Code As Community

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- https://bssw.io
- https://bssw/psip

Agenda: Code as Community

- Why is “code as community” important?
- What is this minisymposium trying to accomplish?
- Minisymposium program speaker lineup

```
Main( ){
        printf(“hello, world”);
}
```

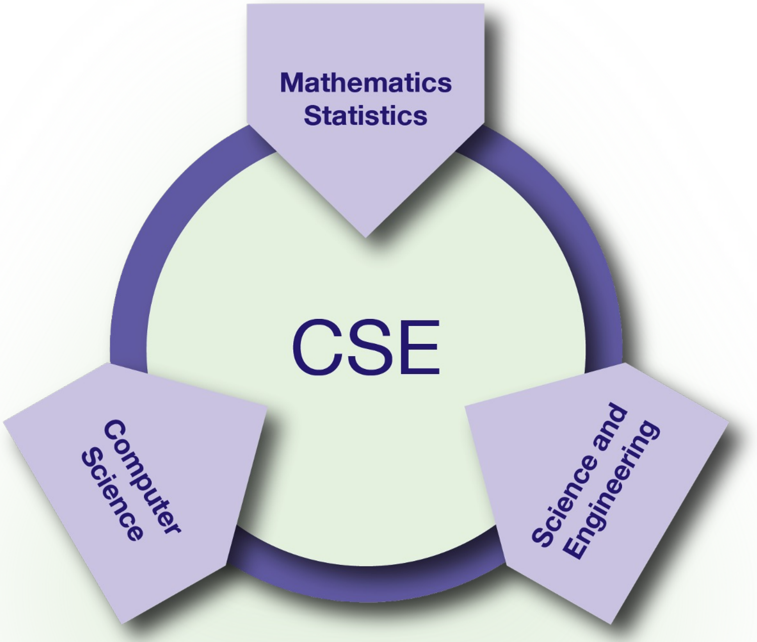
Why is Software/Code Important?

CSE = Computational Science & Engineering

- **Development and use of computational methods for scientific discovery**

- **Plays a significant role in:**
    - ○ All branches of the sciences, engineering and technology
    - ○ Support of decision-making across a spectrum of societally important applications

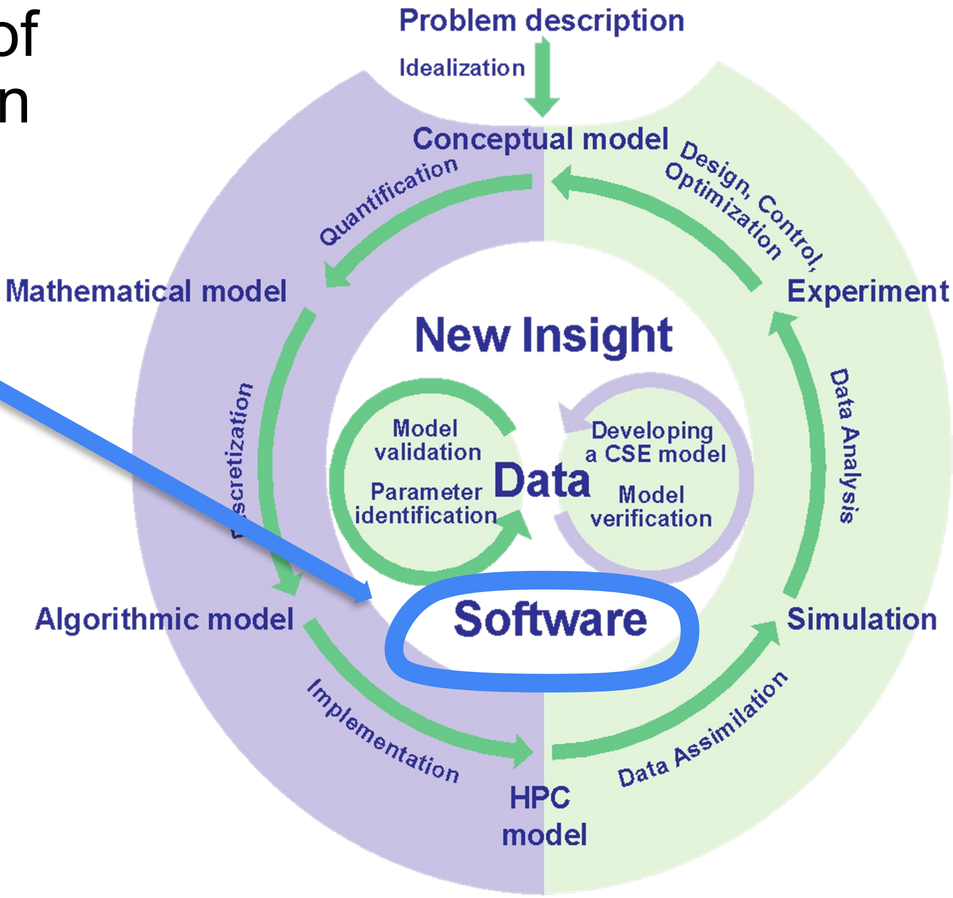
The rapid growth of available compute power drives CSE research toward ever more complex simulations in ever more disciplines, creating ever more opportunities



Slide Credit : Lois Curfman Mcinnes, SIAM PP2018

Software is the foundation of sustained CSE collaboration and scientific progress

- CSE cycle: Modeling, simulation, and analysis
- **Software: independent but interrelated elements** for various phases that together enable CSE
- No single team has expertise for all phases of simulation: **collaboration via software can create teams of teams and communities**



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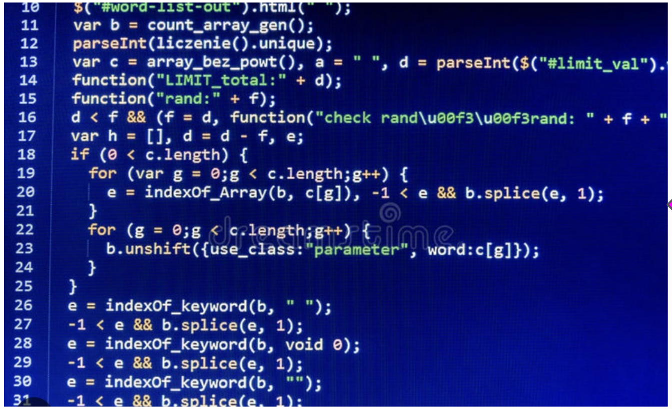
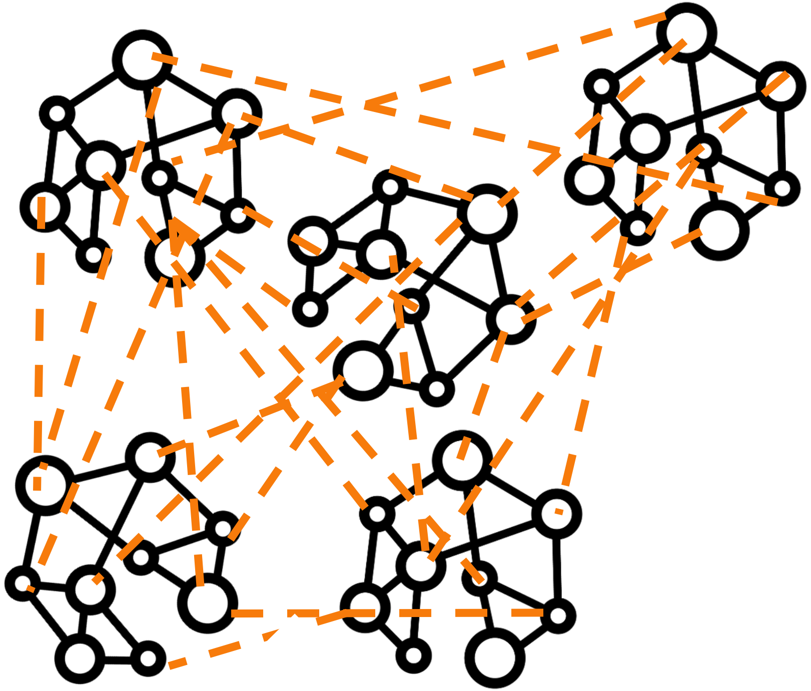
The relationship between code and communities



```
$("#word-list-out").html(" ");
var b = count_array_gen();
parseInt(liczenie().unique);
var c = array_bez_powt(), a = " ", d = parseInt($("#limit_val").
function("LIMIT_total:" + d);
function("rand:" + f);
d < f && (f = d, function("check rand\u00f3\u00f3rand: " + f + "
var h = [], d = d - f, e;
if (0 < c.length) {
  for (var g = 0;g < c.length;g++) {
    e = indexOf_Array(b, c[g]), -1 < e && b.splice(e, 1);
  }
  for (g = 0;g < c.length;g++) {
    b.unshift({use_class:"parameter", word:c[g]});
  }
}
e = indexOf_keyword(b, " ");
-1 < e && b.splice(e, 1);
e = indexOf_keyword(b, void 0);
-1 < e && b.splice(e, 1);
e = indexOf_keyword(b, "");
-1 < e && b.splice(e, 1);
```

- **Code Empowers Communities**: Software provides the foundation for enabling science by creating software solutions and empowering communities to achieve their goals
- **Communities Drive Code:** Contributing to the vision, development, improvement, and evolution of code through collaboration and shared expertise
- **Collaboration and Feedback Loop:** Iterative process where communities collaborate with developers, providing feedback, ideas, and testing, driving code enhancements and refinements

Teams of Teams: Communities with purpose



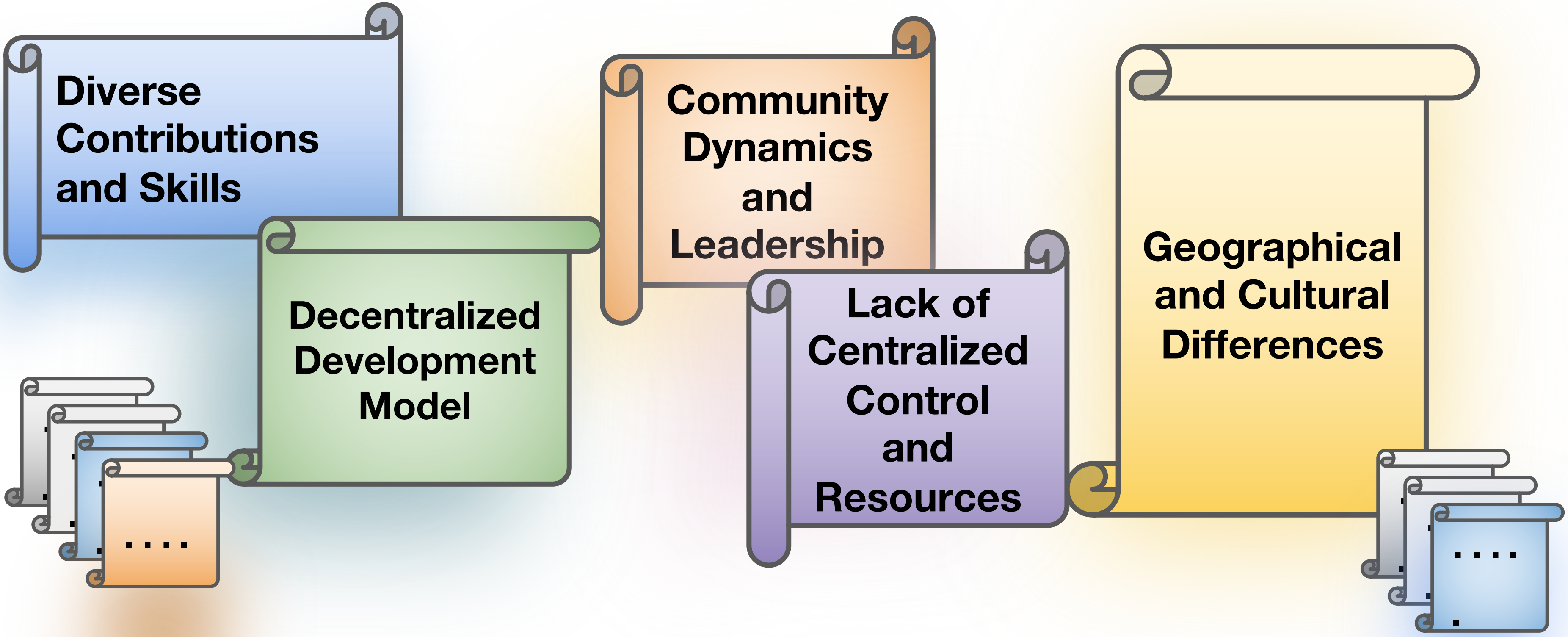
Teams of teams and community can be formed via codes: allowing us to scale the efforts of small teams and leverage a larger network

Several key ingredients include:

- Shared mental models, aligning narrative
- Empowered to commit
- A focus on the ecosystem
- Embedded members or liaisons build the network and breakdown silos

- McChrystal, S., Collins, T., Silverman, D., Fussell, C. (2015). Team of teams: New rules of engagement for a complex world. Penguin Random House LLC: NY.
- Raybourn, E.M., Moulton, J.D., Hungerford, A. (2019). Correction to: Scaling Productivity and Innovation on the Path to Exascale with a “Team of Teams” Approach. In: Nah, FH., Siau, K. (eds) HCI in Business, Government and Organizations. Information Systems and Analytics. HCII 2019. Lecture Notes in Computer Science(), vol 11589. Springer, Cham. https://doi.org/10.1007/978-3-030-22338-0_39

What challenges and opportunities exist in code communities?


Diverse Contributions and Skills
Decentralized Development Model
Community Dynamics and Leadership
Lack of Centralized Control and Resources
Geographical and Cultural Differences
....
....

1. **Technical challenges** with codes adopted by communities
2. **Social/non-technical challenges** with codes and communities

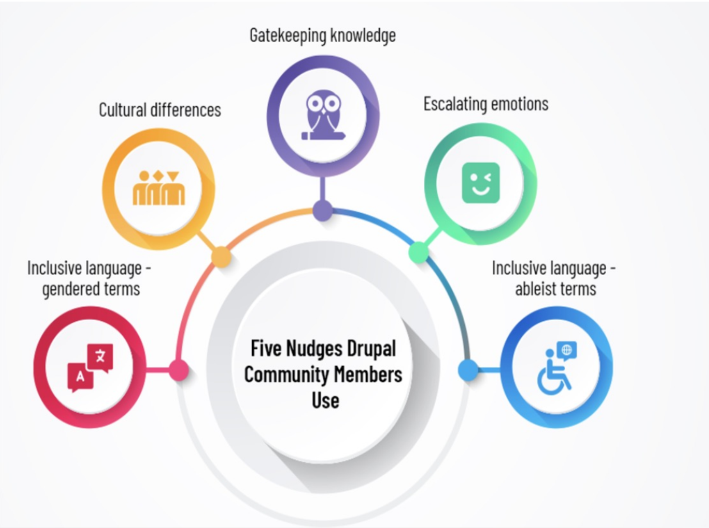
Social challenges and opportunities of code communities (1)

- **Governance and Decision-making:**
  - Diverse opinions and interests
  - Balance between priorities of different stakeholders vs. maintaining a coherent project vision
- **Language and Cultural Barriers**
  - Diverse backgrounds, language translations, cultural differences, different perspectives

- **Diverse Skill Sets and Expertise**
  - Advantage: broad range of skillset available
  - Disadvantage: Balance with technical excellence is demanding
  - Knowledge sharing and mentorship can help
- **Coordination and Collaboration:**
  - Alignment of efforts and avoid duplicating work
  - Adherence established agreed-upon development processes
  - Requires robust communication and coordination mechanisms/project management tools

Social challenges and opportunities of code communities (2)

- **Credit and Recognition**
  - Attribution of contributions accurately and fairly
  - Maintaining a positive and inclusive community culture
- **Legal Issues and Licensing**
  - Protect contributors' rights
  - Ensure compliance with licenses
- **Funding and Sustainability:**
  - Voluntary contribution of time and expertise; difficult to gauge resources needed
  - Finding sustainable funding models is crucial


Gatekeeping knowledge
Cultural differences
Escalating emotions
Inclusive language - gendered terms
Inclusive language - ableist terms
Five Nudges Drupal Community Members Use

Nurturing Community Dynamics

Foster open and respectful communication channels. Encourage active participation. Transparent Conflict Resolution. Cultivating Trust and Collaboration

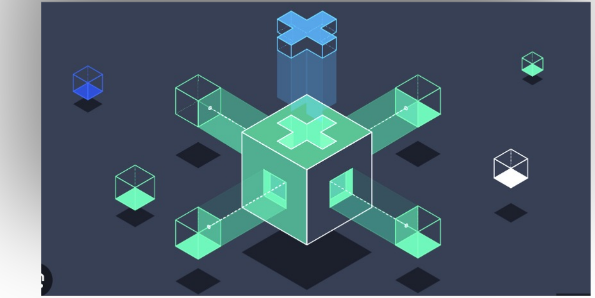
Technical challenges of code in large communities (1)

- **Understanding and scoping requirements**
  - Diverse community members, different expectations
- **Scaling (code + contributors)**
  - Increasing number of contributors and codebase size
  - Collaboration and coordination among developers
- **Code Consistency and Integration**
  - Maintaining code consistency
  - Managing version control and addressing conflicts during code merging
- **Compatibility and Interoperability**
  - Ensuring compatibility across platforms
  - Integrating diverse technologies
  - Interoperability across different systems
- **Reproducible Results**
  - Ensuring processes in place for reproducibility

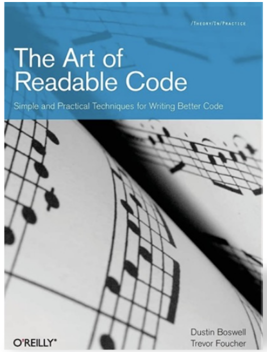
Technical challenges of code in large communities (2)

- **Functionality, Performance and Scalability: Expectations vs. Reality**
  - Is final code meeting expectations?
- **Long-term Maintenance**
  - Funding for maintenance and sustainability
  - Technical Debt, Legacy code, backward compatibility
- **Documentation and Knowledge Management**
  - Managing code documentation
  - Sharing knowledge among community members

Enduring characteristics of code in large communities (1)

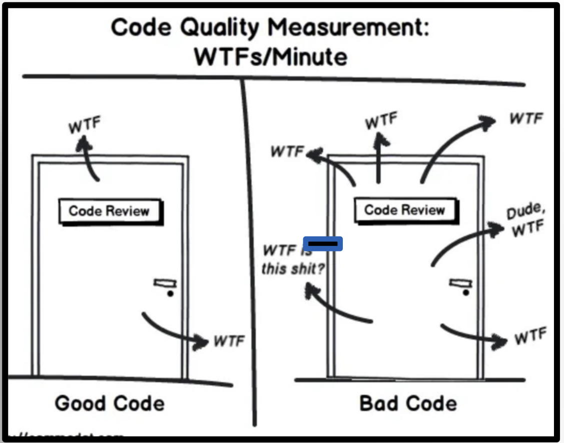


- **Code Development**
  - **Modularity:**
    - Organized into modular units
    - Promotes better understanding, reusability, manageability
  - **Readability**
    - Highly readable
    - Well-organized code, consistent naming conventions, clear syntax
  - **Documentation**
    - Comprehensive documentation (purpose, coding guidelines, usage, and dependencies)
  - **Extensibility**
    - Well Designed to allow easy addition or modification of functionality
  - **Maintainability**
    - Proper abstraction, Minimal duplication, Adherence to best practices



Enduring characteristics of code in large communities (2)

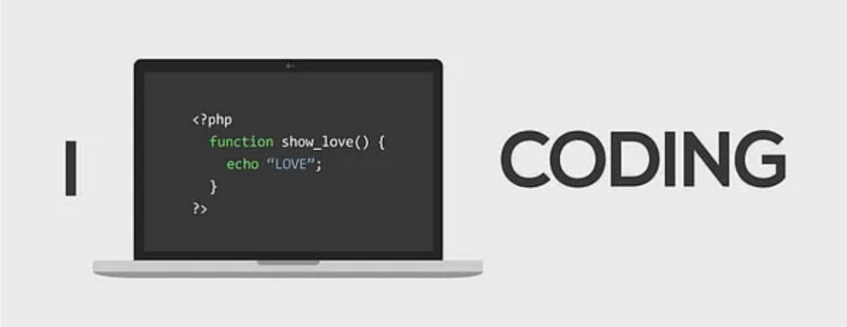
- **Code Development (contd)**
  - Testing and Quality Assurance:
    - Robust testing practices
    - Automatic testing
    - code review processes for high quality
  - Factors for Performance, Efficiency, Portability, Interoperability
    - The end result counts!
  - Planned Sustained Funding
    - $$$ needed for any and all of this!



- **Community Engagement:**
  - Open communication
  - Inclusive environment
  - Collaborative tools and processes in place
  - Two-way Feedback mechanism from community members
  - Facilitating knowledge sharing and mentorship programs

Conclusion: Codes as communities are important

- Code communities are complex adaptive systems sustained by enduring characteristics
- There are challenges and opportunities as codes become communities
- Collaboration and collective intelligence drives science for society
  - Enable knowledge sharing and learning for all
  - Vast amount of potential resources available
  - Support and problem solving
  - Increases adoption and growth
- Code is language, art, and science
- Code is an expression of human creativity and ingenuity

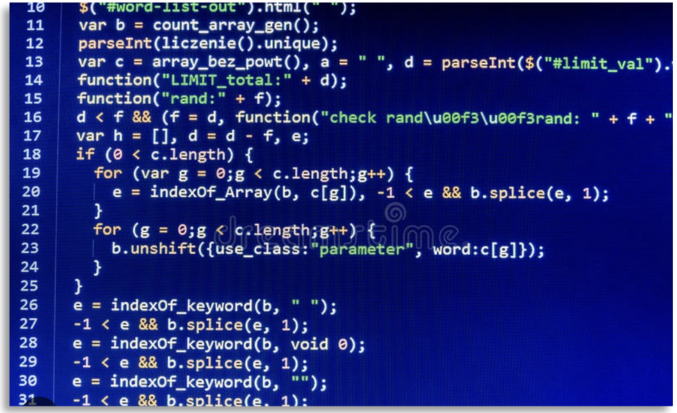


```
<?php
  function show_love() {
    echo "LOVE";
  }
?>
```

What will this PASC minisymposium accomplish?

We will continue to address the following questions:

- What are the challenges with integrating codes and teams across distinct communities?
- What are the challenges associated with growth by community adoption of code?
- What are the enduring characteristics of codes that survive the test of time in large communities?
- When do software developers and RSEs formally identify as a community service?
- How does code communicate?



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 var h = [], d = d - f, e;
 if (0 < c.length) {
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   }
   for (g = 0;g < c.length;g++) {
     b.unshift({use_class:"parameter", word:c[g]});
   }
 }
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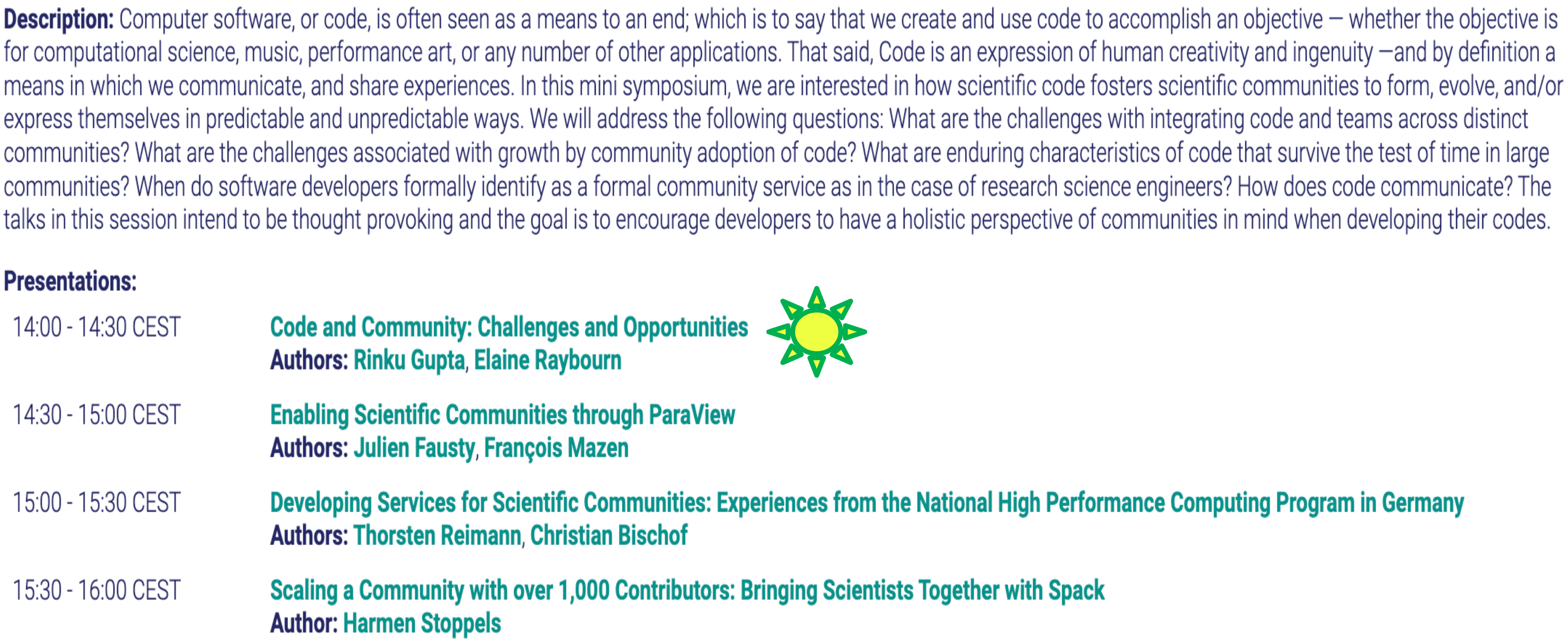
Agenda that follows



Description: Computer software, or code, is often seen as a means to an end; which is to say that we create and use code to accomplish an objective – whether the objective is for computational science, music, performance art, or any number of other applications. That said, Code is an expression of human creativity and ingenuity –and by definition a means in which we communicate, and share experiences. In this mini symposium, we are interested in how scientific code fosters scientific communities to form, evolve, and/or express themselves in predictable and unpredictable ways. We will address the following questions: What are the challenges with integrating code and teams across distinct communities? What are the challenges associated with growth by community adoption of code? What are enduring characteristics of code that survive the test of time in large communities? When do software developers formally identify as a formal community service as in the case of research science engineers? How does code communicate? The talks in this session intend to be thought provoking and the goal is to encourage developers to have a holistic perspective of communities in mind when developing their codes.

Presentations:

14:00 - 14:30 CEST	**Code and Community: Challenges and Opportunities** **Authors:** Rinku Gupta, Elaine Raybourn
14:30 - 15:00 CEST	**Enabling Scientific Communities through ParaView** **Authors:** Julien Fausty, François Mazen
15:00 - 15:30 CEST	**Developing Services for Scientific Communities: Experiences from the National High Performance Computing Program in Germany** **Authors:** Thorsten Reimann, Christian Bischof
15:30 - 16:00 CEST	**Scaling a Community with over 1,000 Contributors: Bringing Scientists Together with Spack** **Author:** Harmen Stoppels