textarossa

Towards EXtreme scale Technologies and Accelerators for euROhpc hw/Sw Supercomputing Applications for exascale

Innovative Two-Phase Cooling Solutions for the Exascale Computing Systems

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IQUATTRO

THE TWO-PHASE COOLING COMPANY

ISC High Performance 2022 - May 29 - June 2, 2022

ISC High Performance

The HPC Event.

TEXTAROSSA

TEXTAROSSA: Towards EXtreme scale Technologies and Accelerators for euROhpc hw/Sw Supercomputing Applications for exascale

TEXTAROSSA is an European project funded by EuroHPC (The European High Performance Computing Joint Undertaking)

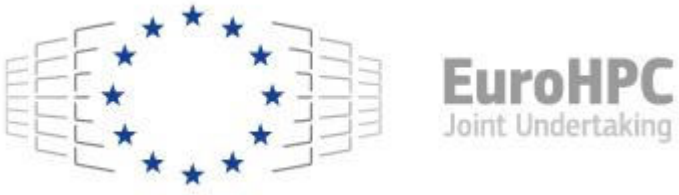
The project will develop core technologies for computing architectures towards exascale-class systems.

Objectives: to realize the EuroHPC roadmap for energy-efficiency, high-performance and secure services by enabling new computation paradigms for HPC, AI and HPDA applications

Innovative Two-Phase Cooling system for thermal control

TEXTAROSSA

TEXTAROSSA: Towards **EX**treme scale **T**echnologies and **A**ccelerators for eu**RO**hpc hw/**S**w **S**upercomputing **A**pplications for exascale

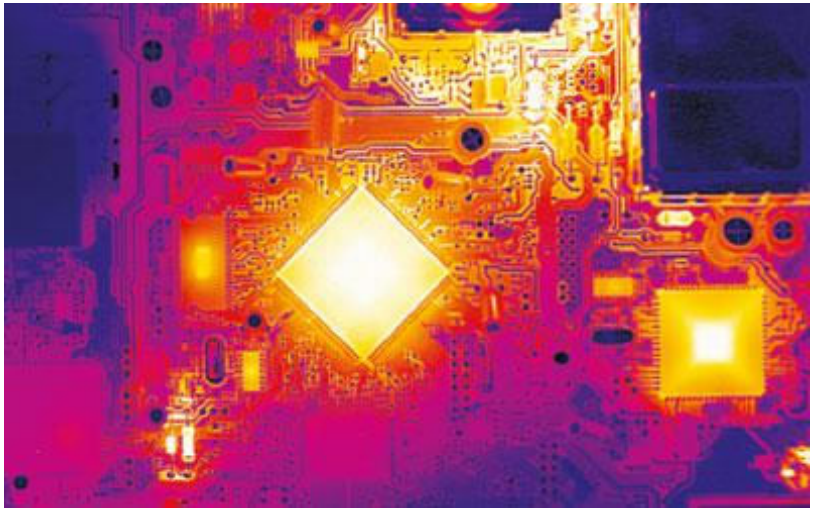


Participant No.	Participant organisation name	Short name	Country
1 (Coordinator)	Agenzia Nazionale per l'Energia, le Nuove Tecnologie e lo Sviluppo Economico Sostenibile	ENEA	IT
2	Fraunhofer Gesellschaft Zur Förderung der Angewandten Forschung E.V.	FHG	DE
3	Consorzio Interuniversitario per l'Informatica	CINI	IT
4	Institut National de Recherche en Informatique et en Automatique	INRIA	FR
5	Bull SAS	ATOS	FR
6	E4 Computer Engineering SpA	E4	IT
7	Barcelona Supercomputing Center - Centro Nacional de Supercomputacion	BSC	ES
8	Instytut Chemii Bioorganicznej Polskiej Akademii Nauk	PSNC	PL
9	Istituto Nazionale di Fisica Nucleare	INFN	IT
10	Consiglio Nazionale delle Ricerche	CNR	IT
11	In Quattro Srl	InQuattro	IT

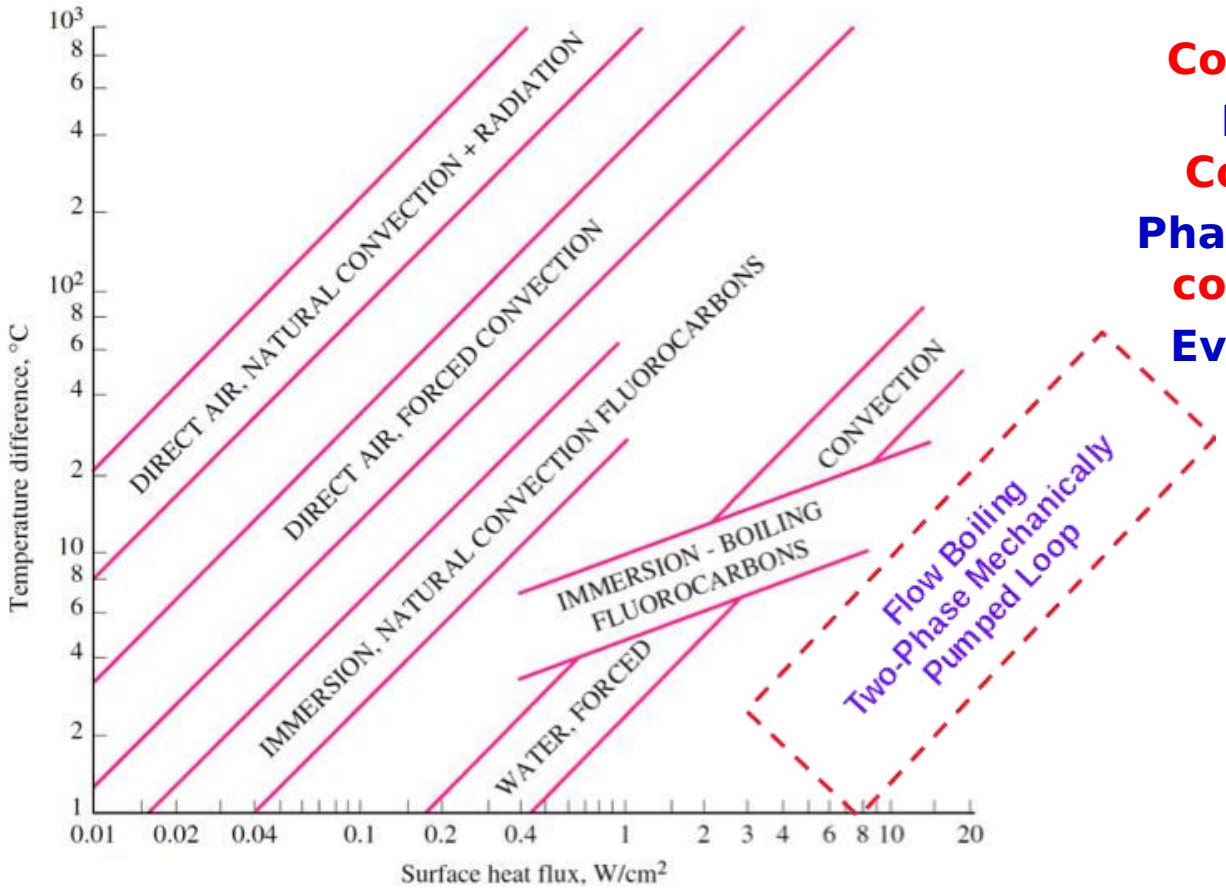
Thermal Control of Electronics: Problem

Driven by the continuous increase in power loads and continuous miniaturization of processors, thermal management presents a complex challenge to thermal engineers.

Present cooling solutions are not adequate (air cooling, heat pipes, liquid cooling) for demanding electronics and future requirements.



Thermal Control of Electronics: Problem



Temperature difference versus heat flux for some heat transfer mechanisms

Kraus and Bar-Cohen, 1983

COOLING TECHNOLOGIES

Air (Natural/Forced Convection, Sensible Heat)

Liquid (Natural/Forced Convetion, sensible heat)

Phase Change (evaporation & condensation, latent heat)

Evaporative Liquid Cooling

Given the rate of heat dissipation and the maximum allowable component temperature, the graph helps to determine the appropriate cooling technology.

Temperature difference is the difference between the case surface temperature (max. allowable value) and the ambient temperature.

Surface heat flux is determined by dividing the power dissipation rate to the exposed surface of the device.

Thermal Control of Electronics: Solution

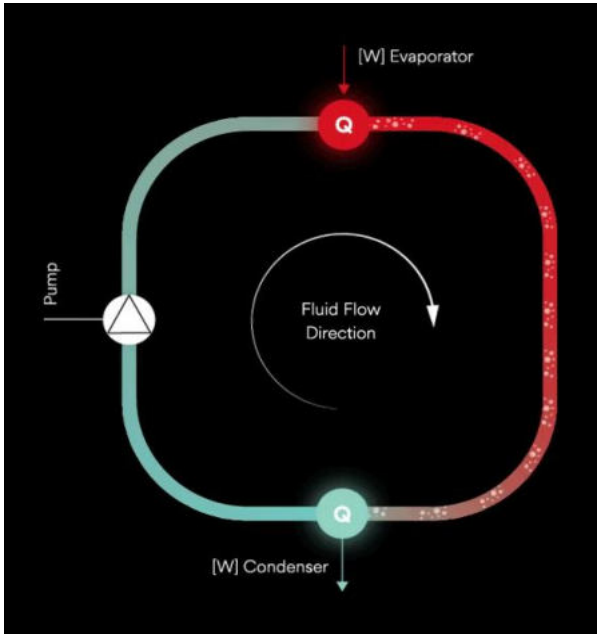
Two-Phase cooling technology

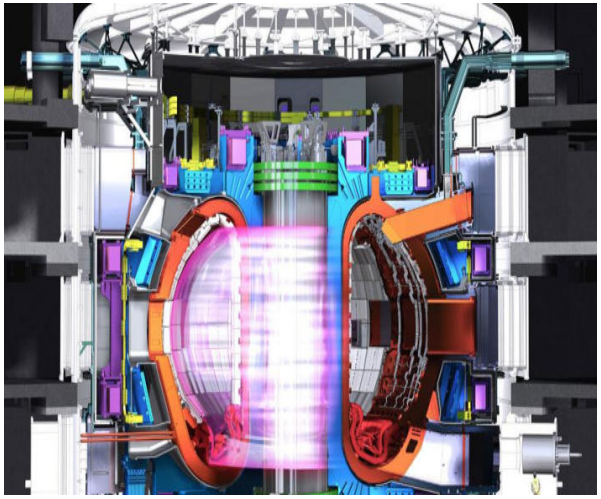
Evaporative Liquid Cooling

Two-Phase Mechanically Pumped Loop: a new cooling technology for the next generation of electronic components (Data Centers)

The innovative feature of this system is the use of flow boiling heat transfer (latent heat) for cooling electronic devices. Compared to traditional cooling systems, significantly higher heat transfer coefficients can be achieved at significantly lower flow rates and pumping power.

Flow boiling is one of the most efficient cooling systems. It is the cooling systems of the components of fusion reactor (ITER).





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THE TWO-PHASE COOLING COMPANY

Thermal Control of Electronics: Solution

Two-Phase cooling technology

Direct to Chip Two-Phase Cooling

Features:

1. Decrease energy consumption.
2. Increase processing capacity
3. Increase density
3. Safety: dielectric fluids

TEXTAROSSA: Two-Phase Cooling

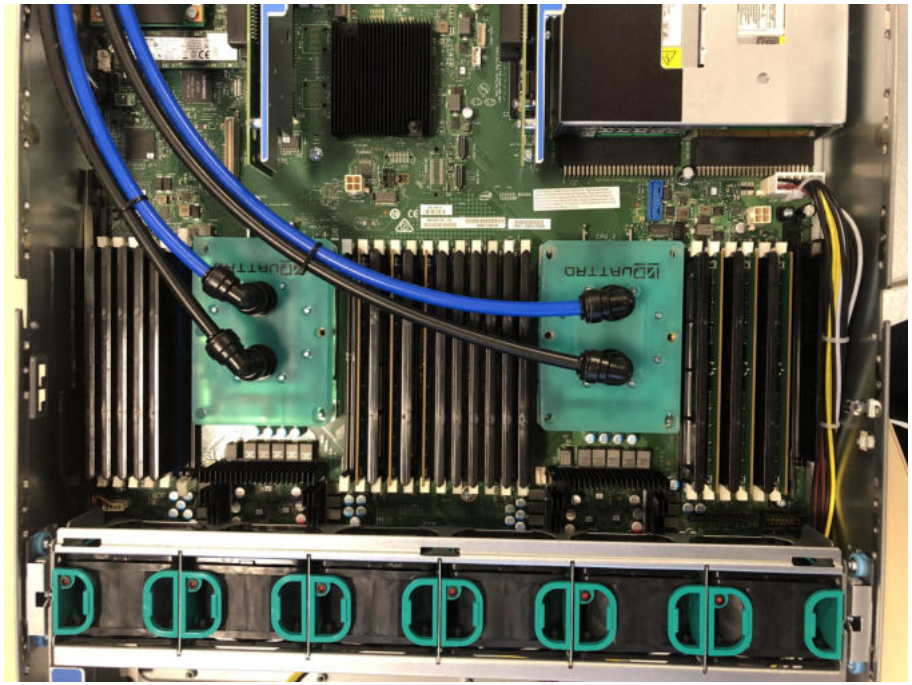
WP 3 Development of the two-phase cooling technology

Leader: InQuattro.

Partners : ATOS, E4-Company, ENEA, Politecnico di Milano

The Two-Phase Cooling system will be installed in two server configurations:

1. **FPGA platform (E4-Company)**
2. **GPU platform (ATOS)**



Objectives

1. **Performances (thermal power dissipation, energy efficiency)**

2. **Modeling of the cooling system**

3. **Developent of thermal and power management strategies**

In Quattro - Who We Are

IQUATTRO

THE TWO-PHASE COOLING COMPANY

In Quattro is a registered Italian start-up (July 2018) with a strong expertise in thermal management systems for terrestrial and space applications.

In Quattro develops and manufactures advanced two-phase cooling solutions for thermal management of high performance computers and high power electronics.

In Quattro is a spin-off of ENEA (Italian National Agency for New Technologies, Energy and Sustainable Economic Development).

In Quattro is included in the ESA (European Space Agency) **Business Incubation Centre** in Rome (Regione Lazio), Italy

esa business incubation centre

ENEA Ente per le Nuove tecnologie, l'Energia e l'Ambiente

In Quattro - Who We Are

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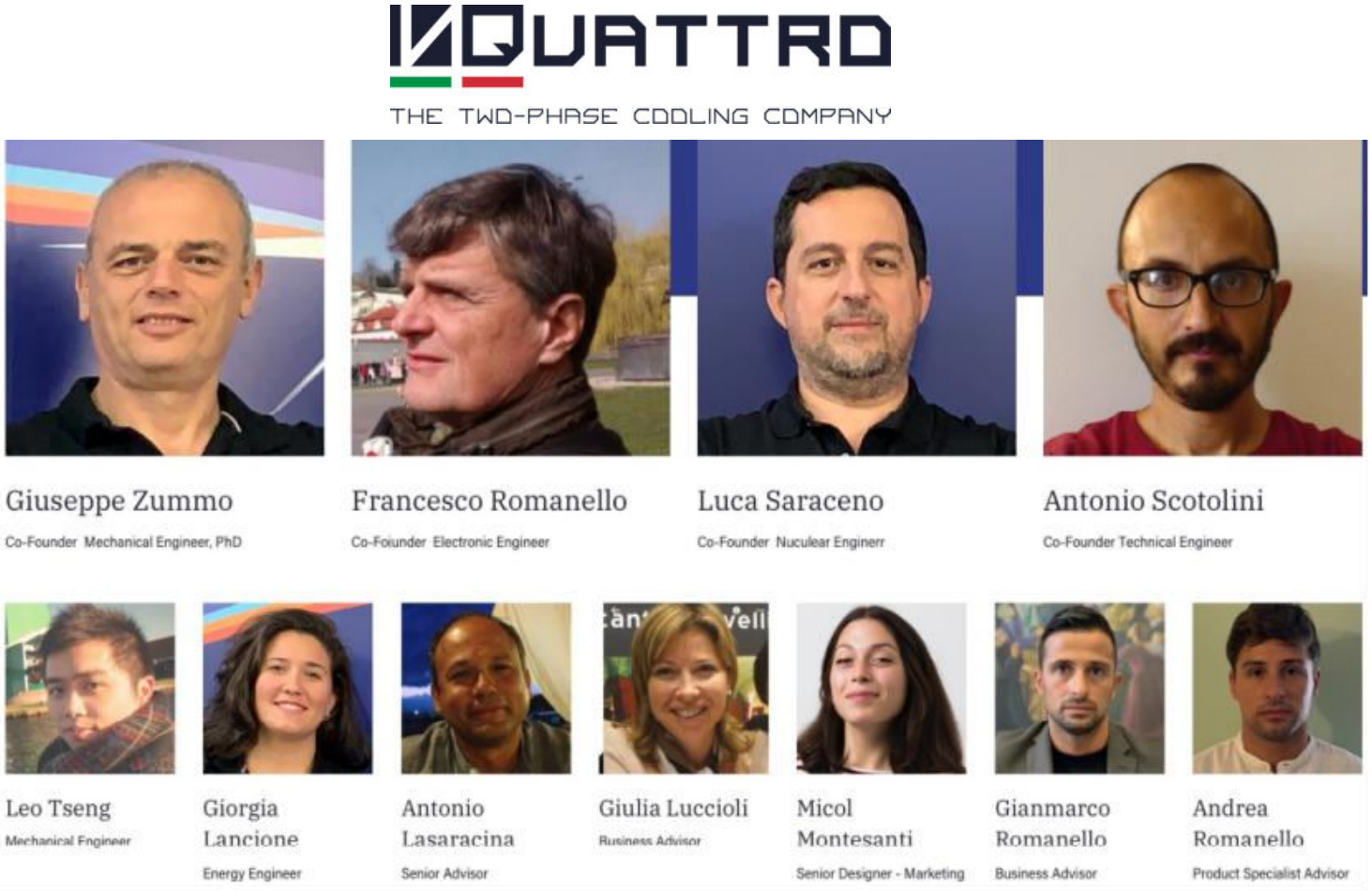
In Quattro was formed by four researchers of ENEA with strong background in **Two-Phase Thermal Management of nuclear reactors and of components for space**.

The team has 14 years of experience in microgravity thermal management systems, and have been performing many parabolic-flight campaigns in the frame of ESA projects.

In Quattro - People



In Quattro team is formed by 11 people in different areas: thermal enegineering, legal, marketing, management, design, electronics, sensors

In Quattro

THANK YOU FOR YOUR ATTENTION!

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