

# The LinkSCEEM-2 Project

## What it does...and what it can do for you

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Useful websites

Training: <http://linksceem.eu/ATutor>

Allocations: <https://ssl.linklings.net/applications/linksceem/>

# Who is involved in LinkSCEEM?



## The goals of LinkSCEEM-2 are fourfold:

- To facilitate the collaboration, coordination and improvement the HPC infrastructure of the Eastern Mediterranean
- To promote HPC as a scientific research tool and cultivate an HPC scientific community in the Eastern Mediterranean
- To assist in the generation of research of the highest calibre so that this effort can be sustainable
- To provide the technical and educational support necessary to achieve these goals

# How is this achieved?

## Networking/Coordination

- Networking
- Access to resources
- Training
- Dissemination & Outreach

## Services

- User support
- Connectivity
- Integration of resources

## Research

- Cross disciplinary research
- Climate research
- Cultural Heritage research
- Synchrotron Radiation research

# Management & Coordination



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- Access to resources
- Training
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# Management & Coordination



## Networking/Coordination

- Networking
- Access to resources
- Training
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## Services

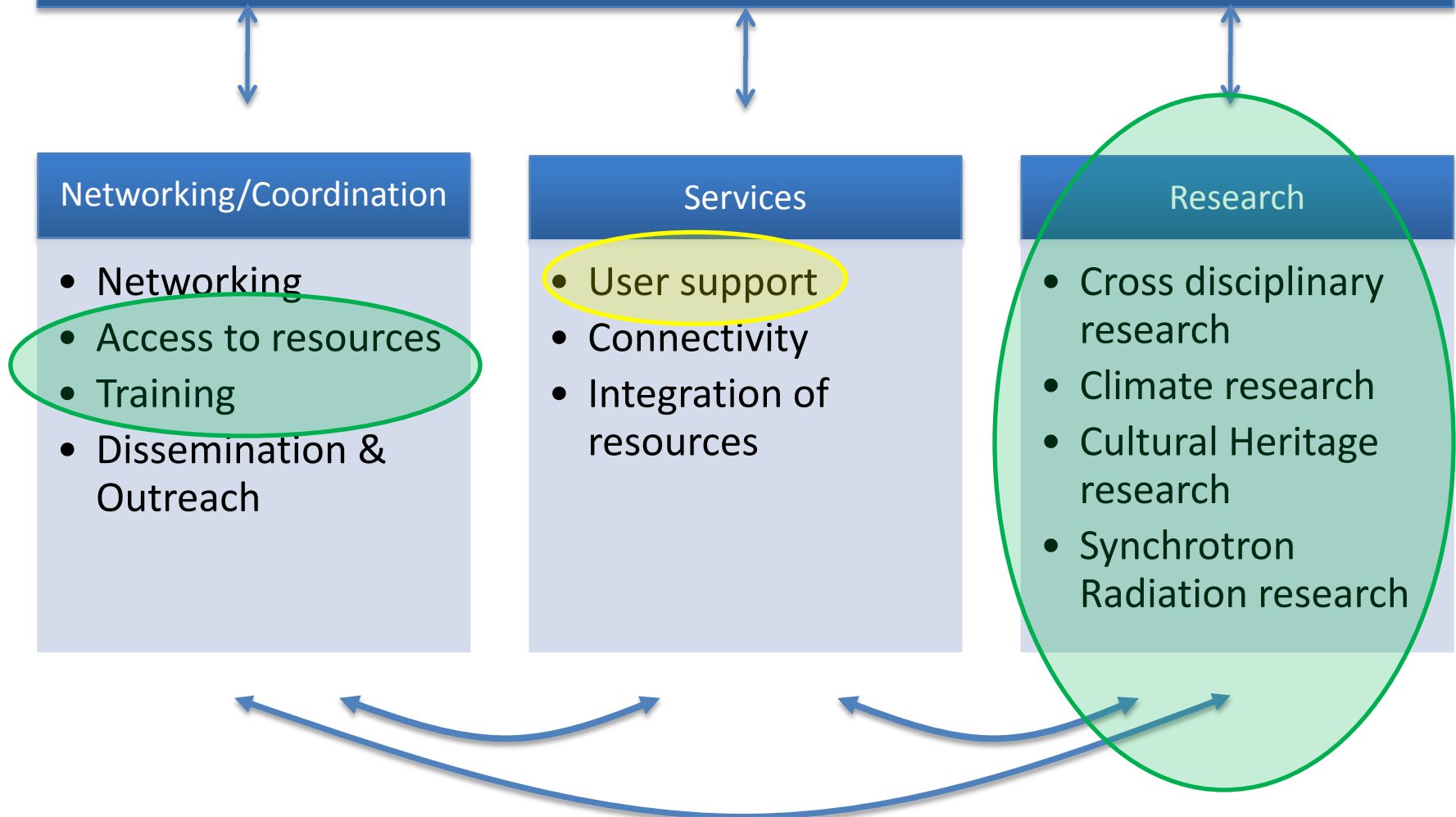
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- Integration of resources

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# Management & Coordination





# What Resources are available?

## Cyl

### Prototype:

- Total peak performance ~1 TFlop/s
- Total memory .192 TBytes
- QDR Infiniband network for MPI
- Lustre filesystems
- 16 GPUs

### Cy-Tera:

- 40+ Tflop
- Fermi GPU
- 12 Core Nehalem

## BA

- 130 8-core nodes
- **Total peak performance 11.8 TFlops**
- Total memory 1.05 TBytes (132 \* 8GB)
- DDR Infiniband @ 10 GBbps network
- Lustre filesystems
- Storage: 36 TByte

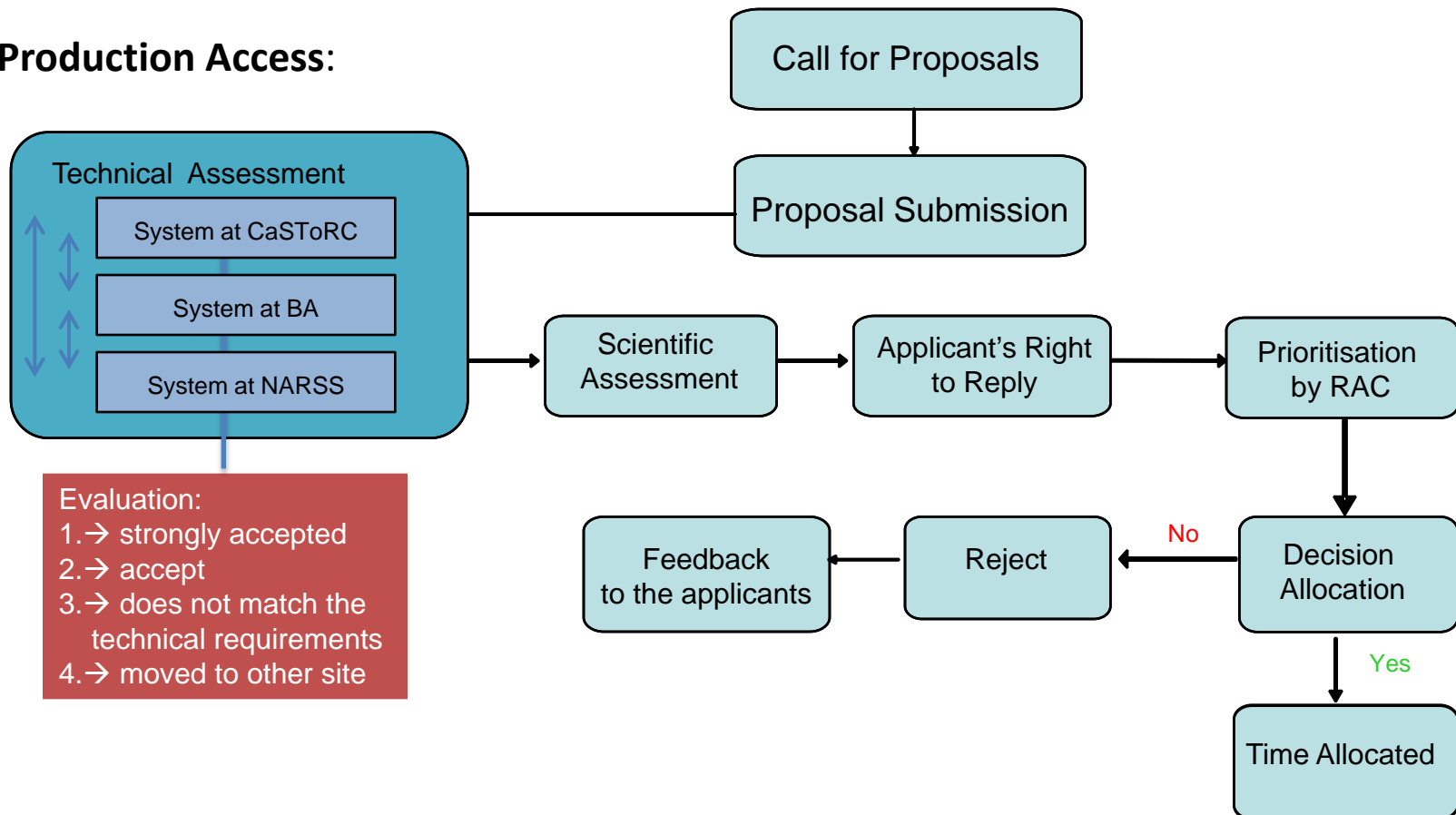
## NARSS

### Blue Gene/L:

- 1024 dual processor compute nodes
- Total peak performance per rack – 5.73 TFlops
- Total memory .5 TBytes (1024 \* .5GB)
- 3D toroidal network for peer-to-peer communication

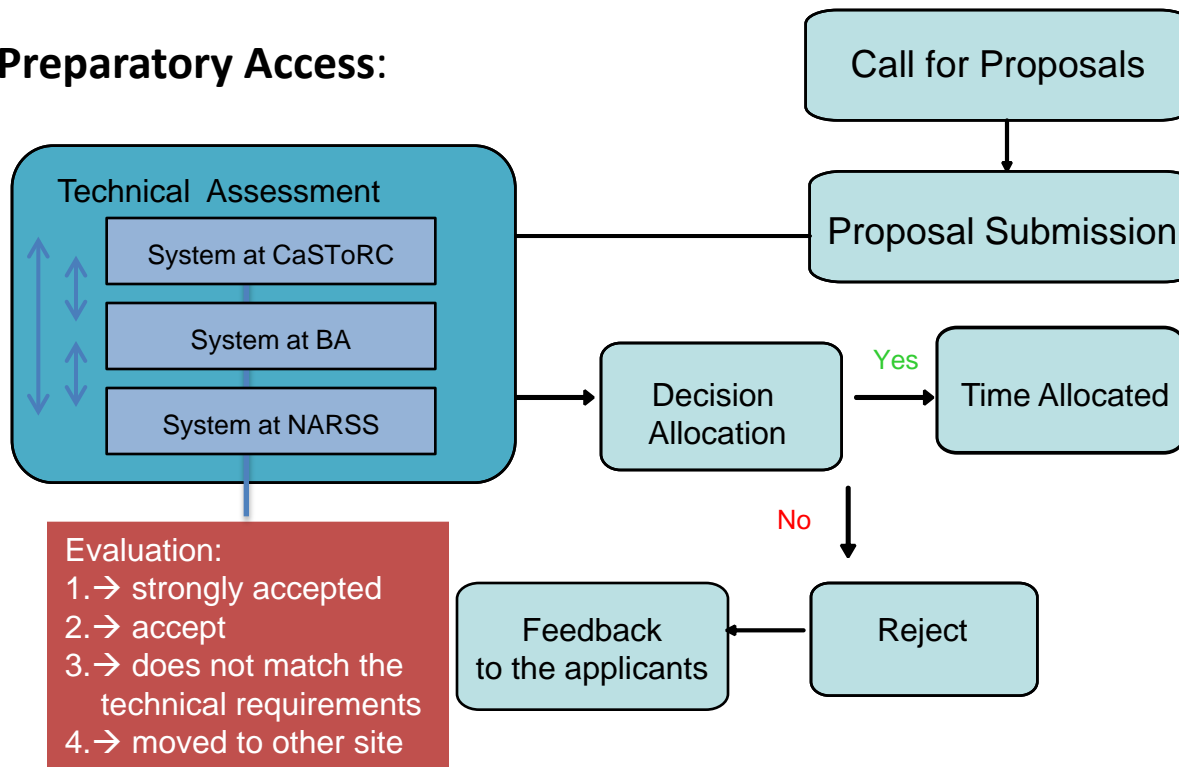
- Create a peer review process for coordinating access to HPC, visualization and storage resources
- Form a Resource Allocation Committee to implement and oversee the process

## Production Access:



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## Preparatory Access:

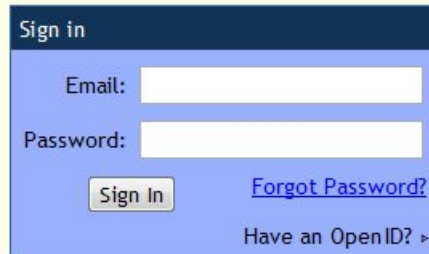


[Sign in](#) | [Create an Account](#) | [Sample Application Forms](#)

## Welcome to the LinkSCEEMPS2011 application site!

### LinkSCEEM HPC Proposal Submission 2011

In order to apply, you need to [create an account](#). If you have an account, please sign in below. If you would simply like to look at the required application forms, you may do so by selecting them in the "Sample Application Forms" box above.



**Spam Filters:** To make sure that you receive important email that is being sent from this site (e.g., registration and submission confirmations, password reminders, decision notifications, review assignments, etc), you should make sure to include

`do_not_reply@linklings.com`

in your spam filter's whitelist. Failure to do this may result in you missing an important email.

**Cookies:** For security purposes only, this site requires that you have browser cookies turned on. If you have trouble signing in, verify in your browser settings / preferences that cookies are allowed.

**Javascript:** This site requires javascript.

**Trusted Sites:** Some Internet Explorer users have needed to add the URL of this site to the IE "Trusted Sites" list in their browser settings.

## Applying for Resources

- Online system
- Year round preparatory access call – access to systems as soon as technical evaluation is complete
- Production access calls twice a year – access after decision of RAC (2 months)

## Type of proposal & resources request

- Type A - Code scalability testing:  
Scalability testing to obtain scalability plots which can be used as supporting information when applying to future Cy-Tera or LinkSCEEM project calls.  
Please fill out questions 1.1-2.2 of the project information section of the application form.
- Type B - Code development:  
Code development and optimization by applicant (without Cy-Tera or LinkSCEEM support).  
Please fill out parts 1.1-2.3 of the project information section of the application form.
- Type C - Code development with support:  
Code development and optimization by applicant with support from Cy-Tera or LinkSCEEM experts.  
Please fill out parts 1.1-3.3 of the project information section of the application form.

### Select the applicable category

- Type A - Code scalability testing
- Type B - Code development
- Type C - Code development with support

### Which resource centers are you requesting access to?

- Bibliotheca Alexandrina
- CyI/CaSToRC
- NARSS

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# Preparatory Access

## - Scientific information

### 1.1: Summary of the project

1.1: Summary of the project (Maximum 200 words)

0 words

### 1.2: Scientific case for the project

1.2: Scientific case for the project (Maximum 500 words)

0 words

### 1.3: Computational Resources Requested

Please detail here the amount of computational resources you require, for example:

- Total CPU time required (in core hours)
- Total storage required (in Gbyte, *this is only available for the duration of the preparatory access project*)
- Maximum amount of memory per core (Mbyte)
- Any other resource dependencies known

1.3: Computational Resources Requested (Maximum 200 words)

0 words

## 2.1: Application software details

If known, please provide the following information on the simulation software required by your project:

- Name and version
- Any software dependencies (such as special compilers, libraries, software applications, etc.)
- Webpages or other references
- Licenses required; If the code is open source please state "open source".

2.1: Application software details (Maximum 200 words)

0 words

## 2.2: Algorithms and Parallelisation of Application Software

If known, please briefly describe the main algorithms used (e.g., conjugate gradient) and whether they have been parallelized.

If they are parallelized how is the parallelisation implemented (MPI, CUDA, etc.)?

2.2: Algorithms and Parallelisation of Application Software (Maximum 300 words)

0 words

## 2.3: Enabling/optimization work required

Describe the application enabling/optimization work that needs to be performed to achieve the target performance.

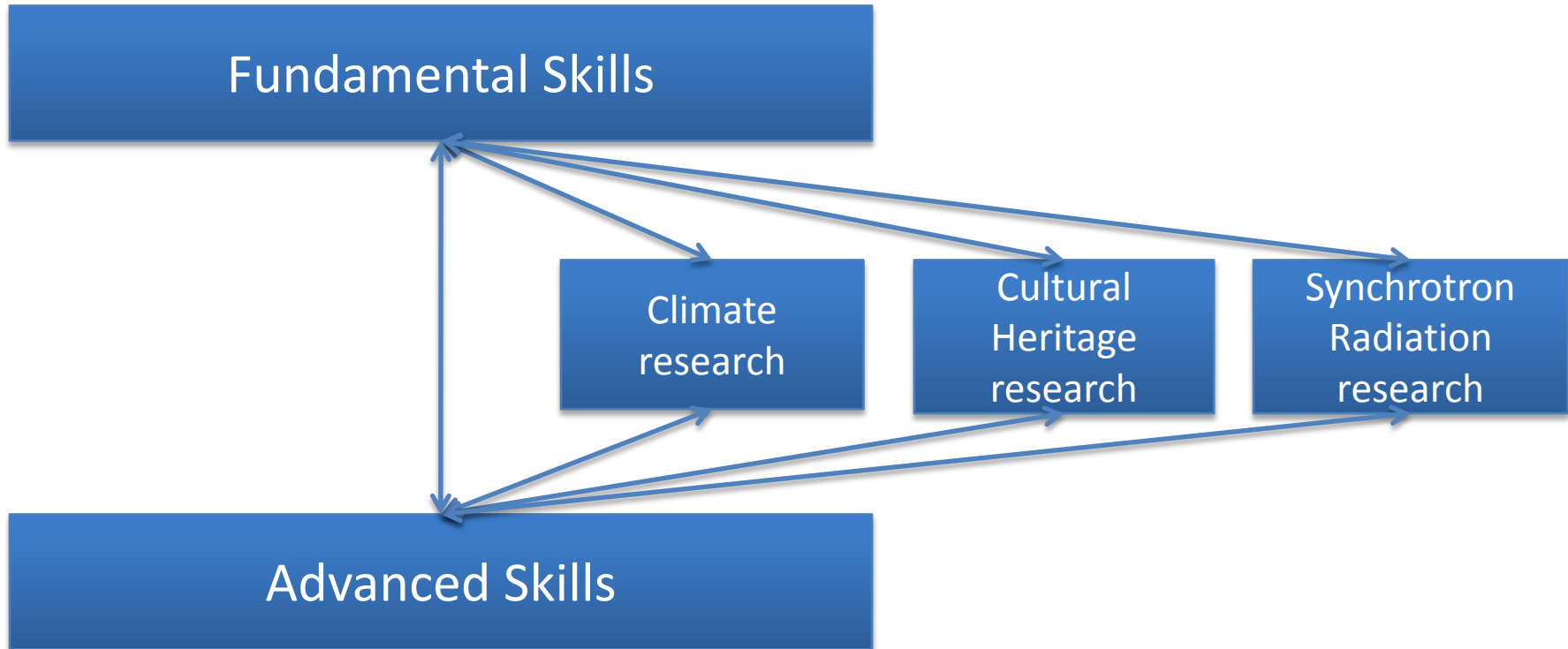
This may include factors such as, for example:

- Implement parallelisation such as MPI, OpenMP, hybrid, CUDA, OpenCL etc.
- Improve I/O
- Reduce global communication

2.3: Enabling/optimization work required (Maximum 300 words)

0 words





- **Tasks**

- Develop a tiered HPC training program to support new and existing users
- Leverage material and skill developed at NCSA and JSC
- Develop online training portal

- **Impact**

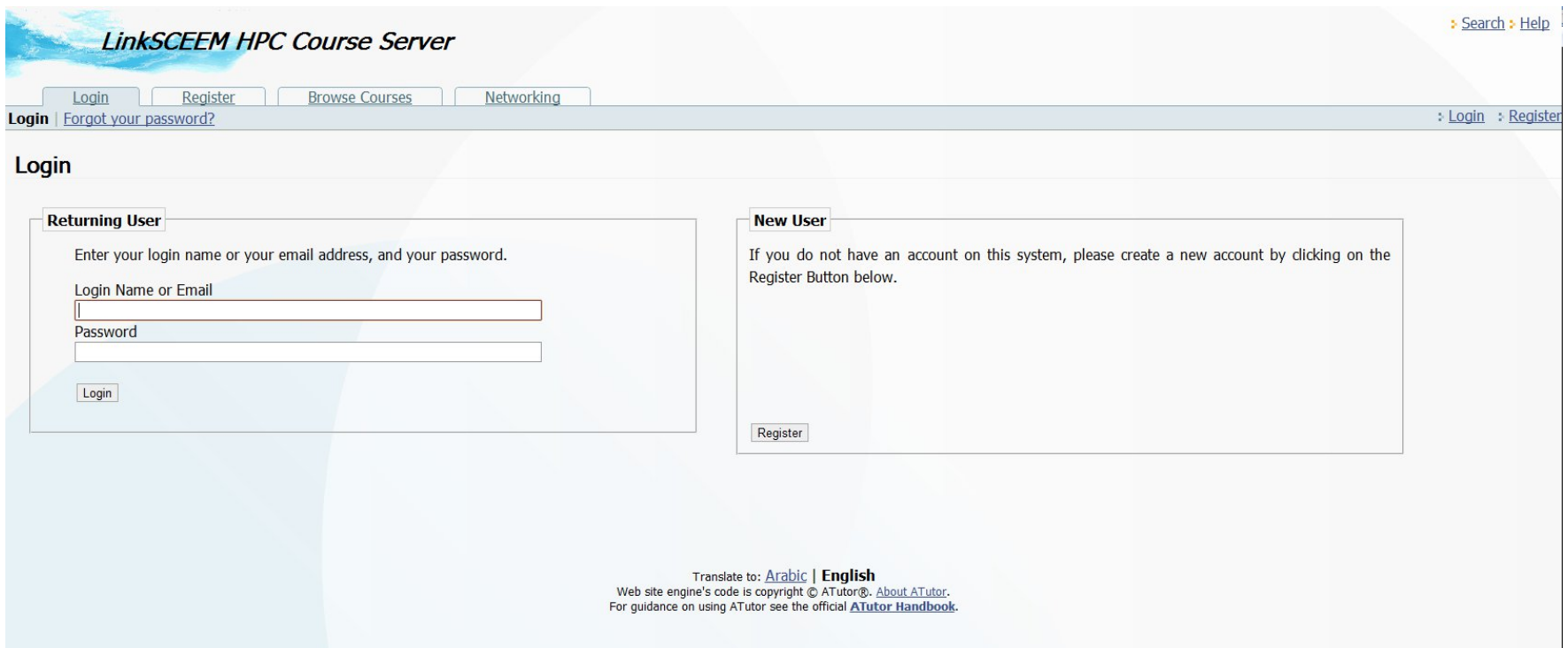
- Prepare the regional scientific communities for using the LinkSCEEM e-infrastructure
- Enable implementation of high-calibre research activities

- Four 1-day user meetings
- One 3-day basic user meeting
- One 3-day advanced cross-sectional workshop
- Three 3-day thematic workshops (one in each thematic area)
  - Climate Research
  - Digital Cultural Heritage
  - Synchrotron Radiation

| BASIC  | ADVANCED  |
|--|---|
| <ul style="list-style-type: none"><li>▪ Basic system interaction</li><li>• Introduction to MPI</li><li>• Introduction to OpenMP</li><li>• Introduction to GPU programming</li><li>• Introduction to data management</li><li>• Introduction to Performance Analysis</li><li>• Optimisation and libraries</li><li>• Debugging</li><li>• Introduction to Visualisation</li><li>• Application specific introductions</li></ul> | <ul style="list-style-type: none"><li>• Intermediate MPI</li><li>• Hybrid programming</li><li>• Intermediate GPU programming</li><li>• Parallel I/O</li><li>• Performance analysis</li><li>• Porting workshop</li></ul> |

# Online Training Portal

- Training content from Great Lakes Consortium
- Tailored for LinkSCEEM-2
- Offline browsing
- FAQ, forum, Q&A capabilities



The screenshot shows the 'LinkSCEEM HPC Course Server' login page. At the top right, there are links for 'Search' and 'Help'. Below the header, there are navigation tabs for 'Login', 'Register', 'Browse Courses', and 'Networking'. The 'Login' tab is active, and there is a link for 'Forgot your password?'. The main content area is titled 'Login' and is divided into two sections: 'Returning User' and 'New User'. The 'Returning User' section contains a text box for 'Login Name or Email' and a password field, with a 'Login' button below. The 'New User' section contains a text box with instructions to create a new account by clicking the 'Register' button below. At the bottom of the page, there is a footer with text: 'Translate to: Arabic | English', 'Web site engine's code is copyright © ATutor®. About ATutor.', and 'For guidance on using ATutor see the official ATutor Handbook.'

## Course



### [1.1 Getting Started on LinkSCEEM HPC Resources](#)

Category: Parallel Computing



### [1.2 Parallel Computing Explained](#)

Category: Parallel Computing



### [2.1 Introduction to MPI](#)

Category: HPC Programming



### [2.2 Introduction to OpenMP](#)

Category: HPC Programming



### [2.3 Debugging Serial and Parallel Codes](#)

Category: HPC Programming



### [2.4 Multilevel Parallel Programming](#)

Category: HPC Programming



### [2.5 Intermediate MPI](#)

Category: HPC Programming



### [3.1 Parallel Numerical Libraries](#)

Category: HPC Applications and Libraries



### [4.1 Introduction to Performance Tools](#)

Category: HPC Performance Tuning



### [4.2 Performance Tuning for Clusters](#)

Category: HPC Performance Tuning



### [4.3 Introduction to Multi-core Performance](#)

Category: HPC Performance Tuning



### [5.1 Introduction to Visualization](#)

Category: Data and Scientific Visualisation



### [5.2 Tuning Applications for High Performance Networks](#)

Category: Data and Scientific Visualisation

## Content

- Huge amount of content
- Many topics covered
- Exercises with solutions
- Material for all levels
- Expanding material based on hardware available within the project, new languages and emerging tools

## 1.1 Getting Started on LinkSCEEM HPC Resources - [Enroll Me](#)

[Course Home](#)[Frequently Asked Questions \(FAQ\)](#)[Forums](#)[Export Content](#)[Site-map](#)[Networking](#)[1.1 Getting Started on LinkSCEEM HPC Resources](#) > [Course Home](#)[Login](#) [Register](#)

### Course Home

LinkSCEEM is an open scientific discovery infrastructure combining resources at partner sites to create an integrated, persistent computational resource. This tutorial provides you with the general information that you need to quickly get started using LinkSCEEM resources. Topics covered in include:

- connecting and logging in to a LinkSCEEM resource
- maintaining security
- using login shells in a Unix-like environment
- transferring files, customizing your software environment
- compiling and running jobs via the queueing system

After you have worked through the lessons in this course, you will have the skills needed to begin your research on LinkSCEEM resources.

### Prerequisites

This tutorial assumes that you have a LinkSCEEM allocation and have received your account packet. If you do not have an allocation or have not received your account packet, see the [LinkSCEEM Allocations website](#) for information on obtaining one.

Original material for this course was provided by CI-Tutor.org. CI-Tutor is hosted by the [National Center for Supercomputing Applications \(NCSA\)](#) at the [University of Illinois at Urbana-Champaign](#). That effort is supported in part by the [National Science Foundation Office of Cyberinfrastructure](#) through the [TeraGrid](#) project.

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### Content Navigation

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### Forum Posts

[Test](#)[Go to Top](#)

### Search

Match:

 All words Any word

### Related Topics

## 1.1 Getting Started on LinkSCEEM HPC Resources - [Enroll Me](#)

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## 2.1 Introduction to MPI

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### Course Home

The Message Passing Interface, or MPI, is a standard library of subroutines (Fortran) or function calls (C) that can be used to coordinate a program running as multiple processes in a distributed memory environment, yet is flexible enough to also be used on a single processor. The MPI library makes it very powerful and enables source code portability since MPI programs should compile and run as-is on a wide range of architectures, offers a great deal of functionality, including a number of different types of communication and special routines for user-defined data types and topologies, and support for heterogeneous parallel architectures.

This tutorial is an introduction to MPI. No prior experience with MPI or parallel programming is required to take this course necessary.

Original material for this course was provided by CI-Tutor.org. CI-Tutor is hosted by the [National Center for Supercomputing / Champaign](#). That effort is supported in part by the [National Science Foundation Office of Cyberinfrastructure](#) through the [TeraGrid](#).

The content for this particular course was provided by the following institutions - the [National Center for Supercomputing / Supercomputer Center \(OSC\)](#), [Boston University \(BU\)](#), the [University of Kentucky \(UKy\)](#), and the [Center for High Performance Computing](#).



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## 2.2 Introduction to OpenMP

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### Course Home

OpenMP is a standardized API for parallelizing Fortran, C, and C++ programs on shared-memory architectures. This introduce the components of OpenMP in a concise, progressive fashion, so users can begin to apply OpenMP to their code. Parallel processing is also included to the extent necessary to explain various points about OpenMP. Examples are present.

The only prerequisite for this tutorial is knowledge of basic programming in Fortran, C, or C++.

Original material for this course was provided by CI-Tutor.org. CI-Tutor is hosted by the [National Center for Supercomputing Research Center](#). That effort is supported in part by the [National Science Foundation Office of Cyberinfrastructure](#) through the [Teragrid](#).

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- Course Evaluation Form x**



# Research Activities

**Cross-disciplinary research**

**Cyl, NARSS, BA, JSC, NCSA, SESAME, IUCC**

**Climate research**

**Cyl, MPG, NARSS**

**Cultural Heritage research**

**Cyl, BA, NCSA**

**Synchrotron radiation research**

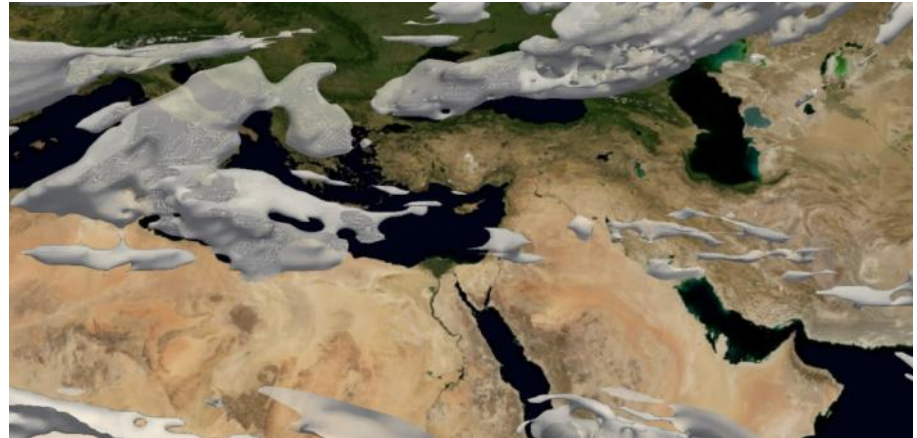
**Cyl, SESAME, ESRF**



# Cross-disciplinary Research

- **Tasks**
  - **Optimization of parallel applications from Eastern Mediterranean computational scientists on large-scale HPC systems**
  - **Adaptation and development of tools for data repository management (for Cultural Heritage, Climate and Synchrotron data) and the visualization of complex data**
- **Impact**
  - **Provide know-how for scientific applications for use by the LinkSCEEM e-infrastructure users**
  - **Prepare data repository service for use with Cultural Heritage, Climate and Synchrotron data**
  - **Accumulate regional expertise on implementation of optimized parallel applications, data repository management and visualization.**

# Climate Research



- **Tasks**

- **Porting, optimizing and sharing the existing global ECHAM5/MESy Atmospheric Chemistry (EMAC) climate model to the CaSToRC and BA hardware and software computing environments**
- **Study climate change and air quality scenarios in the Eastern Mediterranean**

- **Impact**

- **Develop a custom, version of the EMAC model optimized to regional computational resources available through the LinkSCEEM e-infrastructure to regional users**
- **Implement climate scenarios for the Eastern Mediterranean**



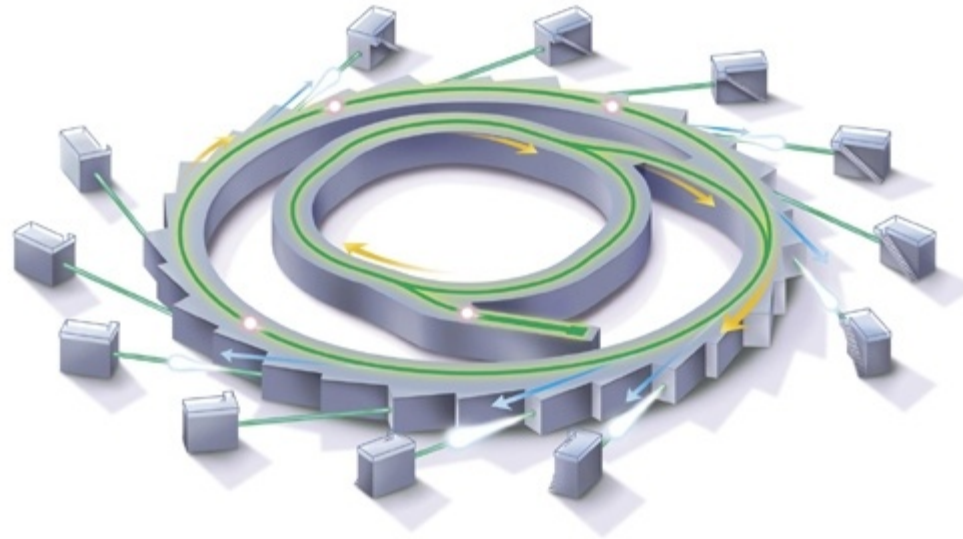
# Cultural Heritage Research

- **Tasks**

- Prototyping a novel, small object imaging centre at CaSToRC
- Implementing a Digital Library of sufficient storage capacity to accommodate the high-resolution image-objects of cultural heritage artifacts.
- Producing tools for tele-immersive collaborative environments and data

- **Impact**

- Establish a small object imaging centre that can be used for developing high-resolution image objects for regional artefacts
- Implement a pilot project to evaluate utility of the small object imaging centre
- Develop and make available a Digital Library, open to regional users, to host high resolution image-objects of regional artefacts
- Develop tools and expertise for creating tele-immersive collaborative environments



- **Tasks**

- **Port existing and develop new GPU programs to improve the efficiency and quality of experiments carried out on micro- and nano-focussing synchrotron beamlines**
- **Provide support to package, distribute and install GPU programs in an HPC environment**

- **Impact**

- **Implement a collection of tools optimized for the CaStoRC HPC infrastructure which includes GPU hardware made available to the regional user community through the LinkSCEEM e-infrastructure.**
- **Develop regional expertise in synchrotron data analysis and simulation**