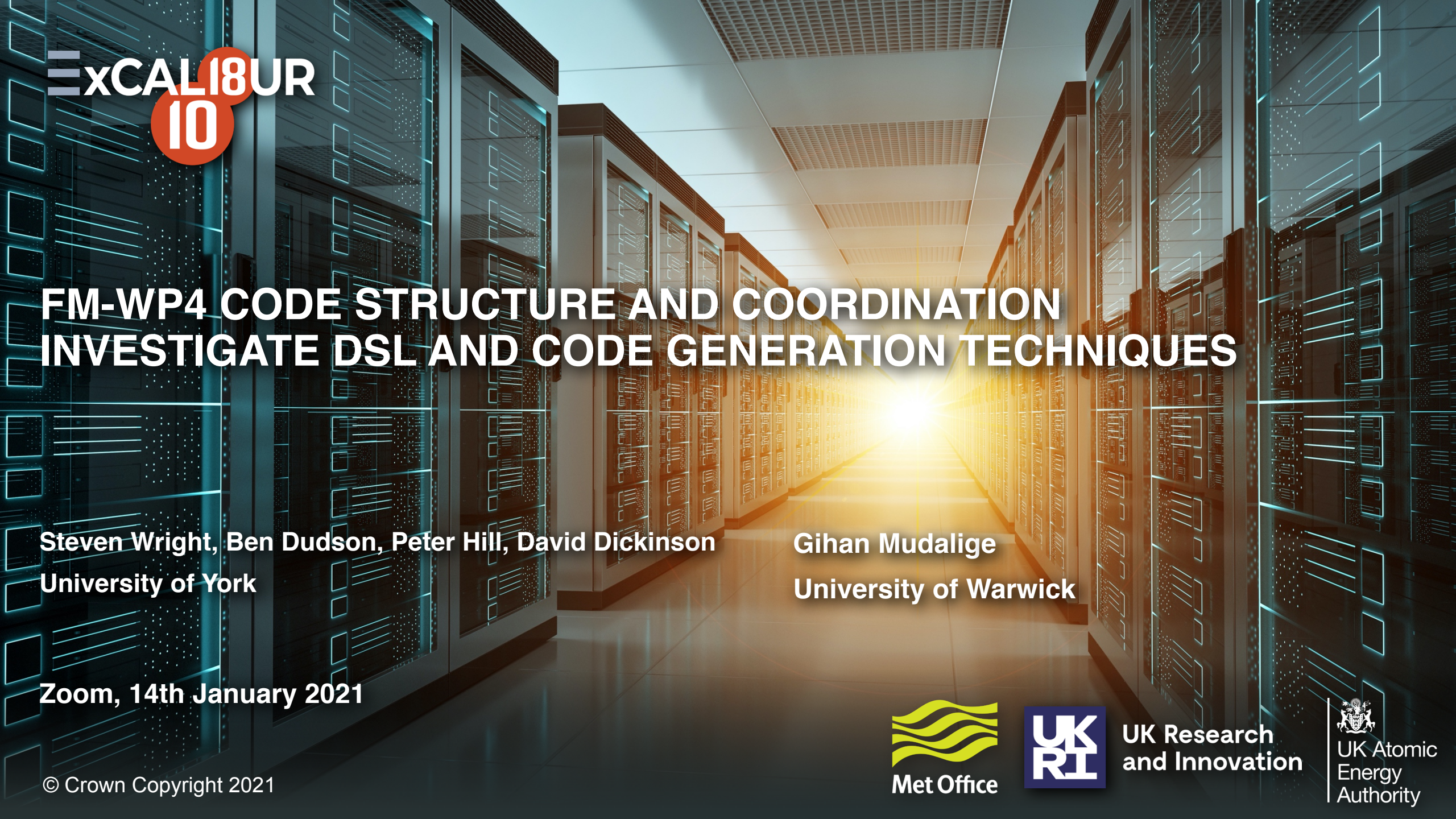

FM-WP4 CODE STRUCTURE AND COORDINATION INVESTIGATE DSL AND CODE GENERATION TECHNIQUES

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Zoom, 14th January 2021

Introduction

FM-WP4 Code structure and coordination

- Ensure that in-development software is fit for its defined purpose
  - Define appropriate standards and approaches for development
  - Define suitably flexible code structures and related infrastructure
  - Define common interfaces for I/O
  - Ensure portability across architectures (future proofing)
- Coordination required across work packages

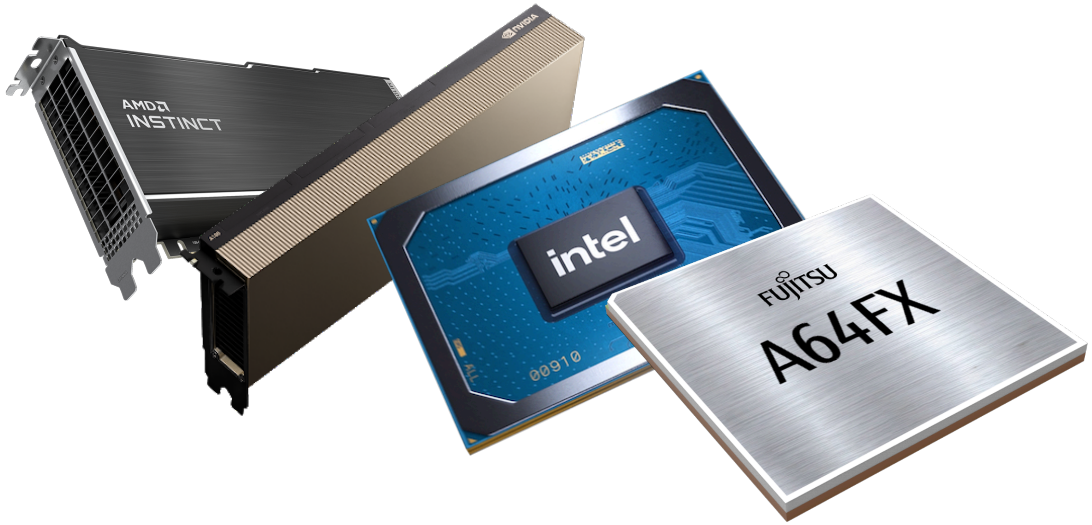
Project Goals

Investigate DSL and code generation techniques

1. Survey available technologies
   - Current HPC hardware, and hardware likely to be available at Exascale
   - Programming models for performance portability
   - Appropriate Domain Specific Languages (DSLs)
   - Portable Math Kernel libraries
2. Identify testbed platforms and representative proxy applications
3. Evaluate approaches using proxy apps
4. Produce recommendations for NEPTUNE

Task 1: Survey of available technologies

Analysing the landscape



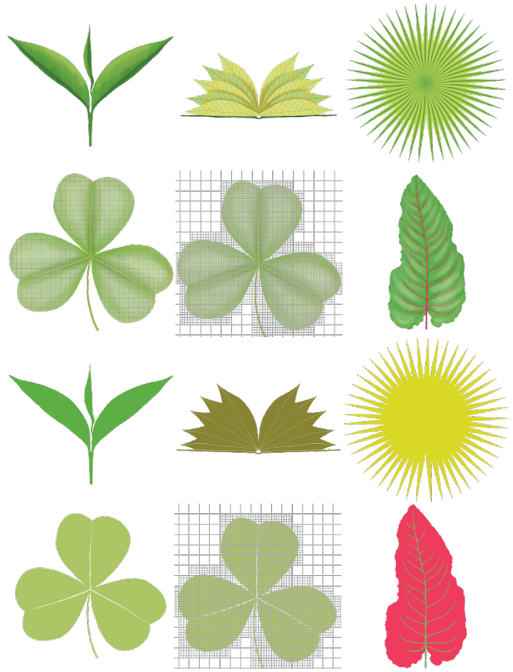
- Identify architectures commonly in use today and those in candidate exascale systems
- Identify compilers, languages, libraries, programming model, DSLs
- Analyse parallel file systems, data structures, output libraries

OpenMP
kokkos
RAJA
OP-DSL

Task 2: Setup Evaluation

Identification of testbed platforms and representative proxy applications

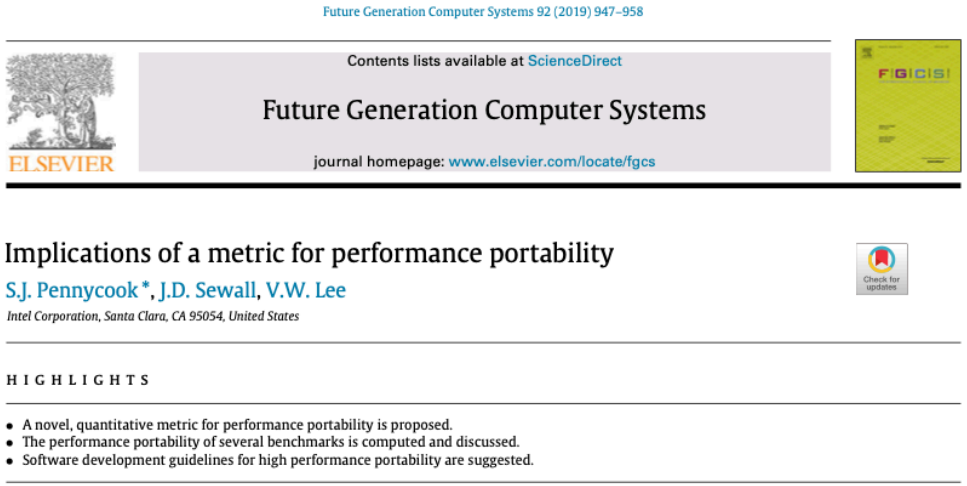
- Identify the key computation components of NEPTUNE applications
- Find mini-/proxy-apps with computationally similar algorithms (or develop proxies with other NEPTUNE groups) implemented in a variety of programming languages or models or DSLs
- Establish availability of testbed platforms
  - E.g. Viking, Bede, Avon, Isambard, ARCHER2
- Acquire representative datasets



Task 3: Evaluation of Approaches to Performance Portability

Testing Future-proofing

- Set up test systems, environments and applications
- Evaluate proxy-app performance over differing platforms
- Analyse applications *performance* and *performance portability* using metrics such as Pennycook et al. [FGCS 2019]



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Implications of a metric for performance portability

S.J. Pennycook *, J.D. Sewall, V.W. Lee

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HIGHLIGHTS

- A novel, quantitative metric for performance portability is proposed.
- The performance portability of several benchmarks is computed and discussed.
- Software development guidelines for high performance portability are suggested.

Task 4: Dissemination of Best Practices

Establishing feedback loops

- Coordinating with other groups to gather requirements and find or develop relevant proxy apps
- Coordination throughout NEPTUNE to aid in performance portable application of NEPTUNE proxyapps

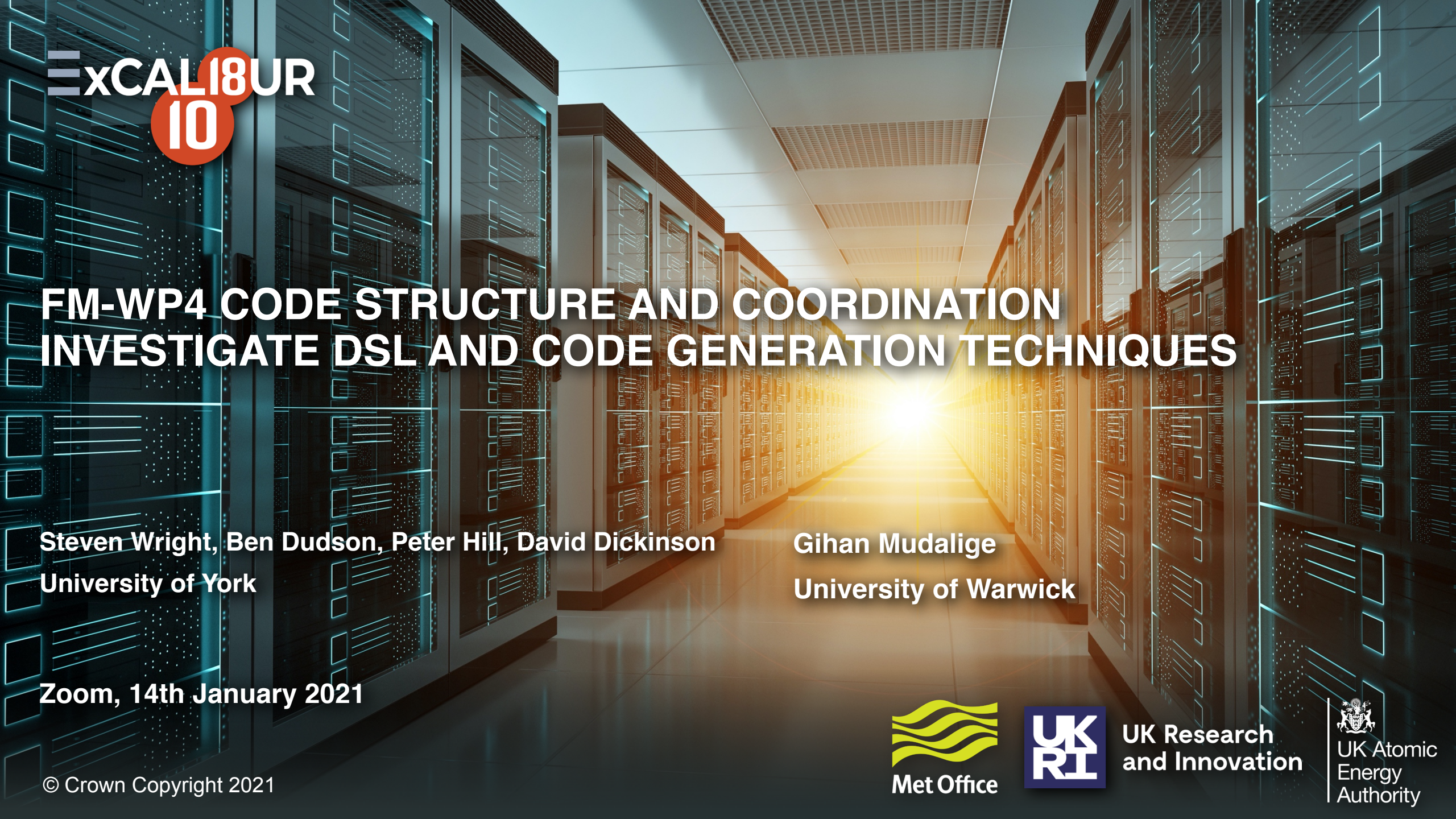
Project Timeline

		J	F	M	A	M	J	J	A	S
Task 1	**Survey of tech**									
1.1	Hardware survey									
1.2	Software survey									
1.3	I/O survey									
Report										
Task 2	**Identification of Platforms and Apps**									
2.1	Identify proxy apps									
2.2	Identify platforms									
2.3	Acquire datasets									
Repository										
Task 3	**Evaluation**									
3.1	Setup systems									
3.2	Evaluate performance									
3.3	Analysis of performance									
Report										
Task 4	**Dissemination of Best Practices**									
4.1	Gather requirements									
4.2	Feedback approaches									
Report										

Getting Involved

How you can help

- In-development Applications
  - Is your application “mini”? Does a “mini app” version exist?
  - Are there applications in ECP, UK-MAC, etc. that are similar?
- What programming model are you using?
- What systems are you using? What scale are you running at?
- What do typical datasets look like?



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