



**FROHES FEST
HAPPY HOLIDAYS**

Let it snow, let it snow: We wish all our readers atmospheric celebrations, wonderfully relaxed vacations and the best for the New Year. After a funny and fantastic start on January 1st, you can also calculate with the LRZ in 2021 - and read about it.

LRZ-Newsletter December 2020

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NEWS

"Stay up to date with new architectures and components"



Exploring and helping to shape the future of computers. The Leibniz Supercomputing Center (LRZ) is implementing the high-tech offensive of the Bavarian State Government in its field and is launching the ambitious ["Future Computing" program](#): This includes a test environment with the latest computer technologies, the ["Bavarian Energy, Architecture and Software Testbed" or BEAST](#) for short. In addition, the Future Computing program contains offers to qualify colleagues and young HPC professionals and to explore and exploit innovative computer technology and systems for High Performance Computing (HPC) with selected scientific partners. "We want to intensively research the latest computer systems and architectures, their energy requirements and mode of operation," explains the habilitated computer scientist Josef Weidendorfer, who heads the Future Computing initiative at the LRZ. In the meantime, login and storage servers are already available in Garching, as well as two AMD Rome systems and servers with Marvell ThunderX2 processors, both with graphics cards as accelerators. A Cray CS500 system, which works with Fujitsu A64FX processors, is currently being installed. It's planned over the next few years, that [BEAST](#) will be continuously expanded, become an integral part of the research work at the LRZ and will serve to evaluate new computer architectures for Bavaria's largest scientific data center. In an interview, Josef Weidendorfer explains the strategy of Future Computing:

What is special about the Cray CS500 or the Testbed BEAST? **Dr. Josef Weidendorfer:** The technology is completely new and contains, among other things, the same processors that are used in the Japanese supercomputer Fugaku, currently the fastest computer in the world. This technology is more innovative. For example, it offers a main memory that is four times faster than that of SuperMUC-NG. In a production system like the SuperMUC-NG, which is constantly working on research projects, we cannot experiment with the configurations of operating systems, different accelerators and other hardware adjustments. But that's exactly the plan with BEAST and for Future Computing - to get the latest systems or hardware that you can exhaust, test, plug together according to your own ideas, configure and confront with different applications or codes to observe under which conditions they work and how. We want to research the latest computer systems and architectures, their energy requirements and mode of operation intensively, without disturbing the scientific work at the LRZ supercomputers. Of each piece of hardware, there will be two identical components in BEAST so that possible applications can be compared.

Why is testing necessary? **Weidendorfer:** With BEAST, we are preparing for the challenges of the next generation of supercomputers and for the successors to SuperMUC-NG. We are investigating which architectures make sense for larger systems and parallelization. This is also important because computer technology is about to take the next development step towards the exascale-era. The processing of growing amounts of data, applications such as machine learning and artificial intelligence require, among other things, new chip design and other computer architectures. Conversely, these technologies are likely to establish themselves in the supercomputing systems of the near future, where they will optimize work or memory performance. BEAST will therefore soon also include prototypes of the latest technologies, which we will design and build together with the manufacturers wherever possible. If we experiment with the latest hardware and prototypes today, we can firstly formulate sound requirements and benchmarks for supercomputers to come. Secondly, we can estimate much better which systems will satisfy our users and the scientific community and how services related to HPC will develop and change. Third, the LRZ develops software itself - with the help of BEAST we can better adapt our own creations such as the monitoring tool DCDB or the control system Wintermute and prepare them for other systems. Last but not least, BEAST enables us to support selected user groups in their basic research on modern computer architectures.



Who is allowed to try out the test environment at all? **Weidendorfer:** BEAST is not on of the classic services LRZ offers. It is primarily available to our colleagues for experiments and own research. They can use it to develop recommendations for future systems and their use, but also to gain experience with new architectures. Then we open the test environment for selected researchers working on next generation hardware. We accompany and support their work and stay up to date with new architectures and components. Crashes that require hardware revitalization are to be expected. While the Linux cluster and SuperMUC-NG are administered by the LRZ, for BEAST we wanted to allow more freedom. User groups should be able to intervene in the operating system, configure processors themselves and make changes in the system that would otherwise be reserved for administrators. The system will be much more demanding, but this is the only way for all participants to learn.

Will students also work with BEAST? **Weidendorfer:** Of course, with the testbed we want to intensify the existing cooperation with the Ludwig-Maximilians-Universität and the Technical University of Munich and inspire students to write their theses on BEAST. To support their lectures on computer architectures, both Munich universities, together with the LRZ, are offering an internship for the first time in the winter semester 2020/21. About 30 students will be given direct access to BEAST systems to understand their suitability for sample codes and to trim them for best possible performance. And we invite employees of the manufacturers to present the hardware and their working methods in more detail. The cooperation with universities and students also allows for in-depth investigations that help us at the LRZ to understand the latest technology even better.

Are manufacturers even interested in such tests? **Weidendorfer:** That is the long-term hope that resonates in the LRZ's Future Computing Program. In the medium to long term, manufacturers should no longer see us only as customers; we can and want to help shape new computer technology. We have already succeeded in doing this with hot water cooling, and with the contract awarded to Intel and Lenovo for the construction of the SuperMUC-NG, we were able to deepen our cooperation with these manufacturers to such an extent that we now have access to prototypes and can influence them with our ideas and recommendations. As a service provider, we act as an interface between basic research and manufacturers - with the help of research results and our practical experience with components or the various fields of application of supercomputers, manufacturers can optimize products and establish greater customer proximity. Conversely, we can comprehensively explore and test the latest technologies while they are still in the experimental stage. This benefits everyone involved. (Interview: vs)

"Putting content into context"

700 virtual machines in the cloud and around two petabytes of storage: Since 2007, the Bayerische Staatsbibliothek (BSB) has been cooperating closely with the Leibniz Supercomputing Centre. LRZ not only stores in Garching the data from the 462-year-old Stabi, the data centre is also responsible for IT services and applications and, if necessary, advises the digital specialists within the

library on technical issues. "We don't have to worry about issues such as data security or long-term storage, but it is precisely these backup services that are critical to our success," says Dr. Klaus Ceynowa, Director of the BSB.

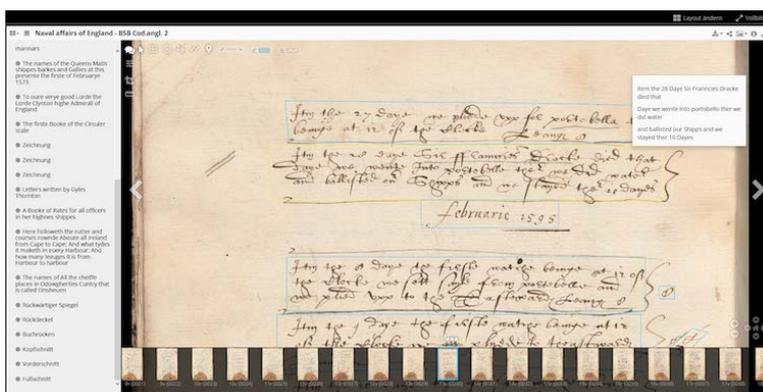
2.5 million books digitized

As early as the 1990s, the library began to make its rich holdings - including some 34 million media, including the most valuable manuscripts from the Middle Ages and historical prints and art objects - digitally accessible. "As early as 1997, we initiated the Munich Digitization Center MDZ and since then we have been scanning rare and conservatively demanding library materials," says Ceynowa in an interview with the LRZ. "Stabi is one of the four libraries in the world with the largest holdings of the most valuable, unique manuscripts, incunabula and historical prints from around the 16th century. In the meantime, around 2.5 million copyright-free works, mainly from the

17th to 20th centuries, as well as magazines and newspapers, maps and art objects have been scanned with the help of Google and can be borrowed online.

Browse virtually through old manuscripts

Users can browse through magazines from the Golden Twenties and Art Nouveau or the logbook of Sir Francis Drake, in which he described his last voyage to the West Indies in 1595. The International Image Interoperability Framework (IIIF), a standard for online access, allows marking, annotation and completion of transcriptions of illegible passages. "A library is just becoming two, one analog and one digital, and both challenge us," observes Ceynowa. "We do not detach ourselves from the analog, the printed book continues to exist alongside the electronic one. Scientists appreciate on site library and the work in reading rooms, where they find a place for exchange in addition to scientific literature. Our task was and is to put content into context". Stabi is developing its own software and technologies for this purpose in cooperation with partners and the Stanford University Library. This will create virtual reading rooms like the one at Ludwigstrasse 16 in Munich, and enable scientists to conduct joint research in manuscripts and books across borders. (vs)





Learning and researching with Apps

You want to use your time wisely and learn while queuing, being on the bus rides or during breaks? With three apps, produced with the help of the Leibniz Supercomputing Centre (LRZ), you are able to test your knowledge about English or your general knowledge, to discover the nature of a moor or to explore your environment. [Bridge of Knowledge VR](#) is still in its beta version, but can already be downloaded for free from [Google Play](#). It allows users to move around inside the

virtual space and cross a gorge in the jungle. They are confronted with all kinds of questions about English grammar and word formation, and possible solutions are found on the planks of a bridge. But beware - not everyone is right: "If you make the wrong choice, you could experience a free fall. We wanted to bring some thrill into learning," says Dr. Christina Sanchez-Stockhammer, a lecturer in English linguistics at the LMU Munich and one of the initiators of the educational app.

One app for many fields of knowledge

Elisabeth Mayer from the Center for Virtual Reality and Visualization (V2C) of the LRZ supervised the technical part of the app's development. "The App will be designed in a modular way so that different university chairs can load questions into the app," says the virtual reality expert. With *Bridge of Knowledge VR*, it is possible to learn about general knowledge or about archaeology in addition to English. The fun is even bigger when users place their smartphones inside a simple virtual reality viewer. Those who are afraid of heights can change the app settings so that in *Bridge of Knowledge VR* the river is directly under the bridge and there is no free fall. The app was developed within an LMU [program](#), in which lecturers from a wide range of disciplines promote innovative learning methods and curricula and pass on their own enthusiasm for good teaching.

Understanding nature with augmented reality and data

MOOSAIK is the name of the app, which has now been completed by V2C on its own initiative: "Originally MOOSAIK was planned as an app for an educational trail. With the help of augmented reality, walkers were to discover fauna and flora in the Thalhammer Moos on the trail", reports LRZ-employee Lea Weil. "Now the app works without linking to a specific environment". No matter whether on the meadow, in the office, at home or in class - MOOSAIK brings lapwings, snipes and other endangered marshland inhabitants or even flowers on smartphone and tablet: spatially, acoustically, in original size. "With MOOSAIK, we now have a [showcase](#) to show researchers or organizations how augmented reality can enrich information from the environment and visualize research data in a lively way," says Weil. The V2C specialists are still putting the finishing touches on the app, but it will soon be available for download from the [LRZ website](#).

[BAYSICS](#) is also about nature: An app is now available for download on the [project's web portal](#), which aims to promote the observation of nature and encourage schools and citizens to develop their own research plans. Users can make observations on plants, allergenic species, tree heights and animals, they can also upload photos of the animals and plants they observe and compare allergic symptoms with pollen data. Besides the occurrence and phenology of species is mapped by this way. More functions are planned, the [BAYSICS app](#) works on devices regardless of operating systems. (vs)



"The LRZ is a good place for many to work"



Corona promotes digitization in Germany and thus also working from home: At the Leibniz Supercomputing Centre (LRZ), too, the majority of the 260 employees were sent home during the Corona lockdown. After the first re-opening in summer, the corridors have emptied again now. 94 percent of the employees assessed the corona measures of the LRZ as good, 91 percent saw the scientific data center as well prepared for the pandemic. This is the result of a survey conducted by the human resources department. "I was surprised that the results were so positive on all questions", says Sabine Osorio, head of the human resources department of the LRZ in the interview. "The answers indicate a high level of satisfaction, good cohesion and a lot of understanding. The fact that the LRZ is obviously a good place to work for many people makes

me happy."

About 80 percent of the employees feel well informed in the home office of the LRZ, communication is also good in teams as well as across departments. More than 80 percent of the employees also feel that the technical equipment in the home office is sufficient. More than 60 percent like to work flexibly at home, 55 percent even feel more productive there. "Nevertheless, there are some areas in which we can do much better," says Osorio. "The recording of working hours and vacation must become much more digital. The processes are still too cumbersome. There should be ways of applying for vacation in the home office and

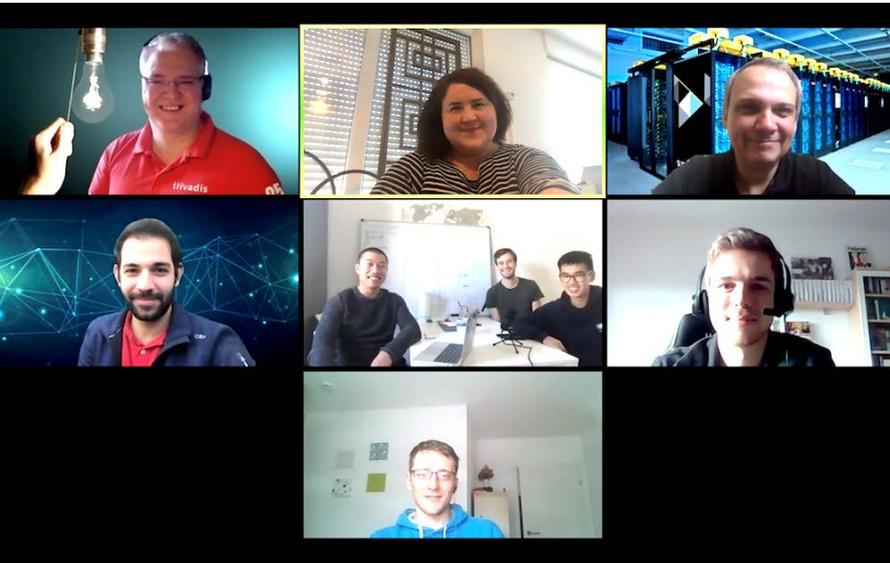
recording work electronically. The expansion of home office and teleworking is currently being discussed at the LRZ. You can read more about the plans and personnel development at the LRZ in the interview on the website. (vs)

Digital ideas for climate protection

Improving the climate with digital solutions: The Bavarian State Ministry for Digital Affairs invited participants to the ["FutureTech4Climate" hackathon](#) from November 13 to 15. The Leibniz Supercomputing Centre (LRZ) set the theme "Software, Sensors and Supercomputers" and provided a team of four supervisors: "Big science needs big computing, but high-performance computers consume a lot of power," says Laura Schulz, Head of Strategy at LRZ, explaining the commitment. "For years, we have been looking for ways to squeeze as much computing power for science as possible with little energy.

Getting to know new ideas and perspectives

Seven of more than 100 pupils, students, coders, climate conscious people who worked in 18 groups on digital solutions for sustainable consumption and environmental protection analyzed the sensor data and energy consumption of SuperMUC-NG and applications. Supervised by Laura Schulz and Alessio Netti from the LRZ, as well as Amir Raoofy and Professor Martin Schulz from the Technical University of Munich (TUM), they delivered three practicable solutions for the use of renewable energy, for forecasting power demand and for controlling power consumption in supercomputing: "The purpose of the hackathon was to work with the sensor data from the SuperMUC-NG and to use the ideas of the participants," says strategist Schulz. "Certainly no easy task, but we all had a lot of fun with each other and we supervisors were very impressed by the



unbiased view and experience of the three teams".

The [Greencrease.ai app](#) combines weather and sensor data to enable the use of renewable energies in supercomputing. Problem: The fluctuations in the production of electricity from water, wind and sun and in the energy requirements of applications. "The basic idea is to use data and machine learning to forecast the energy consumption of computing tasks and the available power," explains Moritz Münker. "With this knowledge, more energy-intensive jobs could be planned on days with lots of sun or wind". Sounds as simple as it is plausible - and convinced the ten jurors from industry and science. At the [Bavarian Digital Summit](#), Greencrease.ai was honored as the solution "with the greatest potential for saving CO2". Software engineer Münker and his fellow campaigners, data scientists Patrick Tu, Thieng Quang Nguyen and Duc Mai, now share prize money of €2,500: "We found it exciting to tackle the challenges of climate protection with digital innovations," says Münker. "Patrick quickly convinced us to take part in the hackathon, and since we studied either computer science or data science, the challenge of the LRZ appealed to us in particular.

Learning from practical tasks

Big Data and artificial intelligence also motivated the other two teams to face the challenges of the LRZ. "FutureTech4Climate was exactly my thing, I wanted to do something I had never looked at in detail before," says Andreas Fend, explaining his interest in sensor data and supercomputing. The consultant at IT service provider Trivadis has been working with neural networks for some time now and has used the data from the SuperMUC-NG to develop [a forecasting and control tool](#) for energy suppliers and data centers. "There are actually two challenges," says Fend, "on the one hand classifying the immense amount of data, and on the other hand quickly deepening my hitherto rather limited knowledge of neural networks by working out a practical example and training an initial network.

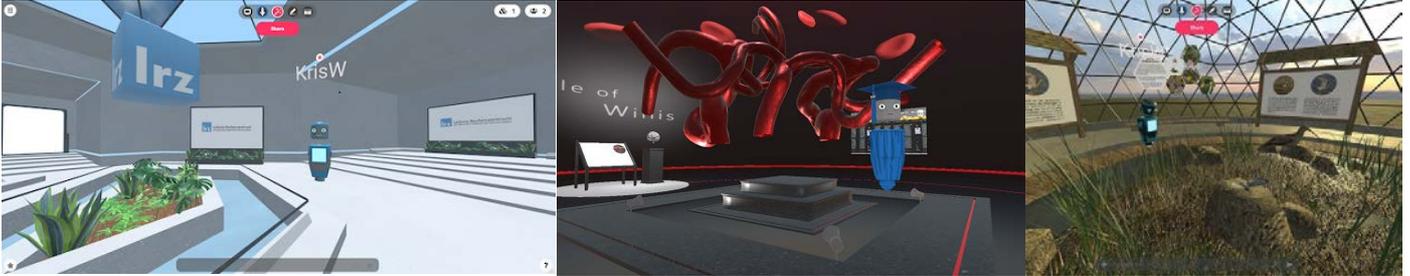
["Queuing 4.0"](#) is what calculation engineer Carsten Gorkow and scientist Franz Plaschkies once again called their software, with which the jobs of a supercomputer can be optimized and consciously controlled for greater energy efficiency. "We had great teams", says Laura Schulz, "their questions and ideas inspired us a lot, the three days full of talks and discussions were very valuable for everyone involved". (vs)



The LRZ in virtual worlds

[Medientage](#), Supercomputing ([SC20](#)), Bavarian [Digital Summit](#), [Innovation Day](#) of the Vereinigung der bayerischen Wirtschaft (vbw) – for these digital fairs and conferences in late autumn, the team from the Center for Virtualization and Visualization (V2C) from the [Leibniz Supercomputing Center](#) (LRZ) built Mozilla hubs: [SuperMUC-NG](#), simulations such as [“Virtual Human”](#), apps such as [“MOOSAIIK”](#) as well as art historical works, presentations, posters or publications and brochures are presented to these three-dimensional, virtual spaces. This is not only worth seeing – and by the way opened until the New Year - the [virtual beer garden](#) shows that virtual realities even enable conversations.

Even if there are occasional technical problems, visitors can look and chat. This almost creates a beer garden feeling - neighboring groups are audible, quieter and as if they were sitting at the next table: “The beer garden is a good idea,” says David Brayford, LRZ expert for High Performing Computing (HPC), “Unfortunately I had my laptop with me to fight the virtual environment and turned the fan on fully, just when external visitors were there.”



Open HPC technologies

Despite such difficulties, those involved in the SC20 draw up a positive summary: In addition to discussions in the beer garden, online workshops and lectures inspired during the world's largest and most important supercomputing conference, some of which were just as well attended as face-to-face events. Brayford and his colleagues reached more than 150 participants in America and Asia with their online tutorial about Open HPC. The reach for a poster session of the EU research project LEXIS was similarly high: Mohammad Hayek and Stephan Hachinger from the LRZ research data management team showed how multi-part simulations can work on different, distributed HPC systems in the cloud: "It is the first successful application of the LEXIS platform," Hayek explains. "Forest fire data was exchanged and modeled with the help of the Infrastructure as a Service-Cloud of the LRZ and HPC resources of the IT4Innovation data center in the Czech Republic." This technology is of interest to research institutes as well as to medium-sized companies that work with Big Data.



Excellent research

Bavaria's largest scientific data centre continues to gain importance internationally. As in previous years, research work by the LRZ was awarded during the SC20. The readers of the specialist magazine [HPCwire](#) voted the world's largest [simulation of interstellar turbulence](#) the best scientific HPC application. This was created from data from astrophysicist Christoph Federrath in collaboration with experts from user support and the LRZ visualization team. In addition, the first tool for the classification and systematic evaluation of monitoring data from HPC systems was awarded too: [Wintermute](#) complements the LRZ monitoring tool Data Center Data Base (DCDB) and creates the basis for a smart, artificially intelligent control of supercomputers and their orders.

Sustainable supercomputing

The efforts for [sustainability and climate protection](#) were the focus of the Bavarian digital summit and on the innovation day of the business association vbw: In addition to the Mozilla hubs and visualizations of environmental projects, the LRZ also presented the [innovative hot water cooling](#) of its computer systems, which is achieved by interfering with technical operating parameters such as temperature, Water volumes and pump speed continue to gain efficiency. The smart controls, which are based on DCDB and Wintermute, will help reduce power consumption at the LRZ in a very similar way. The online conferences and trade fairs are also proving to be sustainable: like the LRZ-Mozilla Hubs, they can still be visited in peace. If you want, you can even watch and listen to the streams of lectures and workshops on the Internet. The links in this post lead directly to the events - enjoy the HPC community. (vs)

Figures of the month

254 applications and **15 resignations**, **75 job interviews**, **17 assistant students** hired: The HR department of the Leibniz Suoercomputing Centre (LRZ) had a lot to do, not only due to Corona in the past year: By mid-November, Sabine Osorio, head of HR-team, and her colleague Sarah Struck answered **9720 inquiries**, that was just round about **200 a week**. In addition to rather simple topics such as changing addresses and sick leave, there were also collective wages and training, and employees wanted advice on personal or management issues. Last but not least, the HR department provides the statisticians of the State Office for Finance with various reports in the **high three-digit range** and organized **several hundred** internal absence reports. (vs)



Figures of the year

Corona shaped 2020 - this is what the figures collected for the year suggest: So that universities and chairs could teach online, keep in contact with students and save data, the LRZ's Compute Cloud was expanded to a storage capacity of **2 pebibytes**. **120,000 accounts** are set up at the LRZ - from here, data volumes from a few gigabytes to several terabytes are exchanged. Files with the LRZ service LRZ.Sync + Share, whose user load rose immediately by **25 percent** as a result of the Corona lockdown in March. In order to keep students and lecturers informed online, other chairs set up a homepage - the number of websites managed by the LRZ rose to over **1,000**. Moodle, meanwhile, blossomed into a coveted lecture and learning tool: **6 new servers** were set up for this purpose in the spring,

and during peak we registered up to **7 million accesses** from the area around the Technical University of Munich (TUM) and **4.4 million** from the Ludwig- Maximilians Universität (LMU). In midsummer, during the lecture-free period, this number fell to less than a tenth. With Meet.LRZ, the LRZ also offers a tool for video telephony and conferences. Sometimes this is also used for teaching and learning purposes. In peak times administrators registered up to **60 conferences** with up to **300 participants** at the same time. As a data centre, the LRZ has little contact with the users of its services. In the meantime, more than **5000 master users** are taking care of the problems and questions directly in faculties and institutes: We would like to take this opportunity to thank our partners and helpers very warmly! In universities, **1965 switches** and **4679 access points** provide WLAN and networking. And at the LRZ, SuperMUC-NG with **6480 computer nodes** and the Linux cluster with **960 computer nodes** calculate more than **3 billion CPU hours** in the service of research and science. (vs)

WORKSHOPS & EVENTS

The Architecture Machine

A short video already stirs up anticipation: The exhibition "The Architecture-Machine" started in **October** in the [Pinakothek der Moderne](#). It traces the role of the computer in architecture and urban development - and that is a story as worth seeing as it is exciting. Computers have long been helping to draw, design, also to clarify and present, and now they calculate traffic and other developments. The Pinakothek der Moderne is telling this in multimedia and in virtual worlds. The Leibniz-Suoercomputing Centre (LRZ) supports the exhibition with technology and has advised the makers in advance. Unfortunately, the museums are currently closed due to Corona, but [online the video](#) and pictures arouse anticipation. And if it gets boring on the holidays: It's also possible [to look at art online](#) - and it's also worth taking a walk through the museum district and to the Pinakothek museums, where [wonderful, atmospheric light installations](#) can be viewed. By the way, "The Architecture Machine" was extended until June 2021.



LediZ and the Holocaust

Another tip for the holidays: In a documentary worth watching, [ZDF explores](#) the question of why anti-Semitism is once again spreading in Germany despite the Enlightenment, intensive teaching about the Nazi era and the Holocaust, and regular honors and commemoration days. This is a serious topic that we should continue to work on. The film also shows the [LediZ project](#), among other things: It brings contemporary witnesses into museums and classrooms, students and interested parties can question the digital alter egos of Holocaust victims. That impresses - hopefully lastingly.

Programming with OpenMP

With the spread of multi-core processors, programming with shared memory is gaining in importance. OpenMP is proving to be the driving force behind this trend. The powerful, flexible programming model enables parallelism in the applications of researchers:inside. The three-day workshop from **February 17 to 19** presents the basics of OpenMP programming and the "OpenMP Common Core" and introduces the programming of parallelism. Participants will learn about the theory and practice their knowledge in practice. [Information and registration.](#)

Programming with Fortran

Fortran is also a programming language widely used in science. The three-day on-line course of **22. until 24 February** addresses itself therefore to researchers: inside with none to few experiences with it. You will learn about various Fortran standards (95, 2003) and practical tools such as debuggers and syntax checkers, as well as how to work with compilers and libraries and Fortran. Theoretical knowledge is deepened in exercises. The planned follow-up course in autumn will cover Fortran features for advanced users such as object-oriented programming or arrays. [Information and registration](#)

Poster printing runs out

In **March 2021**, the Leibniz Supercomputing Centre will cease printing posters. For a long time, posters replaced presentations during conferences and discussions and enabled group discussions. Now they no longer really fit in with the times. Therefore, the LRZ is giving up this service step by step.

Software design with C++

The three-day online course from **April 21 to 23, 2021**, focuses on object-oriented (OO) software design using the programming language C++. The focus is on essential software development principles, concepts, languages and procedures that researchers use to create professional, high-quality code. The course provides guidelines for the development of mature, robust and code based on C++, but does not go into specialties such as Template Meta Programming (TMP) or peculiarities and curiosities of the language. [Information and registration](#)

JOB OFFERS

You will find an international and diverse team in Garching, which is constantly growing. If you don't find a suitable job profile below, please visit the [career page](#) of the Leibniz Supercomputing Centre or send an [unsolicited application](#). We are LRZ - and curious about you!

[Assistant](#) for the management of the new KI-Agency Bayern (f, m, d)

[Personnel administrator](#) (m,f,d)

[Expert for parallel programming environments and libraries](#) (f/m/d)

[Scientific Employee for Education and Training](#) (f/m/d)

[Storage-Administrator](#) (f,m,d)

[Systemadministrator for Windows Clients](#) (f,m,d)

[Computer Scientist or IT Specialist for Big Data/AI](#) (f/m/d)

MORE TO READ

Here you will find links to latest information from the german-european supercomputing community and our cooperation partners

[Publikations](#) of the Gauss Centre for Supercomputing (GCS): GCS-News und Inside

[Infoletters](#) of the Gauß-Alliance

Publikations of PRACE: [PRACE Digest, Jahresbericht](#)

INFORMATIONS & IMPRINT

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- You can subscribe or unsubscribe the LRZ-Newsletter via our [website](#).
- Current information about the LRZ and about courses and events can also be found on [Twitter](#) and [LinkedIn](#).

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