

# Network Solution for Exascale Architectures

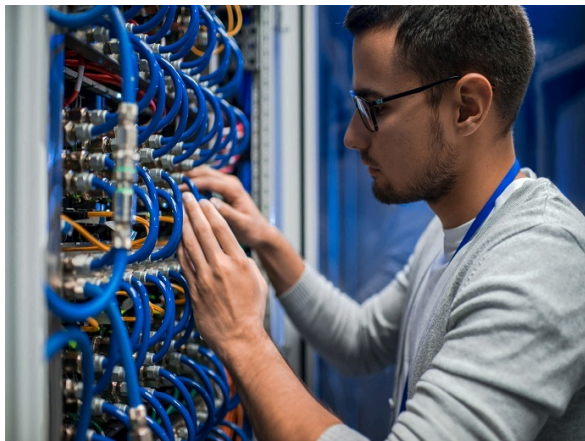
## Results in Brief

## Networking tools to boost supercomputer support



New advances in interconnect technologies from the EuroHPC JU-funded RED-SEA project can place Europe at the forefront of exascale supercomputing, bringing benefits across a range of fields, from climate modelling to drug discovery.



DIGITAL ECONOMY



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Exascale supercomputers represent a significant leap forward in computing power, capable of performing a quintillion calculations per second. “The potential benefits are numerous and far-reaching,” explains [RED-SEA](#)  project coordinator Claire Chen, from technology firm [Eviden](#)  in France.

Applications for supercomputing include climate modelling, astrophysics and genomics. “In essence, exascale supercomputers hold the promise of revolutionising various aspects of science, technology and society by providing unprecedented computational power to tackle some of the most complex and pressing challenges facing humanity.”

## Connectivity boost

The goal of the RED-SEA project was to lay the groundwork for exascale deployment, by identifying ways of efficiently managing exascale computing systems. Within these systems, interconnection networks serve as the backbone, and play a crucial role in overall performance.

“These networks need to support all the individual connecting nodes, parallel processing systems, efficient connection to the data-centre network, and emerging data-centric and AI-related applications,” notes RED-SEA project technical manager Damien Berton.

“Additionally, they need to incorporate features such as efficient network resource management, in-network computing, and power-efficient support for accelerators such as graphic processing units (GPUs).”

The project therefore wanted to develop an innovative, low-latency, scalable and reliable European interconnection network. RED-SEA was carried out with support from the [European High Performance Computing Joint Undertaking \(EuroHPC JU\)](#), an initiative set up to develop a world-class supercomputing ecosystem in Europe.

“The project was built on three pillars,” explains Chen. “The first involved leveraging existing technologies, such as [BXI](#), an interconnection network for high-performance computing, as well as the results of previous EU-funded projects, such as [ExaNeSt](#). The second pillar involved exploring innovative new solutions to lay the groundwork for future versions of BXI, while the third pillar sought to develop an ecosystem of users and developers.”

## Congestion control

Through collaborative partnerships and extensive work, both Chen and Berton believe that significant progress has been made. “We successfully advanced the state of interconnection network technologies,” adds Chen.

One significant outcome for example is the advancement of BXI, with a focus on enhancing the current version (BXIv2) and laying the groundwork for its next generation (BXIv3). Another key achievement has been the exploration of new, efficient network resource management schemes.

“For example, we were able to enhance collective operations, congestion control and adaptive routing,” says Berton. “We also extended the European interconnection networks ecosystem through the expansion of the use of BXI networks.”

## Product range

“We were able to identify and develop 21 RED-SEA [exploitable results](#) and achieve two patents,” says Berton. Products include an [ASIC IP](#) for building an ethernet-integrated circuit, and a software simulator and service for developing highly

parallel systems.

Project consortium members will also continue to develop and implement the next generation of BXI. The plan is to integrate BXIv3 within the [EUPEX](#) project – a EuroHPC JU-funded exascale pilot initiative.

“Mastering interconnect technologies will provide Europe with an advantage in terms of technological sovereignty and economic return,” adds Chen. “We hope that the long-term legacy of this project will include scientific advancement in fields such as healthcare, environmental sustainability and energy efficiency. By harnessing the power of exascale computing, we aspire to create a more prosperous, equitable and sustainable future for all.”

## Keywords

[RED-SEA](#)

[EuroHPC JU](#)

[computing](#)

[supercomputing](#)

[exascale](#)

[software](#)

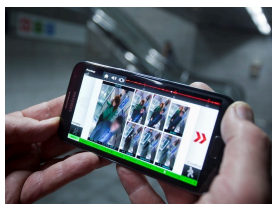
[BXI](#)

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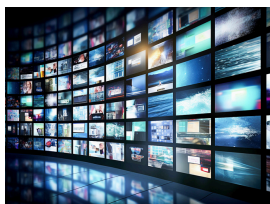
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### Project Information

#### RED-SEA

Grant agreement ID: 955776

[Project website](#) 

#### DOI

[10.3030/955776](https://doi.org/10.3030/955776) 

Project closed

#### EC signature date

2 December 2020

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1 April 2021

#### End date

31 March 2024

#### Funded under

INDUSTRIAL LEADERSHIP - Leadership in enabling and industrial technologies - Information and Communication Technologies (ICT)

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#### EU contribution

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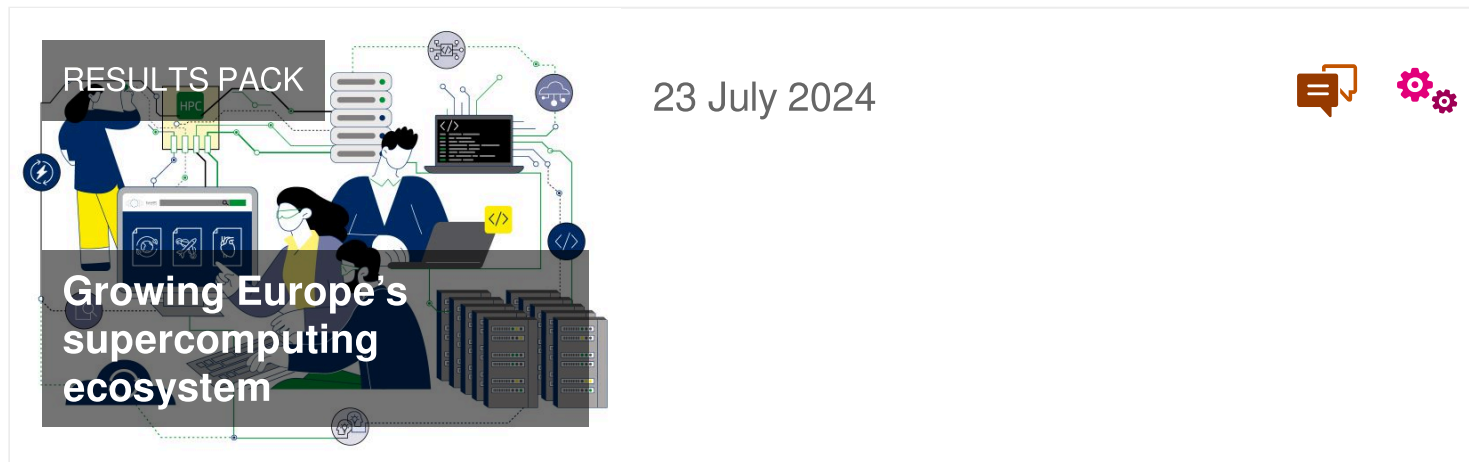
#### Coordinated by

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