

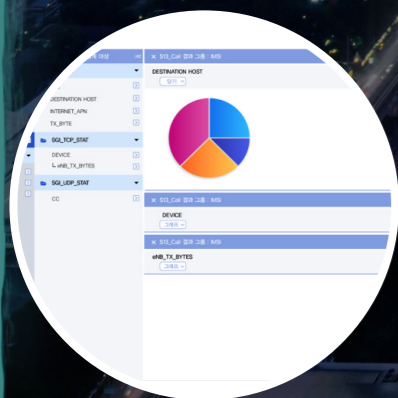


AI/BIG DATA ANALYTICS SOLUTION

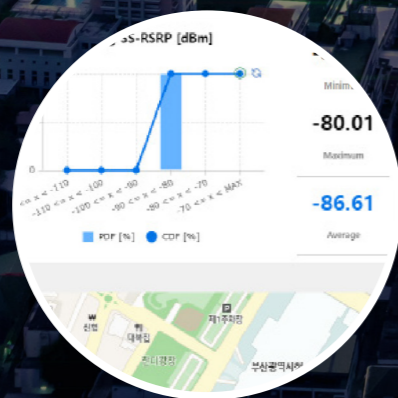
enables monitoring the status of all mobile communication network in real-time and maintaining the best quality.

We provide a platform and application that can analyze large volumes of telecommunication data in real-time based on AI/ML algorithms to monitor QoS, predict performance, and forecast potential issues.

Big Data Analysis



Big Data Platform



AI/ML



Monitors failures and customer service quality in real-time across 5G and 4G telecommunication networks, collecting, analyzing, and providing the results

Leveraging SQL and GPU acceleration for optimal performance, this solution offers deep data insights and fast analysis. It integrates with various databases to provide user-defined dashboards through both web service and standalone applications, allowing easy visualizations without developer assistance

Uses machine learning and a large-scale database to assess streaming video quality and QoE through live capture, without the need for the original video

Big Data Analysis

AI/ML

AEGIS

VQML™

AEGIS-PSee

Big Data Platform

AEGIS-O

XDB

AEGIS-A

XDV

AEGIS-CLAIR

AEGIS

Big data analytics solution

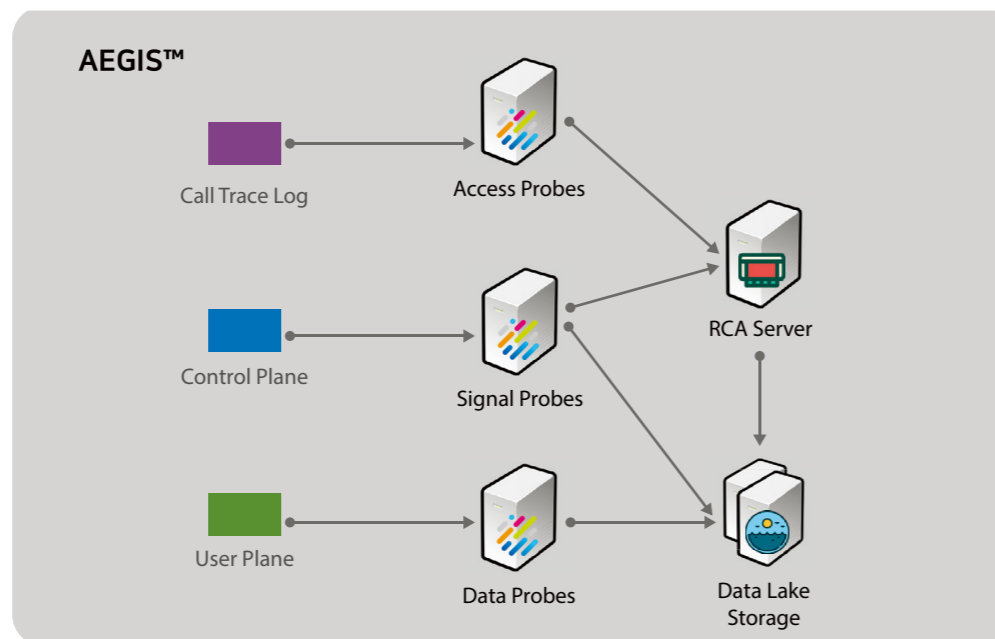
AEGIS empowers network operators to measure and analyze the end-to-end (E2E) performance of 3G, 4G, and 5G networks, including private LTE/local 5G, on a unified platform. By collecting real-time information from diverse network interfaces such as N2, N3, N4, X2, S1 MME, S11, S1U, AEGIS filters, connects, collects, and structures the data, providing an accurate representation of network performance. With AEGIS, network operators can optimize their operations and deliver exceptional service quality.

Features

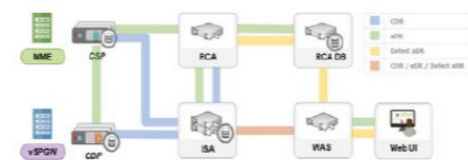
- * 3G/4G/5G Core Network Big data measurement/ analytics
- * Measure Signal and Data of main system(based on IMSI)
- * Provide an integrated solution for measurement monitoring and statistical analytics down to the cell level
- * Time Synchronization of all systems by using GPS

Functions

- * Provide auto recovery feature when error occurs
- * Provide data that compares the number of 5G service experienced customers and traffic usage by access NW
- * Provide a function to compare the traffic ratio for each access network type (gNB, eNB) of 5G customers
- * Provide a function to compare the number of customers by 5G phone
- * Provide a function to compare heavy user traffic share and gNB / eNB traffic ratio



Seamless Monitoring



Root Cause Analysis (RCA)



Data Service Analysis



VoLTE Analysis

AEGIS-PSee

Laptop based portable big data analytics solution

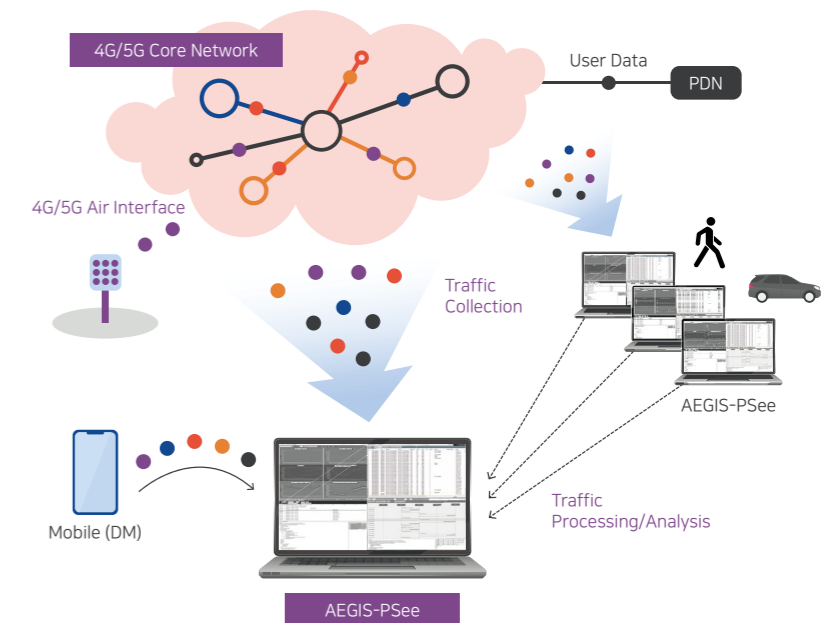
AEGIS-PSee is a portable End to End Network analysis solution that offers to collect and analyze control plane and user plane data from different network nodes. And all these can be done from a notebook PC. It includes real-time packet tracer and CDR viewer. It helps network operators measure and analyzes the end-to-end performance of their 4G and 5G (NSA/SA) networks.

Features

- * Real-time monitoring and call tracing
- * Terminal & Core log collection and analytics
- * Service & Contents delay analytics
- * S/W update verification

Functions

- * Core Traffic Monitoring
- * UE application Server Session based statistics
- * UE and Core data synchronization and logging
- * Call/Session/IMSI based analytics
- * URLLC test/KPI reporting/ Analytics
- * Drill-down chart
- * Create CDR(Call Detail Record) per Interface including time stamp, users, location, node information
- * NTP, GPS, PTP time Sync
- * Real-time trace for IMSI, IP, Port, MSISDN, etc.
- * Support VoLTE and VoNR



AEGIS-O

O-RAN End-to-End Test & Measurement Platform

AEGIS-O is a comprehensive End-to-End network testing and analysis solution specifically designed for 5G O-RAN systems. With a focus on key network nodes on fronthaul, midhaul, and backhaul, AEGIS-O enables network performance monitoring and protocol conformance analysis. By collecting and analyzing control plane and user plane data using prove module, AEGIS-O provides valuable insights into the network's performance.

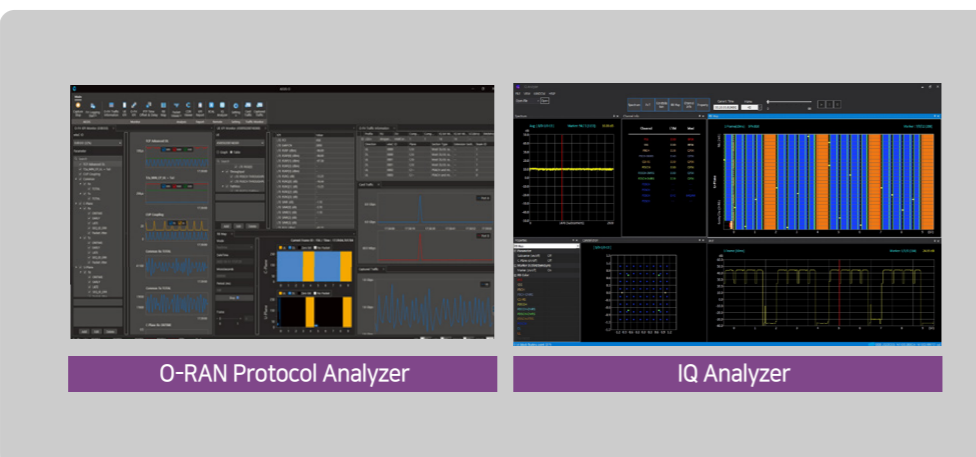
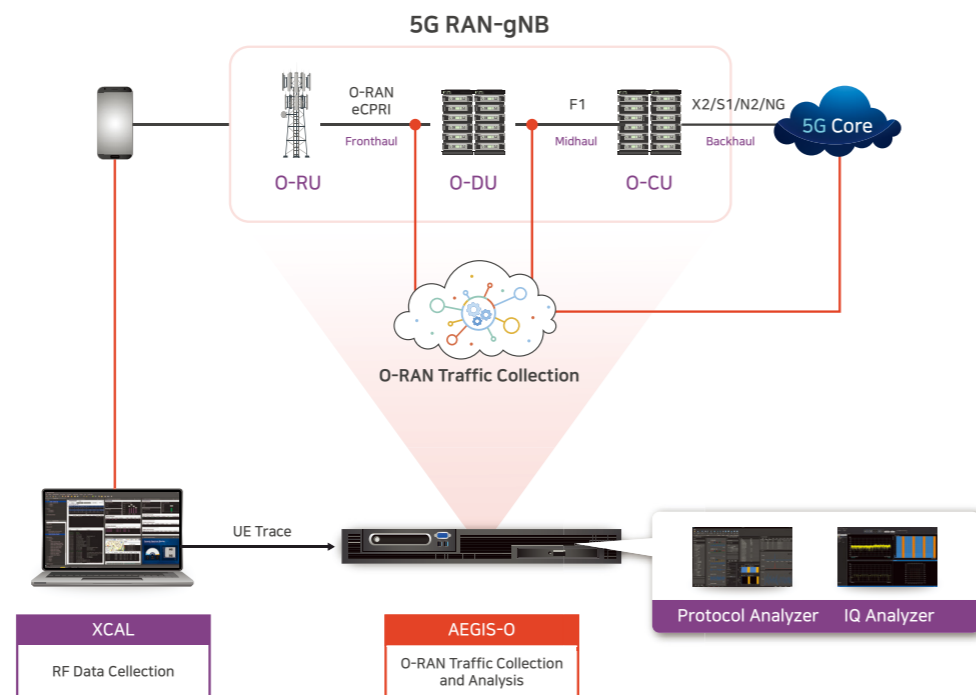
Real-time packet tracer and user-friendly graphical charts provide intuitive understanding across all network interfaces. Additionally, AEGIS-O supports O-RAN Test Case of O-RAN Alliance and offers signal analysis capabilities through IQ Data decoding. With AEGIS-O, network operators and RU, DU, CU vendors can assess and optimize their 5G networks and equipment, ultimately improving the overall network performance.

Features

- * Simultaneous analysis of UE, O-RAN Fronthaul/Midhaul/Backhaul
- * Signal and spectrum analysis through IQ data analysis
- * Objective performance calculation and comparative analysis of various vendor products
- * O-RAN Test Case support
- * Message flow check in real-time or post-processing
- * Beamforming/Scheduling analysis with UE's measured data

Functions

- * **O-RAN Protocol Analyzer**
 - : Collaborative Analytics with UE and Front/Mid/Backhaul packets
 - : Control XCAL and IQ-Analyzer
 - : Integrated dashboard
 - : 5GC Packet analysis
 - : O-FH Performance KPIs analysis
 - : O-FH CUS-Plane Delay/Jitter/PDV measurement
 - : UE Monitoring, O-FH Analysis
- * **XCAL**
 - : UE trace analysis & Report
 - : Call script based automation
- * **IQ-Analyzer**
 - : Power vs Time
 - : RB MAP
 - : Constellation
 - : Error Vector Spectrum, etc.



AEGIS-A

End-to-End High-performance Data Analytics Platform

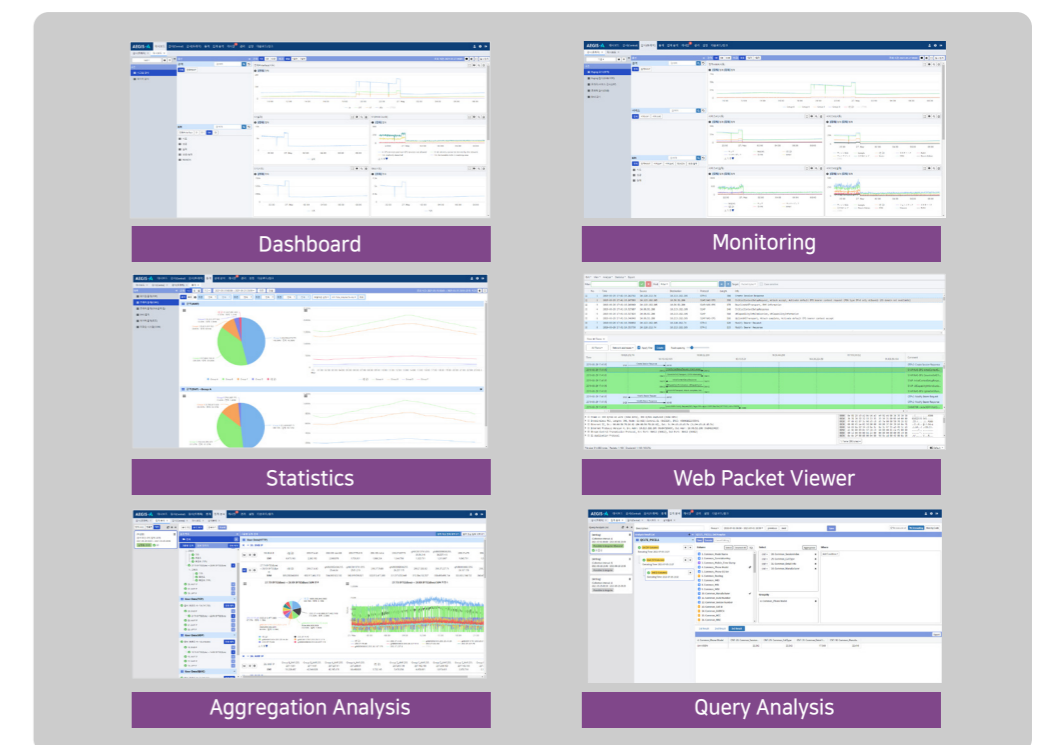
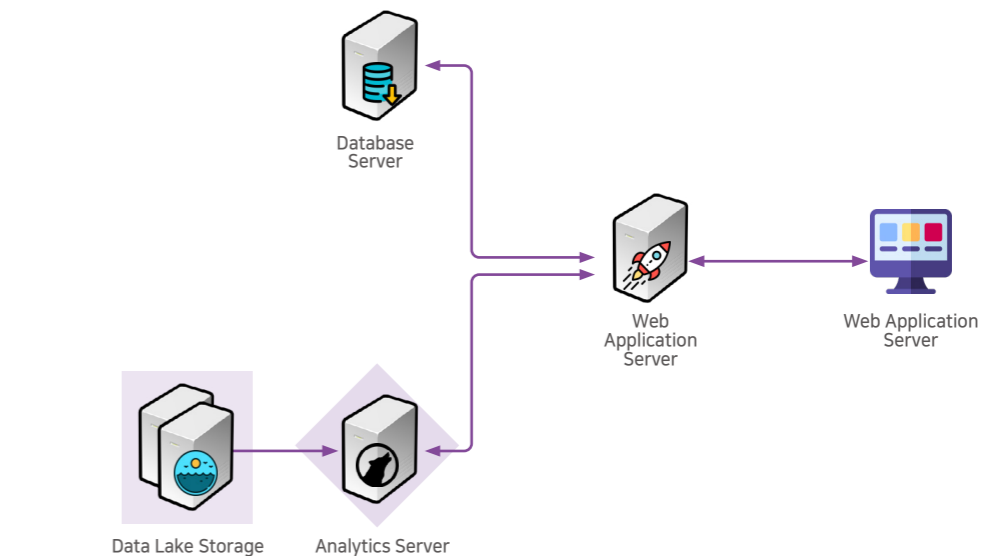
AEGIS-A is a powerful, built-in data analytics platform that enables network operators to efficiently identify specific data conditions from vast amounts of mobile network data. It empowers operators to measure and analyze the end-to-end performance of their 4G and 5G (NSA/SA) networks on a single, integrated platform. With its high-performance capabilities, AEGIS-A helps operators gain valuable insights and optimize their network operations.

Features

- * Monitoring performance and operating status of major network nodes in real-time
- * Check service status and trends based on various KPIs
- * Easy to understand subscriber trend by service statistics
- * Root cause analysis for defect calls
- * Call Trace function that can track call flow of each subscriber
- * Built-in a high-performance data analytics engine and support user-defined queries

Functions

- * **Aggregate Analytics**
 - : Inquire and analyze multi-collection sections at the same time
 - : Share analysis condition/result with other user
 - : Provide detailed analysis with Drill-Down for analysis results
- * **Report**
 - : Report via Pie, Bar, Line, Map chart and Excel table
 - : Generate report according to the user template
- * **Web based Packet viewer**
 - : Packet decode and analytics solution
 - : Support Packet Flow Chart
 - : Support raw data measured by DM



AEGIS-CLAIR

Wireless access network quality management and analytics solution

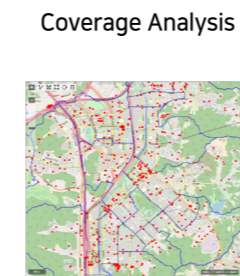
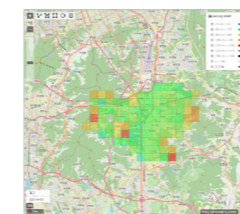
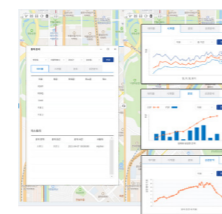
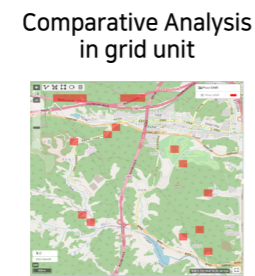
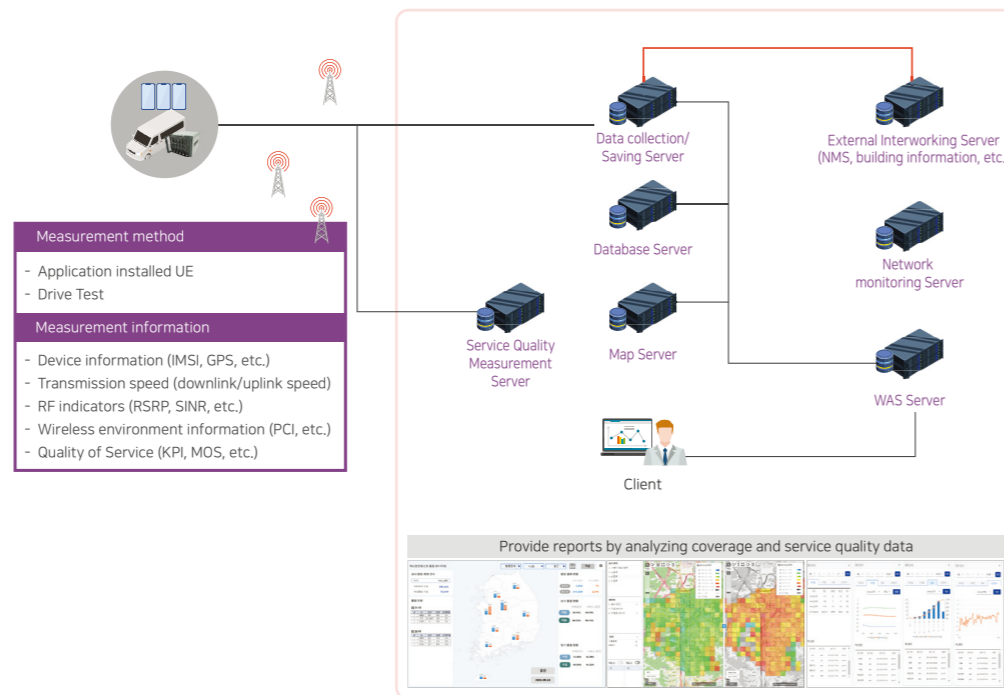
AEGIS-CLAIR is location-based wireless access network quality management and analytics solution using cloud computing/AI technology.

Features

- * Mobile quality information collection through dedicated app, measurement equipment
- * Setup scenario (collection cycle, collection start time, result upload time, etc.)
- * GIS integrated analytics
- * Statistical analytics within the domain

Functions

- * **GIS Analytics**
 - : Analytics of Key quality indicators in 75 x 75 grid units
 - : Time series trend analytics by time and period
 - : Spatial comparative analytics by region or major locations of interest
- * **Call Analytics**
 - : PCI Pollution
 - : MOD3 Collision
 - : PCI Distribution
- * **Failure Analytics**
 - : Sudden Drop RSRP
 - : Sudden Drop SINR
- * **Coverage Analytics**
 - : Interference
 - : RAN sharing
 - : Poor RSRP
 - : Poor SINR
- * **Statistics and monitoring**
 - : Statistical value per Indicator (Min. / Max. / Average / Count)
 - : Correlation analytics between Indicators
 - : Distribution graph



VQML™

AI based Video Quality Assessment Solution

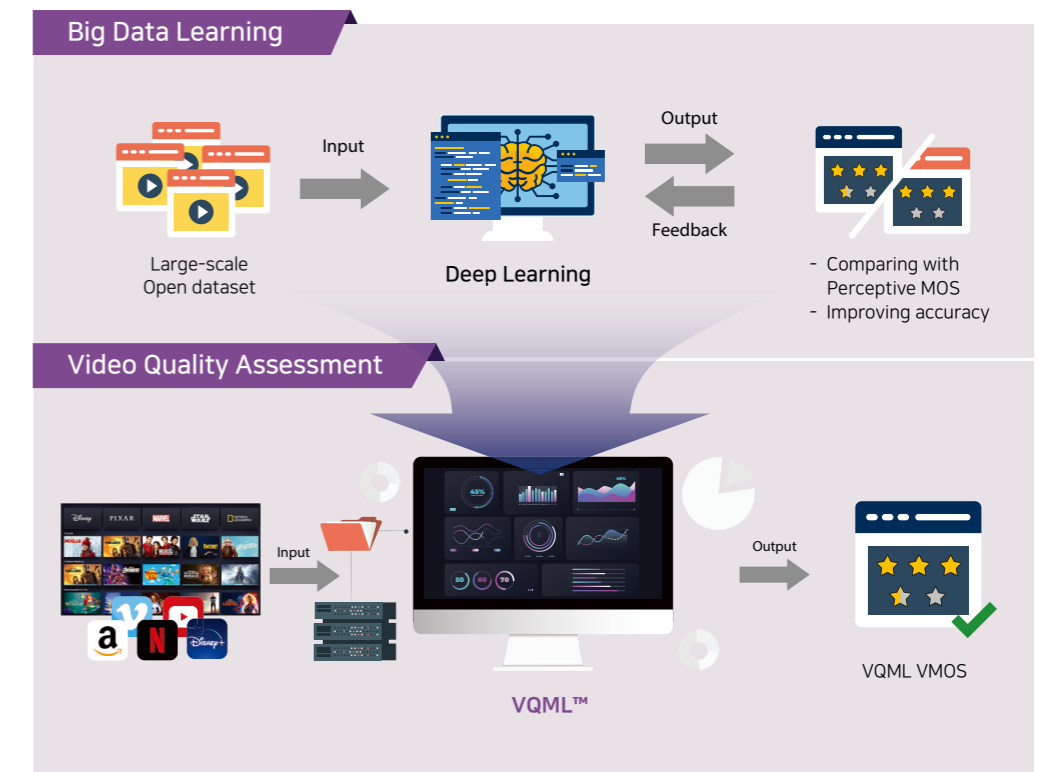
VQML is a comprehensive video quality assessment solution for the streaming video ecosystem. Leveraging ML (Machine Learning) technology and a large-scale database, VQML compares streaming video and V-MOS. Operating in the NR (No Reference) method, VQML assesses QoE through live video capture, eliminating the requirement for preparing the original video. With VQML, users can easily and systematically monitor video quality, ensuring a seamless streaming video quality.

Features

- * Easy QoE check
 - * No more complicated procedure (No reference needed)
 - * Real-time processing
 - * Measurement based on Deep Learning
 - * Learning by highly reliable Database
- : VQML learns the patterns of video and MOS value from the MOS training database built through large-scale viewer survey

Supported services

- * YouTube
 - * Facebook messenger
 - * Skype
 - * WeChat
 - * What's app
 - * Zoom
 - * Google Meet
 - * Microsoft Teams
 - * OTT service
- : Netflix, Disney, Apple TV, etc.



| Title | Description |
|----------------------|--|
| Reference method | NR (No Reference) based Video Quality Assessment |
| AI Model | A unique CNN(2)+GRU model with reference to published papers |
| Image classification | ResNet Algorithm and Deep Learning - The pixels of the original image are used as they are without any processing |
| Model learning | Learning by open database - Large-scale database (KoNVid-1k, KoNVid-150k) - Netflix public dataset (VMAF) |
| Accuracy | 86% of correlation between VQML and KoNVid-1k dataset 89% of correlation between VQML and VMAF |

XDB

High-speed Big data processing and real-time analysis platform supporting GPU-accelerated parallel processing

XDB unleashes unprecedented speed with its support for massive parallel processing using SQL and GPU-accelerated operations. By leveraging both CPU and GPU, it delivers optimal performance, enabling comprehensive analysis of complex and massive data. With its ability to handle large data and deliver high speed, XDB serves as the ideal SQL engine, unlocking deeper data value and providing invaluable business insights that were previously hard to obtain.

Features

- * Support distributed massive parallel processing based on GPU-accelerated computation
- * Analyze all areas of complex and massive data at high speed through the combination of CPU and GPU
- * Analyze even petabyte-level large-capacity data
- * Reduce data collection and query execution time
- * Support standard SQL and various programming languages, APIs, and data sources

Functions

- * MPP (Massively Parallel Processing)
 - : Distributed parallel processing architecture using multiple GPU cards
 - : Process the SQL query in milliseconds and return the result
- * Distributed Architecture
 - : Accelerate big data processing by implementing Multi Node and Multi GPU
 - : Efficient use of resources with distributed architecture load balancing consisting of a master node and multiple data nodes
- * Open Architecture
 - : Easy integration with various devices and platforms
- * Standard SQL
 - : Compatible with ANSI-92 SQL / Excellent query performance
 - : Support complex aggregate operations and federated queries



| Key of Data Processing | |
|------------------------|---|
| Columnar | <ul style="list-style-type: none"> - Based on open Columnar Memory Format - Save Raw data in column unit - Improved performance by reducing memory usage and data migration when performing queries |
| Metadata | <ul style="list-style-type: none"> - Functions equivalent to indexes in existing databases - Storing data-related information such as min, max, datatype - Minimize unnecessary I/O, CPU, and memory usage through data skipping |
| Zero Copy | <ul style="list-style-type: none"> - Minimize the copy process that occurs when data is transferred over the network - Saving CPU and memory resources - Fast data processing and efficient memory management |
| Chunking | <ul style="list-style-type: none"> - Separate and store large columnar data into small chunks - Process for efficient use of GPU resources - Suitable for performing ad-hoc queries |
| Compression | <ul style="list-style-type: none"> - When data is stored, it automatically compresses according to the data tendency - Efficient use of disk space with high-performance compression technology - Improve database performance and reduce usage time |
| GPU Caching | <ul style="list-style-type: none"> - Utilizes CPU memory and GPU memory together for data storage - Minimize access latency by keeping specific data in GPU high-bandwidth memory - Ideal for real-time big data processing |

XDV

Big Data Analysis & Visualization Solutions

XDV is a visualization tool that queries data from DBMS and presents it in user-defined dashboard formats. It integrates seamlessly with various database systems, allowing intuitive understanding and rapid access for analysis. XDV can be used as a web service or standalone application, designed to enable non-experts to create visual elements without developer assistance. It maintains the technical foundation of traditional BI tools while offering unique technology to meet diverse data processing needs.

Features

- * Accessible via the web without installation
- * Content created online can be shared, distributed, and collaborated on
- * User data is securely stored in the server's database management system
- * Available as an easy-to-use app
- * Available on various OS
- * If connected to a database and network, anyone can execute unlimited queries

Functions

- * Supports database integration, data querying, dashboard creation, data visualization, and result reporting, making it easy for anyone to handle complex database tasks



Web Service



Application

| Key of Advantages | |
|--------------------------------------|---|
| Big Data Compatibility | <ul style="list-style-type: none"> - Supports various data sources and DB connections with high-speed interfaces for JDBC and big data - Integration with major universal databases (Oracle, PostgreSQL, etc.). |
| Dynamic Dashboard Layout | <ul style="list-style-type: none"> - Define dashboard layout formats for convenient and efficient object placement - Change object placement methods with layout options - Enhance flexibility of the dashboard UI |
| SQL Query Editor | <ul style="list-style-type: none"> - Provides SQL query editing capabilities for comprehensive data analysis - Allows SQL syntax testing within the XDV environment - Query results from the editor are immediately usable in dashboards |
| Various Visualization Options | <ul style="list-style-type: none"> - Offers a variety of data visualization options - Enables quick comparison and intuitive analysis of datasets through visualization - Supports various forms of visualization, including line, bar, pie charts, and heatmaps |
| JavaScript-Based Scripting | <ul style="list-style-type: none"> - When data is stored, it automatically compresses according to the data tendency - Efficient use of disk space with high-performance compression technology - Improve database performance and reduce usage time |
| Custom Reports | <ul style="list-style-type: none"> - Provides data analysis results in user-friendly report formats - Supports standard and custom report templates - Facilitates efficient data analysis and visualization tasks |