# PrEsto Cloud

## PROACTIVE CLOUD RESOURCES MANAGEMENT AT THE EDGE FOR EFFICIENT REAL-TIME BIG DATA PROCESSING

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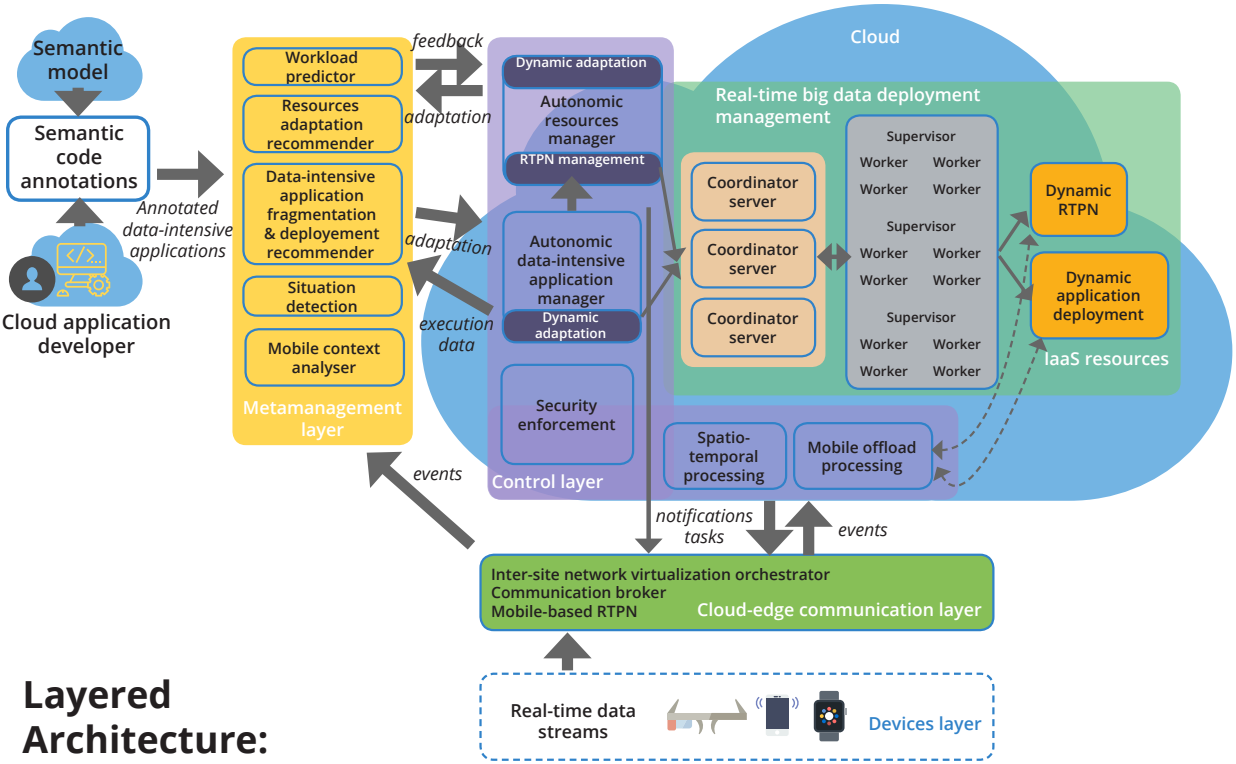
# PROJECT DESCRIPTION

Among the greatest challenges of cloud computing is to automatically and efficiently exploit infrastructural resources in a way that minimises cloud fees without compromising the performance of resource demanding cloud applications. In this aspect the consideration of using processing nodes at the edge of the network, increases considerably the complexity of these challenges. PrEstoCloud idea encapsulates a dynamic, distributed, self-adaptive and proactively configurable architecture for processing big data streams.

# PROJECT OVERVIEW

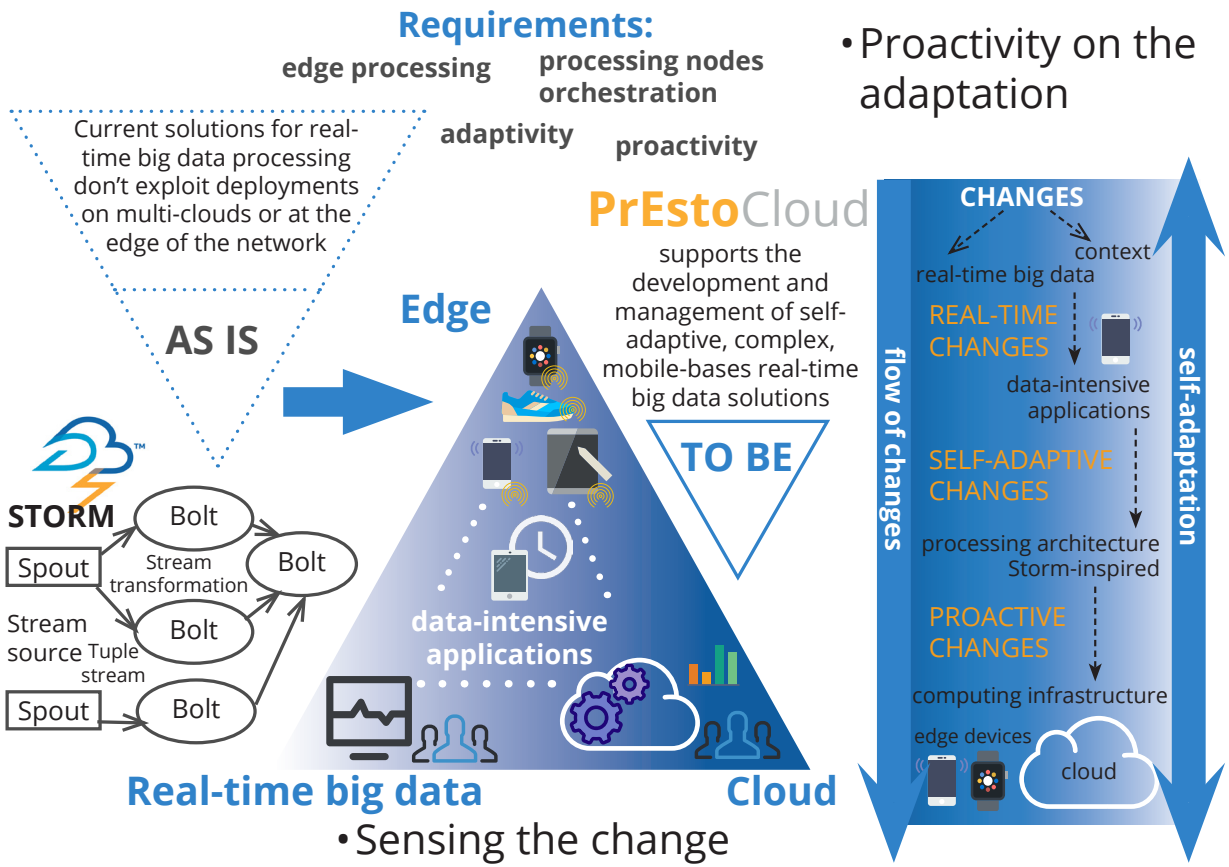



## Layered Architecture:

- Metamanagement
- Control
- Cloud infrastructure
- Cloud edge communication
- Device layer

# CHALLENGES

- Exploit multi-cloud environments for deploying big data processing frameworks extended to the extreme edge of the network
- Make intelligent cloud placements and configurations of applications based on the anticipated processing load with respect to data volume and velocity
- Elaborate on components that are capable to recommend and implement adaptations in real-time



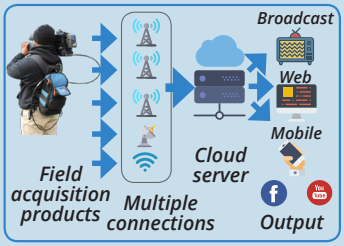

- Sensing the change
- Proactivity on the adaptation

# USE CASES

## Transport (CVS)

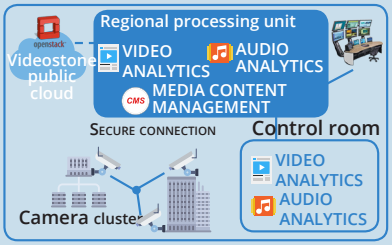

A vehicle/fleet management processes real-time information and alerts – based on data streams from GPS, on-board diagnostics, tire sensors and others.

## Media (LiveU)




A media prosumer platform offers personalized and flexible consumption of real-time stories by combining freelance reporting, traditional broadcasting and social media streams.

## Surveillance (ADITESS)




A surveillance solution combines real-time data streams from cameras and pre-processing results from groups of unmanned aerial vehicles.

# OBJECTIVES

- Inter-site network virtualization and security management
- Multi-layer cloud resource management and monitoring
- Distribution management
- Adaptive scheduling of IoT big data processing tasks between devices and the cloud
- Proactive cloud adaptation
- Test  and validate the proposed approach in complementary use cases

Software AG is the leading European system software manufacturer with the most complete business process and service platform to help organizations to achieve their business objectives faster. The company's big data, integration and business process technologies enable customers to drive operational efficiency, modernize their systems and optimize processes for smarter decisions and better service. Building on over 40 years of customer- centric innovation, the company is ranked as a "leader" in more than a dozen market categories, fuelled by core product families Adabas-Natural, Alfabet, Apama, ARIS, Terracotta, webMethods and Software AG Live. Software AG continuously investigates current trends, pursues future developments, tests, classifies and channels new technologies, and estimates their potential for its customers and partners. In its long-lasting research tradition Software AG has established a worldwide collaborative network with many organizations, among them numerous renowned universities and research institutes, enterprises, government institutions, and customers and takes advantages of the close vicinity to them. This knowledge transfer enables Software AG to create a productive foundation for excellence to provide its customers with a wide range of innovation. Through participation and collaboration in research project new ideas and trends can recognized as early as to take out a competitive advantage through commercialization and market deployment.

As a global player with software solutions in Big-Data, data management, streaming analytics, Intelligent Business Operations, and visualization, Software AG has direct access to the market of potential customers that directly benefit from the insights and developed implementation gained through PrEstoCloud. This will also play a key role along with Software AG's Start-Up program within the Exploitation Task led by Software AG.

Within the project Software AG will bring in its expertise reaching from requirement analysis, and real-time messaging and message analysis of mobile based services. Having access on a vast portfolio of base technologies, results from PrEstoCloud will be integrated fast to provide an data collection mechanisms and an interoperable information infrastructure integrating different services and sources, data streams from heterogeneous sources, and historical records. Through this expertise Software AG will a key role in the Setup of the PrEstoCloud instance

In its coordinator role Software AG will contribute its experience in project management, project administration and quality assurance based on industrial standards.

Nissatech is innovation-driven SME with strong international cooperation and vision to become East European leader in developing advanced IT solutions for real-time processing to be used in various industries and businesses. The main objective is to develop own technological building blocks through an efficient implementation of the cutting-edge research and their usage for resolving very challenging real-world problems in different domains. Building blocks enable us the flexibility in providing heterogeneous solutions, ensure the scalability and support continual improvement of our technologies.

We are a well-recognized technology provider for mobile (semantic) data processing, complex event processing (CEP) and real-time big data analytics. Current innovation focus is on dynamic event processing networks that support early detection of complex situations in a global context, which can be used for developing proactive big data architecture (combining real-time and batch processing).

The application domains range from wearables-based eHealth (remote patient monitoring), through IoT-driven intelligent transportation till Cyber-Physical Production systems (flexible manufacturing), with the main focus on creating dynamically responsive systems that can sense and respond timely (or even ahead of time). We offer end-to-end software services for real- time monitoring, local processing (Edge) and efficient data transfer to the server (Cloud) and complex big data processing/analytics in order to get useful recommendations for managing monitored entities (closed control loop).

In the big data domain we have specialized in efficient hybrid approaches (e.g. lambda architecture) that combine processing data at rest and data on move, creating a foundation for a novel architecture for dynamic-big-data processing. One of the most frequently used services is a massive anomaly detection service, a scalable, Map-Reduce-based unsupervised clustering that helps in detecting outliers in real-time data streams and discovering their root-causes. It supports the big-data-driven improvement of underlying business models, what we call creative analytics.

Recently we have started work on providing wearables-based business solutions, focusing mainly on improving workers performances and safety using smart watches.

Based on positive experiences from developing innovative IT services, the company has developed its own methodology for successfully bringing innovative solutions to market, which is very suitable for the exploitation of the results in research projects. This is one of the strategic orientations of the company.

Nissatech participates actively in the work of industry-oriented communities, currently focusing on Big Data (BDVA member) and Manufacturing (FML member).

ActiveEon is an Independent Software Vendor providing innovative solutions for IT automation, acceleration and scalability, Big Data, Internet of Things, Distributed and parallel applications. With ActiveEon, automate your Business to accelerate your Go-to-market and get competitive advantage. ActiveEon serves national and international clients such as CEA, L'Oréal, SeaEngineering (US), Home Office (UK), etc. ActiveEon offers ProActive , a suite of software solutions available in SaaS mode: Workflows & Scheduling is a complete workload scheduler that distributes and simplifies the execution of applications, featuring a workflow orchestrator and a resources manager, also featuring data transfer and License cost optimization; Parallel Scientific Toolbox is a solution that allows the distribution and the acceleration of Big Data processing in R Language, Spark, Hadoop, Matlab, Scilab, etc. on clusters, grids and clouds; Cloud Automation automates the deployment and management of complex multi-VMs applications, managing heterogeneous and hybrid Clouds (private, public, hybrid, multi- vendors Clouds) and fully compatible with Docker.

ActiveEon is technology provider for the Multi-Cloud management and deployment. Its technology provides a uniform parallel computing interface with distributed and parallel Workflows, and a uniform resource management, independent from the underlying virtualized infrastructure, for better utilization of existing resources from desktop, multi-cores, servers, clusters to Grids and Clouds

**Jožef Stefan Institute** (JSI - www.ijs.si) is the leading research institution for natural sciences in Slovenia with over 900 researchers within 25 departments working in the areas of computer science, physics, chemistry and biology.

**The Artificial Intelligence Laboratory** (ailab.ijs.si), with approximately 40 researchers, is one of the largest European research groups involved in RTD projects and initiatives that introduce AI approaches and technologies to the field of big data analytics. The research topics include Artificial Intelligence, Machine Learning, Data-Mining, Text-Mining, Web-Mining, Multimedia Mining, Semantic Technologies, Social Network Analysis, Language Technologies, Natural Language Processing, Multi-lingual, Cross-lingual Technologies, Scalable, Real-time Data Analysis, Data Visualization, Knowledge Reasoning and recently Sensor Networks. Its key research direction is combining modern statistical data analytic techniques with more semantic/logic based knowledge representations and reasoning techniques with the purpose to make progress in solving complex problems such as text understanding, large scale probabilistic reasoning, building broad coverage knowledge bases, and dealing with scale. Its team consists of individuals with high competences in both research and technical development from data driven analytics to knowledge based systems. The department collaborates strongly with its spin-out companies that are providing real-life big data analytics solutions to companies such as Bloomberg, New York Times, British Telecom, Google and many others.

The **Centre for Knowledge Transfer in Information Technologies** (http://ct3.ijs.si/) has approximately ten researchers and technical staff working in the areas of research results dissemination and eLearning and covers management, training and the dissemination activities of various EU projects. In particular, the centre is well known through its portal http://videolectures.net/ with multimedia materials of numerous scientific events, on-line training materials, and a collection of tutorials on different scientific fields. The portal aims at promoting science, exchanging ideas and fostering knowledge sharing by providing high quality didactic contents not only to the scientific community but also to the general public. The centre has also developed http://scienceatlas.ijs.si/ and http://www.ist-world.org/ for the analysis and visualization of large bibliographic and project databases. The Centre for Knowledge Transfer in Information Technologies act as the UNESCO Chair for Open Technologies for Open Educational Resources and Open Learning.

ICCS is a non-profit private law body associated with the School of Electrical and Computer Engineering of the National Technical University of Athens (NTUA). ICCS was established in 1989 by the Ministry of Education of Greece in order to promote research and development activity in all diverse aspects of computer and telecommunications systems and their applications.

The Information Management Unit (IMU) is a multi-disciplinary unit of ICCS engaged in research and development activities in Information Technology Management. IMU is staffed with three faculty members, seven post-doctoral senior researchers and six researchers.

The research activities of IMU focus on: Knowledge and Semantic Technologies, Decision Support Systems, Recommender and Personalization Systems, Social Computing, Collective Intelligence and Information Systems for Behavioural Change. In terms of application domains IMU's focus is on: enterprise and business computing, e-government, operational intelligence, intelligent transport and e-health, cloud computing, and web applications and tools. Since its establishment IMU has actively contributed in forty seven (47) research and development projects, of which seven (7) are currently active, during the 2016-2018 period.

The French National Centre for Scientific Research (French: Centre national de la recherche scientifique, CNRS) is the largest governmental research organisation in France and the largest fundamental science agency in Europe. It employs 32,000 permanent employees (researchers, engineers, and administrative staff) and 6,000 temporary workers.

CNRS will be involved through the Scale and Signet teams. Scale and Signet are two joint team between CNRS and University Nice Sophia Antipolis.

In PrestoCloud, Scale will mainly interact with the WP3 making contribution in dynamic workload placement over both a hybrid cloud and the network edge. This will result in the modeling and the implementation of consolidation mechanisms inside BtrPlace and make an advance in placement algorithms inside hybrid infrastructures that expose a varying level of details in terms of resource availability, management capabilities, and support for SLAs.

The Signet team will bring its expertise in networking and especially, in the context of the PrEstoCloud project, in the building of a virtual network orchestrator that will interconnect on demand the different PrEstoCloud components. This entails devising the global networking service, its management (on the fly commissioning and decommissioning of network and virtual network components) and design of appropriate security mechanisms to authenticate network components and monitor the traffic.

Both teams will also participate in the high-level requirement analysis for the PrEstoCloud platfom, the establishment of a scientific state-of-the-art and dissemination activities

Ubitech is a leading, highly innovative software house, systems integrator and technology provider, established to provide leading edge intelligent technical solutions and consulting services to businesses, organizations and government in order to allow the efficient and effective secure access and communication with various heterogeneous information resources and services, anytime and anywhere. Ubitech enables real-time valid information processing and decision-making, the realization of intelligent business environments, and B2B and B2C transactions by providing high added-value business –oriented and –based solutions. Ubitech has been established in Athens, Greece back in 2005, concentrated initially in the Greek and Balkan market and acquiring several EC and national grants for novel R&D initiatives. Currently, Ubitech has extended its operations with targeted international activities through its subsidiaries, representation offices, business partners and affiliated companies in Limassol (Cyprus), Madrid (Spain), Buenos Aires (Argentina) and Guayaquil (Ecuador), concentrating mainly in the Spanish-speaking countries of Central and Latin America.

Advanced Integrated Technology Solutions & Services Ltd is a Cyprus-based Small Medium Enterprise (SME) established in 2011. ADITESS is a scientific, consulting, and research company whose purpose is to conduct theoretical and applied research and to produce studies, at strategic and tactical level, on issues concerning Security policies, Critical Infrastructure Protection, Aftermath on crisis events, Transportation security and Border management (monitoring and surveillance), modeling solutions and to develop state of the art applied Security Solutions in the above-mentioned areas. ADITESS staff is composed of dedicated and experienced professionals who have outstanding professional and academic experience in the area of security, and have been involved in EU Research Programs as well as national and international projects for several years. Consisting and cooperating with consultants - researchers with professional and academic experience and a long-standing history in proposal preparation, project management and R&D activities, ADITESS LTD is at the forefront of our offering with clients stemming from a multitude of technological domains, such as Security, Defense, Information and Communication Technologies. Furthermore, a number of ADITESS researchers come with ex-military and ex-police forces background in IT Security, Electronic Warfare (EW) and Signal Intelligence (SIGINT) in large-scale National and International operations, over the last fifteen years. This field experience is enhanced by high academic knowledge especially in the IT and security (IT, UAV systems, Electro-optics, Communication, etc.) system's area.

LiveU Ltd. is an Israeli based startup company that has developed technology that enables live wireless high-qality multimedia transmissions from the field to any location. Our systems use any existing wired and wireless technology including cellular data streams, WiMAX and Wi-Fi hotspots, overcoming the inherent bandwidth limitations and fluctuations of these networks. Our main applications are live video transmission for cable and satellite TV (sport and news gathering) and IP TV/Internet portals streaming.

Our products are currently being used by national and international TV News channels, Internet portals, Web TV and others. We deliver a light-weight, low-cost unit designed for every reporter or location. We currently transmit real-time video at an uplink bitrate of 1-2Mbps (SDTV) using MPEG-4 / H.264 for broadcast TV and WME (Windows Media Encoder) for Internet applications. We are developing a solution for fast deployement, vehicles and man carried, that will integrate numer of cameras and wireless links for mobile surveillance applications in crowed management.

Recent development we do are related to mobile journalism (MOJO) where consumers can generate and exchange content, this live streams are likely to create large amount of data specifically at events, thus highly related with the project

N. Amram Technologies (NAM) is an Israeli software development company providing expert development of custom software applications in the domain of video communications and telecommunication. The main Research and Development areas of NAM activities are:

- Cloud platform for new media elements, enabling developers to create new media applications.
- Improving the Quality of Experience (QoE) via social, spatial, and information connectedness technologies.
- Insights and content identification from digital media on the public social networks domain.

NAM has a vast experience in all aspects related to research, algorithms development, software realization, dissemination, and exploitation. NAM is involved in elastic cloud platform for media application, with mobile connection manager, with video in various formats such as HEVC, SVC, H264 as well as the company is focusing on providing developments in the field of WebRTC and cloud services to various companies. The company team has experience in video conferencing and mobile journalism business case as part of collaboration with relevant stake holders mainly broadcasters and online portals in Israel.

**ADVANCED TELEMATICS**

CVS Mobile Telematic solutions for managing vehicle fleets and working processes are a combination of several advanced technologies. The most prominent of those is geolocation (so called GPS-tracking) and vehicle navigation via the terminal/navigation device in the vehicle. The latter is also used to send work tasks to the driver or the field worker and for communication between vehicles and dispatcher centres. We can also install printing solutions in the vehicles, which can be used together with the communication system to print and capture documents in the field. We also provide comprehensive electronic or paper transactions in areas where the companies have a lot of field work. Modern technology enables the telemetric capture of data in the vehicle, the display of data at the headquarters and processing data on the condition of the vehicle in real time.

All CVS Mobile telematic solutions can be linked with other elements of an information system for managing operations and thus their functionality can be upgraded. The company provides a series of already developed applications to review and manage working activities in the field – via the internet (WEB) or WAP-applications on mobile phones.

The CVS Mobile telematic system is a business solution that enables the flawless management of vehicle fleets, working processes and mobile employees. It is suitable for use in numerous areas, mainly in transportation, logistics, construction, passenger traffic and numerous service-oriented private and public organisations. It also enables constant communication between the vehicle/driver and the vehicle fleet manager.

# CONSORTIUM

Activeeon
SCALE BEYOND LIMITS

CVS mobile
ADVANCED TELEMATICS

software AG

ΕΠΙΣΕΥ
ICCS

cnrs

aditess
Advanced Integrated Technology Solutions & Services

UBITECH
ubiquitous solutions

Nissatech
innovation centre

IJS

N. Amram Technology

LiveU