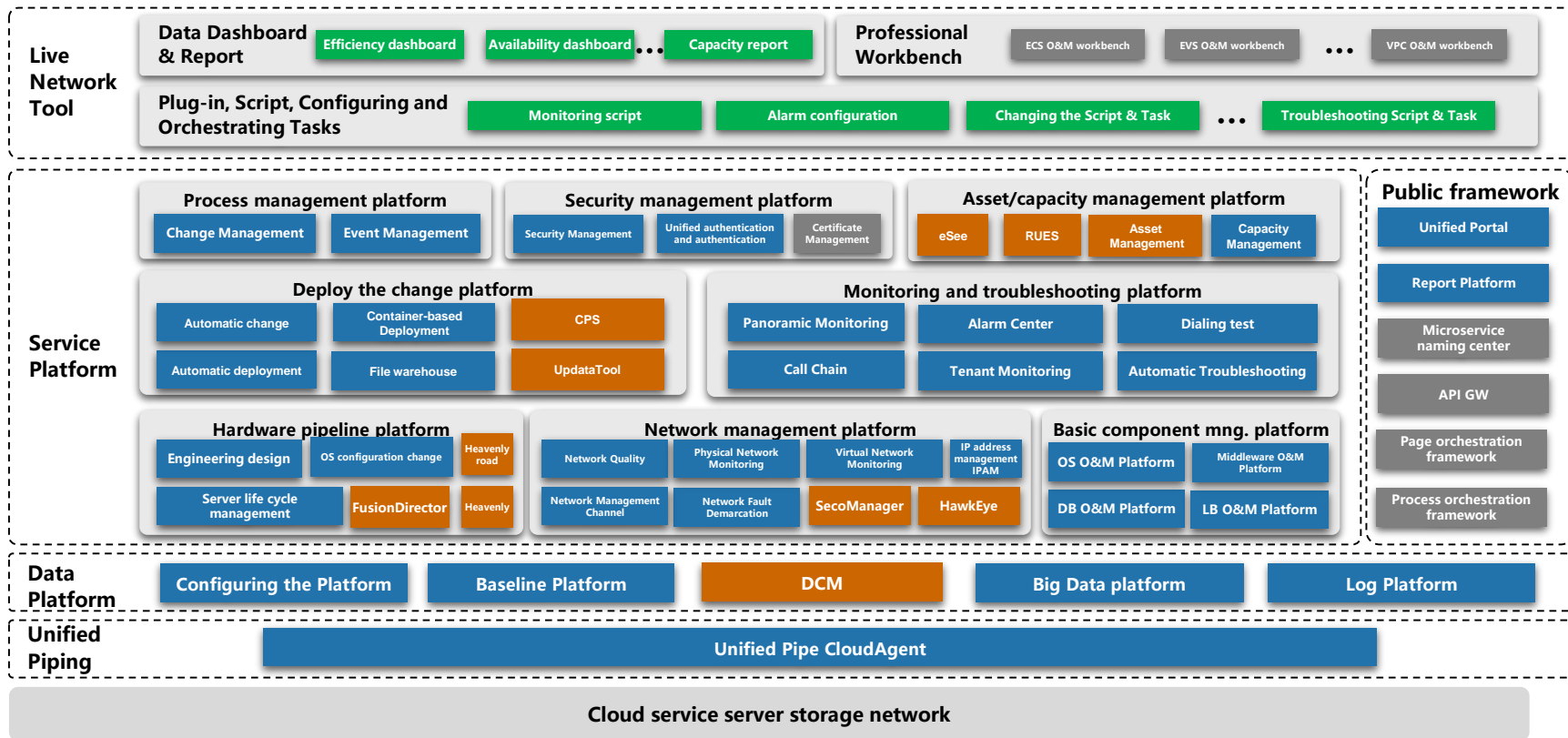
#### Fundamental Research

AIOps, DataOps, MLOps, federated learning, deep learning, formal verification methods

# Intelligent O&M

## CloudScope Platform

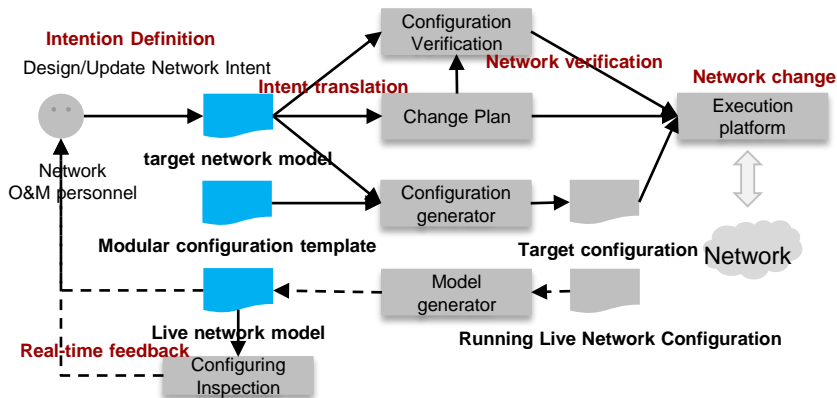
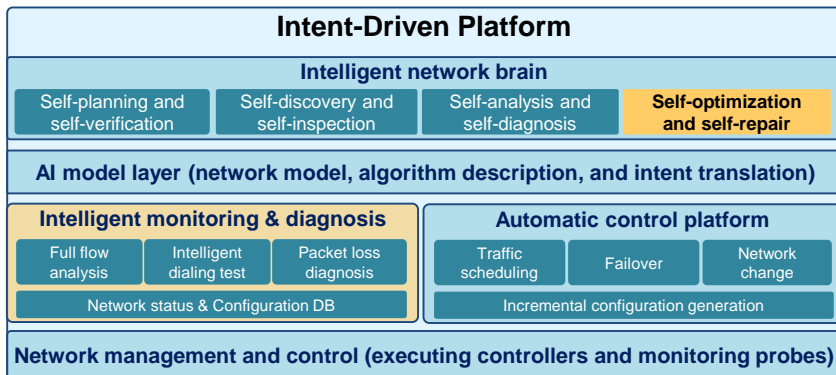
CloudScope provides operators with an end-to-end automated O&M platform to manage cloud data centers and cloud services



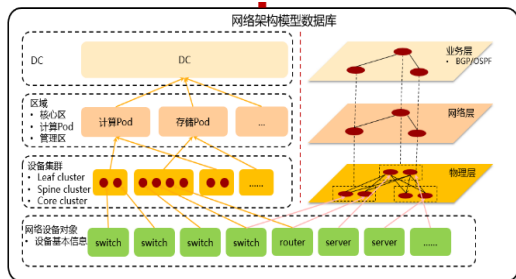


# AI-driven Network Automation

## Intent-Based/Driven Networking (IB/DN)

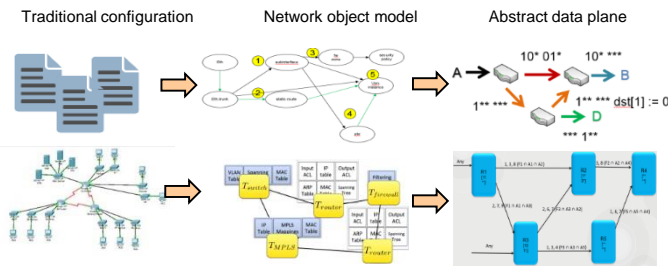


### Network Configuration Model



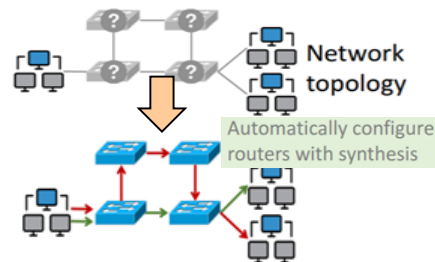
Automatic generation of configuration model definitions and configurations based on network architecture and device layer to support full lifecycle management of network configurations

### Network Verification



**Objective: The network configuration model is standardized**  
**The configuration of a single device evolves to the service rule configuration**

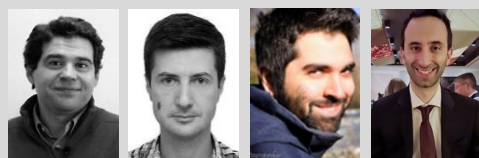
### Network Programmability



Design decomposition, logic simulation, and logic synthesis are designed to improve the automation efficiency and accuracy of network design.

# High-Level Research Key Contributions

Munich



Jorge Ilya Soroush Vittorio



Qiao Yu Paolo Valentin Soumajit



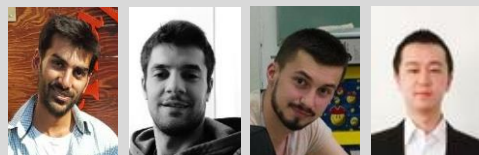
Apoorv German Anindya Haojin

Dublin



Yi Zhang Erekle Ekin Fan Wu

Collaboration



Anshul Sasho Jasmin Zi

**Goal: Achieve worldwide recognition by 2021/22**  
Attract high-level PhD researchers and experts in the fields of AI and CS



Year 2018

## Several AIOps Papers at A and A\* ranked conferences

- Self-Attentive Classification-Based Anomaly Detection in Unstructured Logs, ICDM 2020 (Rank: A\*)
- Self-Supervised Log Parsing, ECML PKDD 2020 (Rank: A)
- Anomaly Detection from System Tracing Data using Multimodal Deep Learning, IEEE Cloud 2019.
- Anomaly Detection and Classification using Distributed Tracing, IEEE CCGrid 2019 (Rank: A)
- ...

## 10 AIOps Patents

- Apparatus and Method for Detecting an Anomaly Among Successive Events
- Automated Root-cause Analysis for Distributed Systems Using Tracing-data
- Span Categorization for Microservice Applications
- ...



2018 Cloud BU President Award  
AIOps / Butterfly R&D



2019 SRE Cloud Eagle Award  
AIOps / iForesight 3.0 R&D



2019 Galileo Award  
AIOps MRC Tech Breakthrough





## WE'RE HIRING

[JOIN OUR TEAM](#)

### PhD Student in Cloud Datacenter Networks (m/f/d)

Intelligent Cloud Technologies Lab · Munich, Bavaria, Germany · Temporary · JC

[OVERVIEW](#) [APPLICATION](#)

#### Description

Huawei is a leading global information and communications technology (ICT) solutions provider. Driven by a commitment to operations, ongoing innovation, and open collaboration, we have established a competitive ICT portfolio of end-to-end solutions in Telecom and enterprise networks, Devices and Cloud technology and services. Our ICT solutions, products and services are used in more than 170 countries and regions, serving over one-third of the world's population. With 180,000 employees, Huawei is committed to develop the future information society and build a Better Connected World.

Huawei's Munich Research Center is responsible for advanced technology research, architectural development, design and strategic engineering of our products.

The size of our cloud platform is gaining momentum and it is already planet scale. **Huawei Cloud** is one of the largest and fastest-growing platforms in the world. It has strong presence with over 40 availability zones located across 4 continents and 23 geographical regions, covering locations such as Germany, Hong Kong, South Africa, or Brazil, among others.

To drive automation and reliable verification to join the Ultra-Lab which is distributed across the world, you are entrusted with developing systematic approaches to solve complex systems work, and feel a great sense of achievement.

### (Principal) Senior Network Architect (m/f/d)

Intelligent Cloud Technologies Lab · Munich, Bavaria, Germany · Full time · JC

[OVERVIEW](#) [APPLICATION](#)

#### Description

[Share this job](#)

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Now we are looking for a:

#### Senior Cloud Network Architect (m/f/d)

As a network expert of HUAWEI CLOUD, you will build and lead a team that is responsible for reliable operation, research and engineering, and evolution of data center networks. You will be part of the Ultra-scale AI/ops Lab and the Computing and Network Innovation

# Thank you.

Bring digital to every person, home and organization for a fully connected, intelligent world.

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