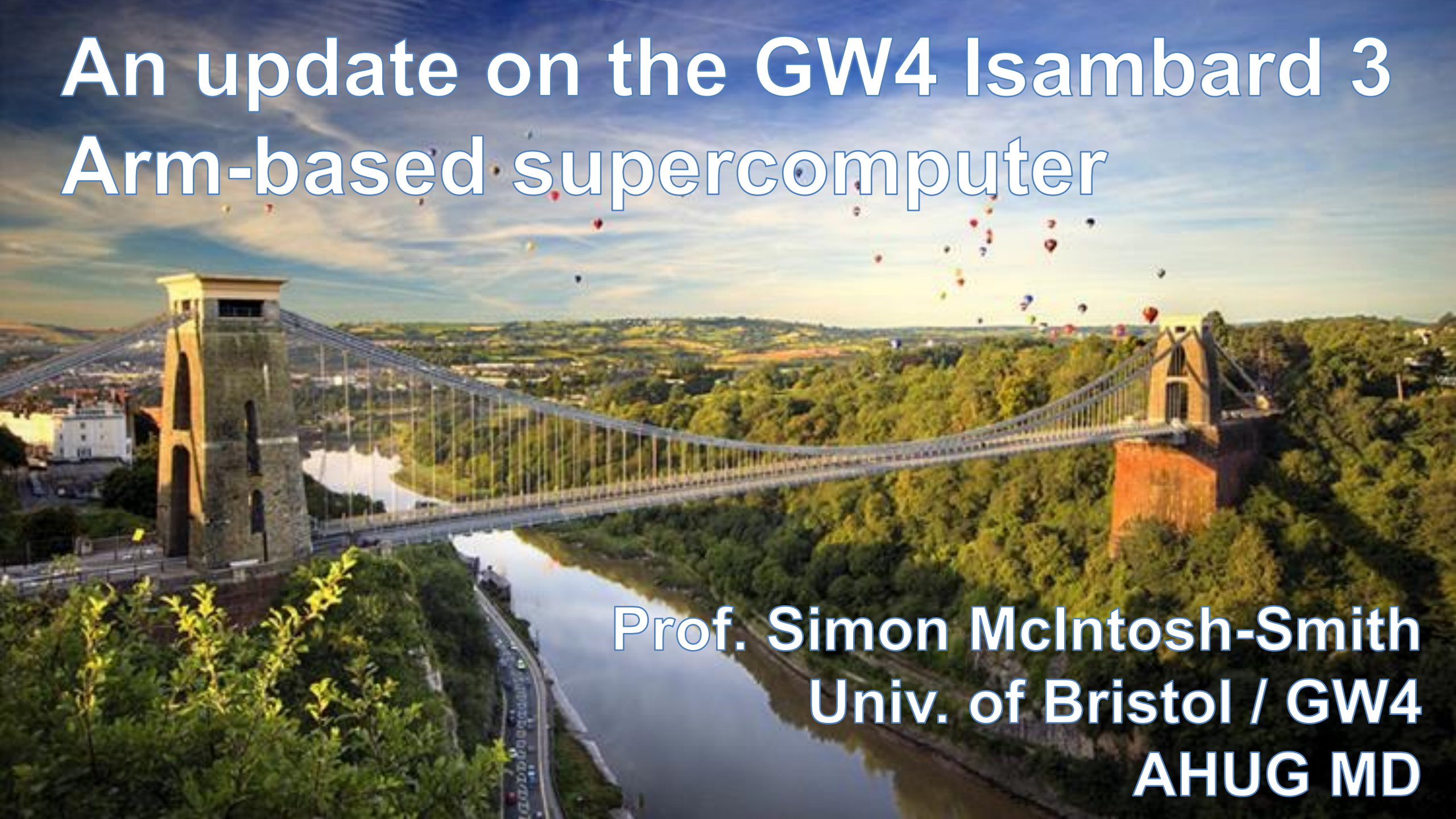
An update on the GW4 Isambard 3 Arm-based supercomputer



Prof. Simon McIntosh-Smith
Univ. of Bristol / GW4

AHUG MD

GW4 Isambard HPC service

- **Isambard 1 was the 1st production Arm-based HPC service in the world**
  - **Went live Spring 2018**
- **Isambard 2** expanded in 2020 to offer one of the **largest** Arm systems in the world at that time
- **>800 registered users, >400 GW4**
- **£7.7M EPSRC funding to date**
- Hosted by the Met Office in Exeter, UK
- **Multiple awards, best papers,...**

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Some of Isambard's achievements to date

- Delivered **nearly 1B Arm core hours to date**, 20M per month
- Hundreds of scientists and engineers **trained on Arm in HPC**
- Dozens of **hands-on tutorials and hackathons** (SC, ISC, AHUG…)
- **Dozens of HPC codes ported to Arm** for the first time on Isambard
- **Best paper award** at CUG 2019
- World's first hands-on Arm tutorial on production system (SC18)
- **World's first open SVE tutorial on real hardware** (SC20)
- Made significant contributions to the quality and robustness of the main **Arm software toolchains**: LLVM, GNU, Cray, Fujitsu

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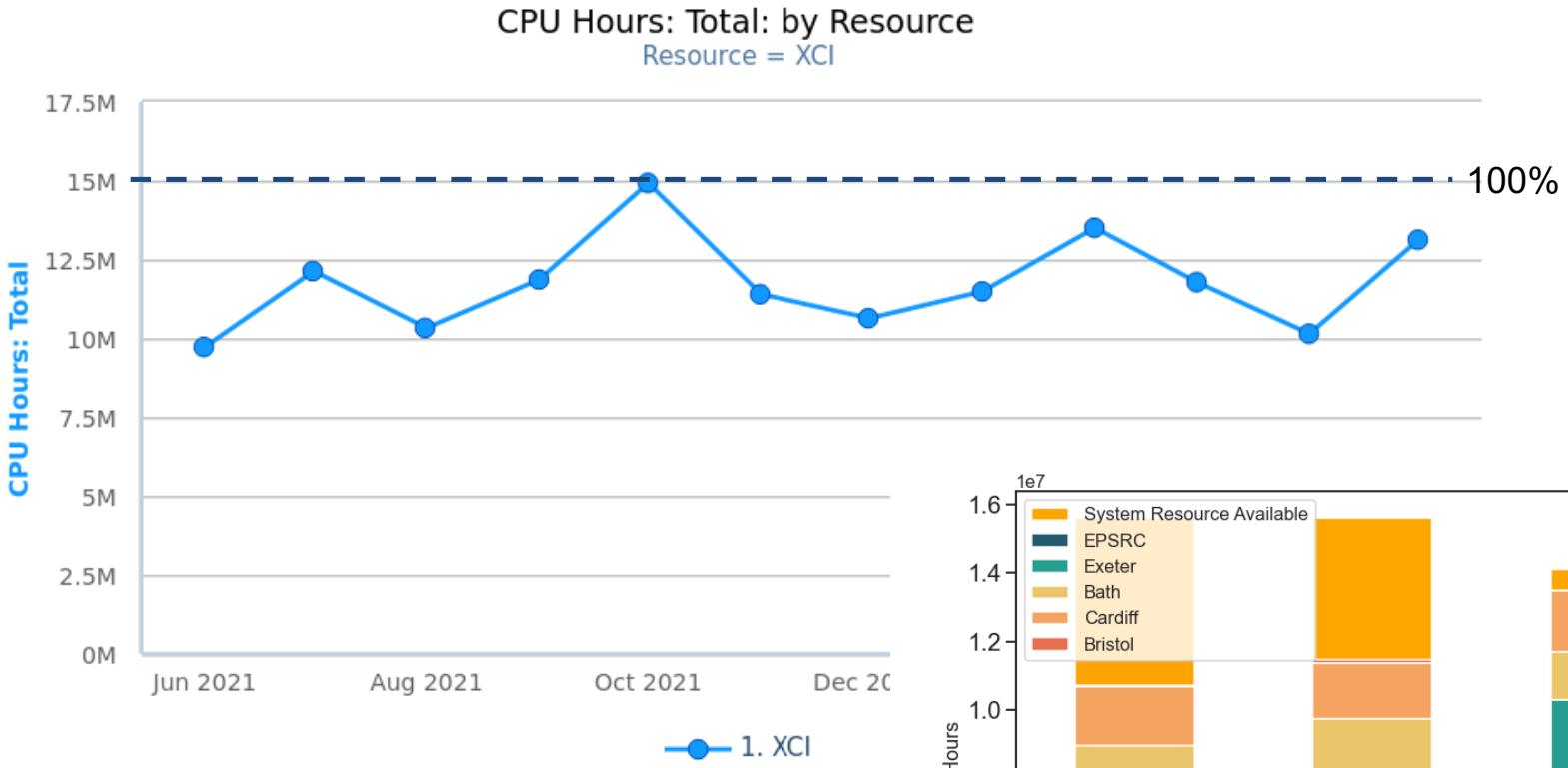
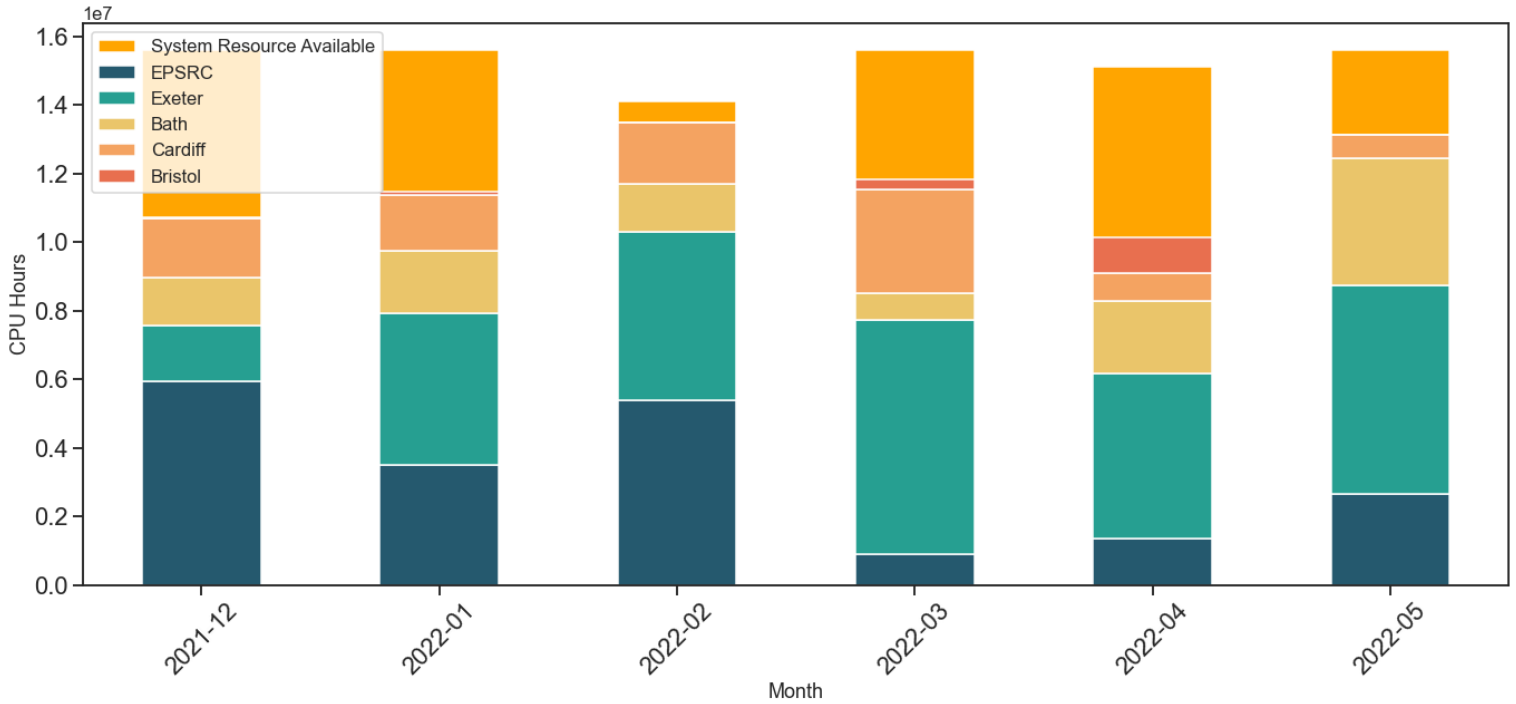
Graphs from recent annual report.





System utilisation typically >90%.
98.9% uptime.

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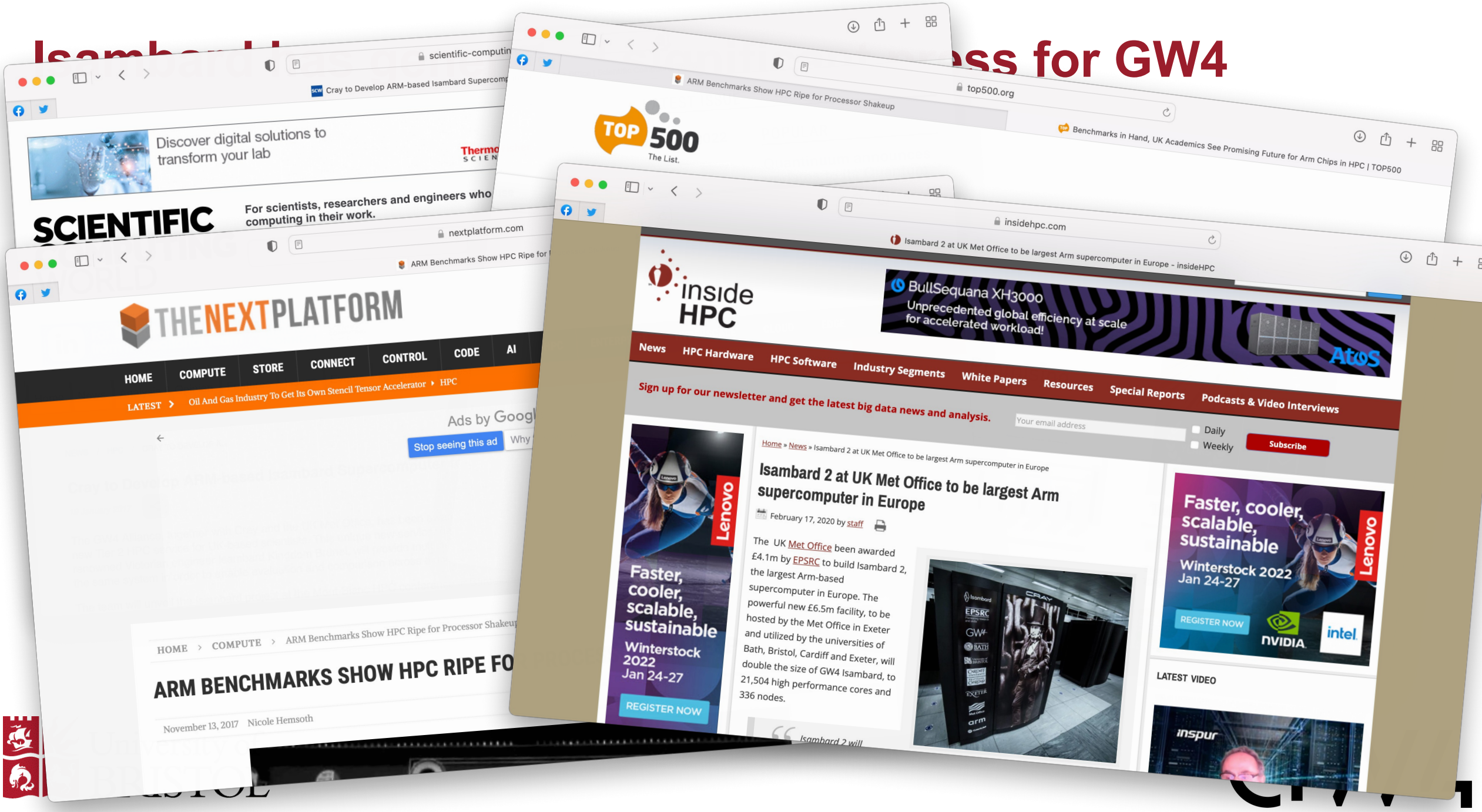
Isambard ... ess for GW4

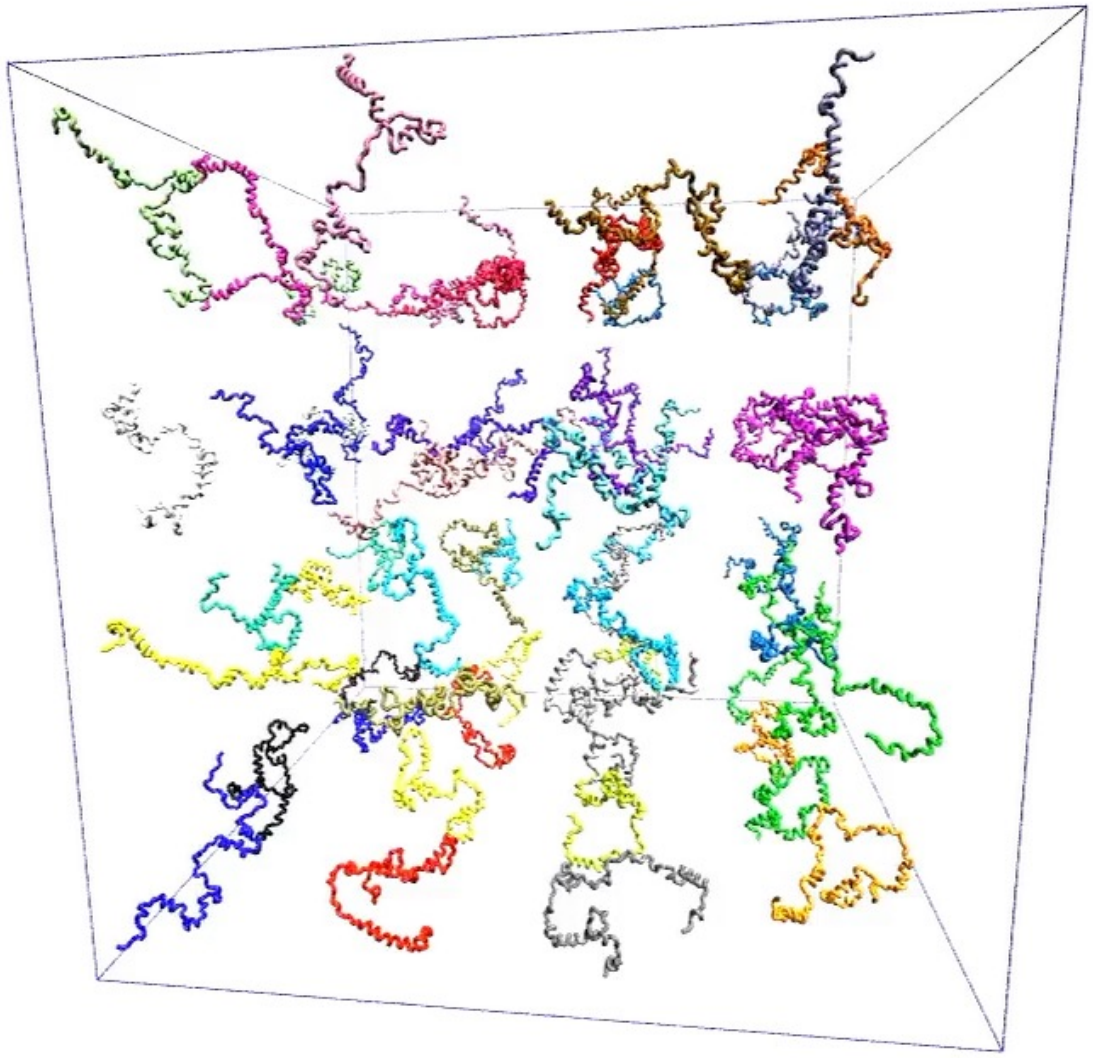


Isambard Arm-based training, hackathons, workshops etc.

- Over 60 tutorials, hackathons and workshops have been run on Isambard since the service's inception, with many at top-tier international conferences, including IEEE/ACM SuperComputing and International Super Computing (ISC)
- To date, over 1,000 international scientists, researchers and developers have attended tutorials, workshops and hackathons run using Isambard

Bristol Isambard case study: molecular simulations of factors behind Parkinson's and osteoporosis

- Bristol researchers have been running molecular level simulations on Isambard to understand the mechanisms behind Parkinson's disease, and to find ways to treat osteoporosis
- Their simulations on Isambard have shown how the alpha-synuclein protein can start to clump together in the human brain, a key feature of Parkinson's disease



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Simulations showing how the alpha-synuclein protein can start to clump together in the human brain

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CRAY
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Isambard
Engineering and Physical Sciences Research Council
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University of BATH
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CARDIFF UNIVERSITY
PRIFYSGOL CAERDYDD
University of EXETER
Met Office
arm
MARVELL
THE GREAT BRITAIN

- A64fx system of 72 nodes added in Sep 2020
- Enabled porting and optimization for SVE
- Supported world's first open SVE hackathon at SC20

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Isambard 3 coming this year

- **£9.2M** CAPEX funding, +£6.1M OPEX for 4 years of operation
  - Significantly expanded support team of 6 RSEs, 2 full-time sys admins
- Isambard 3 will be one of the first supercomputers based on NVIDIA's new '**Grace**' Arm CPUs
- **55,000+** cores, 2-3 PetaFLOP/s, 6X faster and more energy efficient than Isambard 2
- Liquid cooling where possible for a low PUE, waste heat reuse potential
- Each node has 144 cores at 3.5GHz and ~1Tbyte/s memory bandwidth to 256GB of DRAM
- Comes with a complete set of optimized NVIDIA libraries, **including for AI/ML**
- Will also have some **Grace+Hopper GPU nodes**
- On target for installation around the end of 2023

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https://www.bristol.ac.uk/news/2023/may/isambard-3-investment.html

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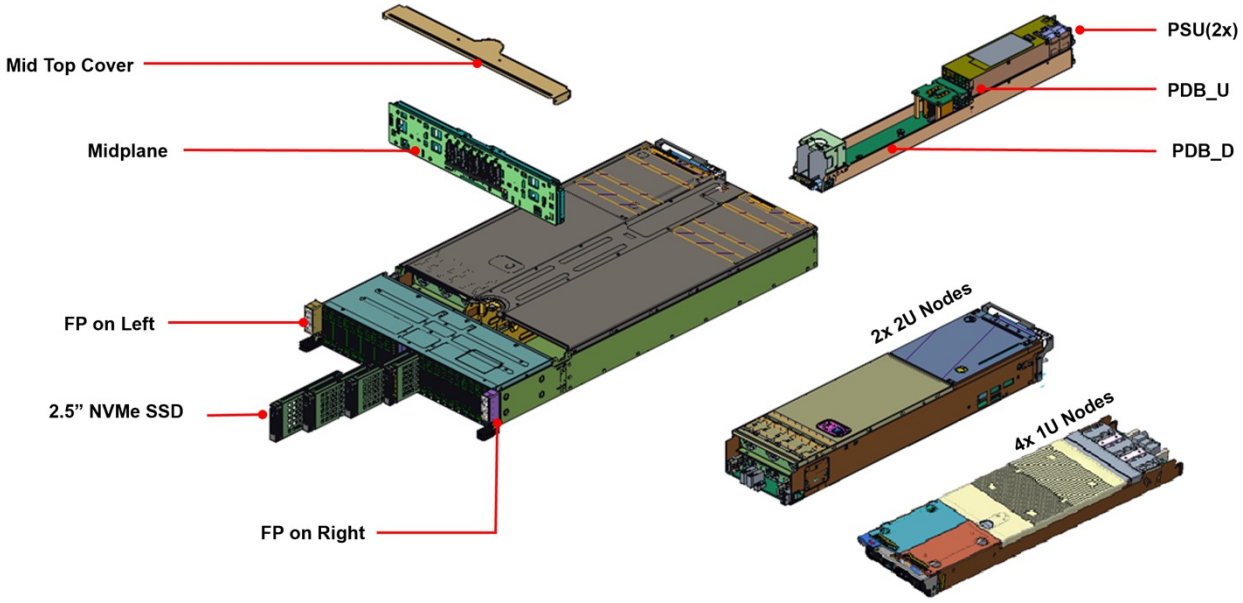
Isambard 3 NVIDIA ‘Grace’ CPU superchip



Competitive with best in class CPUs in 2023 in both performance and energy efficiency.

Using NVIDIA’s whitebox air-cooled servers with water cooled doors.

This is the first time that Isambard’s Arm processors will come from a mainstream HPC chip vendor.

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- NVIDIA Grace-Grace 144 core board for Isambard 3
- Approx. A3 in size and 500W
- 384 of these in Isambard 3
- System delivered by HPE

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Isambard 3 site: the National Composites Centre in Bristol

University composite materials research centre
Close to M4 and Parkway Station.
Significant room for future expansion.

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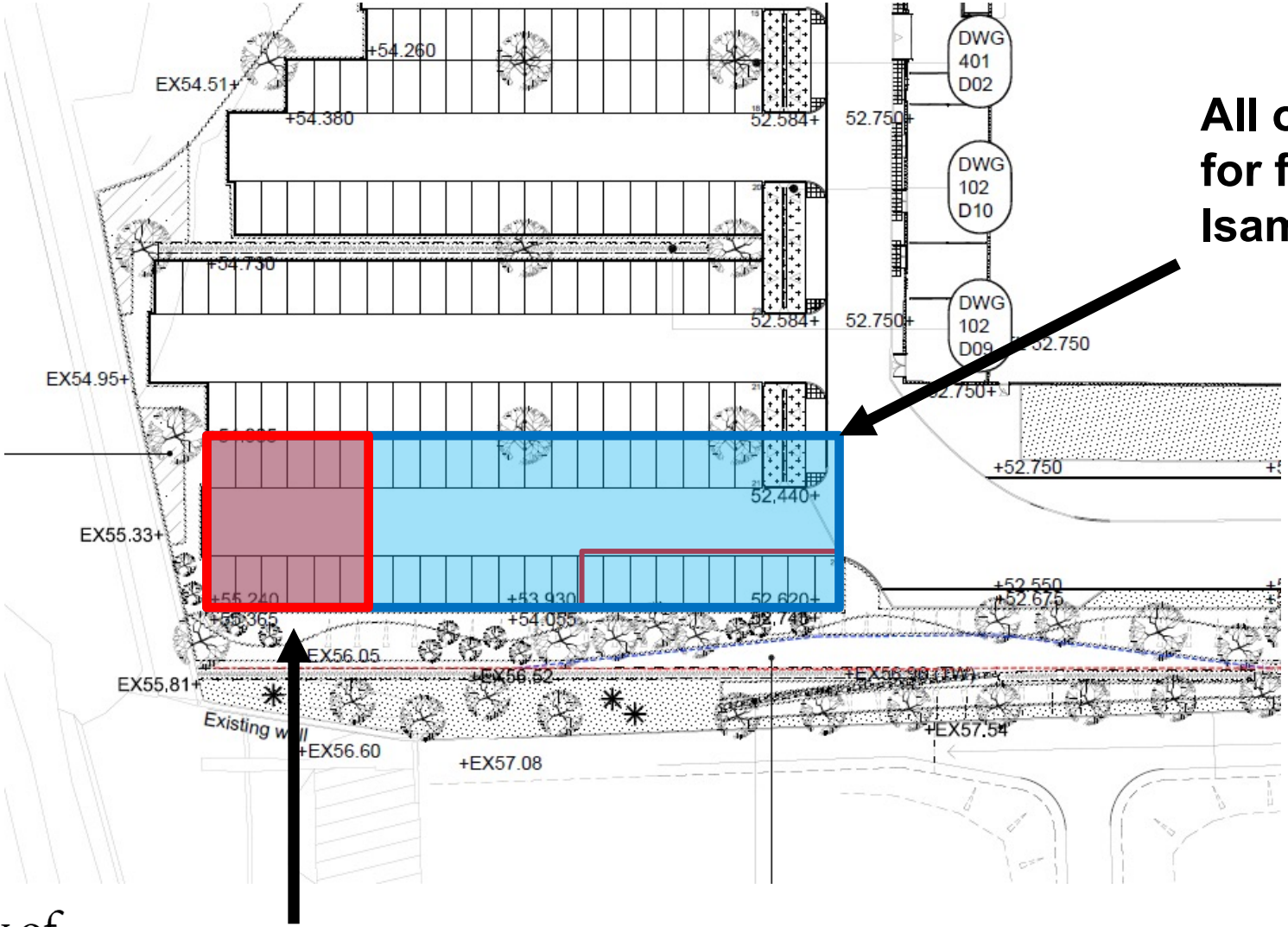
NCC Site for Isambard 3



All of this region available for future expansion of the Isambard service.

Area initially used for Isambard 3

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All of Isambard 3 will fit in a single, agile, energy efficient Modular Data Centre (MDC). Easy to scale up in an agile manner.

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UK Research and Innovation
NVIDIA
arm

Great Western 4 Isambard 3 summary

- The new service will be one of the most energy efficient CPU-based systems in the world, 5-6X better than Isambard 2
- We expect Grace to be performance competitive with the best x86 processors in 2023/24
- Energy efficiency-wise, should be class leading
- DRAM-sized memory per node, but HBM-like bandwidth
- Very flat NUMA structure should enable excellent ease of use
- On the floor late 2023, in production early 2024