



# **HPC RIVR**

## **HPC Facility at SLING**

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Jožef Stefan Institute SLING - Slovenian National Supercomputer Network

# SLING Slovenian Initiative for National Grid



• DataGrid 2002-2004



• EGEE I – III, NorduGrid 2004-2010



• NorduGrid 2004/2011-

• EGI: 2010



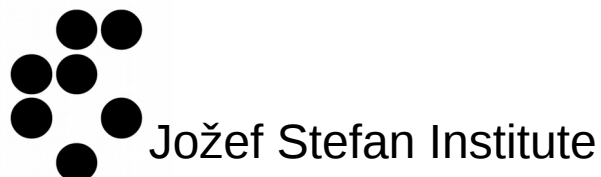
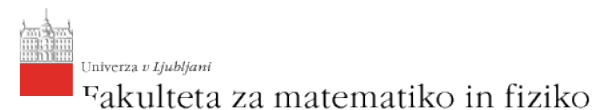
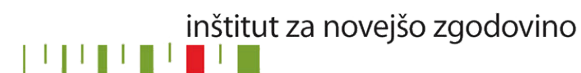
• PRACE 2018



Slovenian National Supercomputing Network

# Members of SLING

Consortium  
Februar 15 2018



# SLING

## ARC Using Partners

Arctur\* – 1024°

Arnes – 4500° $\alpha$

Atos\* – 2941

CIPKeBiP – 984

SiGNET – 4400

UNG – 120

R4\* – 1800° $\alpha$

NSC – 1980° $\alpha$

## Non-ARC Members

Meteo – 740°

CI – 1680° $\alpha$

FMF – 1218

IJS K3 – 500

ME – 1248°

8 sites, 16 members

• ~ 22.000 cores

(+ 5.250 candidatesi)

• > 5PB disc

• > 4 mio. jobs / year

• HPC, GPGPU, chroot

> 90% SLO capacity

## Legenda

\* local jobs

° InfiniBand

$\alpha$  NVidia GPGPU

# Arnes Demo Cluster

- HPC, GPGPU
- EGI - production
- gLite and NG ARC
- LHCONE and Géant
- Users: bioinformatics, chemistry, computational linguistics, knowledge technology, matematika, mathematics, numerical analysis, CS, physics, statistics

## CLUSTER IN NUMBERS

~4500 cores

~150 T job data cache

~500 T storage

~5 T RAM

- largest node: 64 cores

- IB: over 80 %

- also available: Singularity  
cloud VMs, iSCSI storage

# HPC RIVR

Call Opened  
April 11th 2018

- Eastern Slovenia Structural
- Local Consortium
- SLING collaboration
- EGI, PRACE, NorduGrid
- Funding for ESFRI projects
- Regional/2I collaborations





# HPC RIVR

- 20 Mio €
- in 3 years
- project application **TODAY**  
**June 4**



# HPC RIVR

**19 MIO EUR**

- 20 Mio €
- in 3 years, 1 big + 2 small - net





# HPC RIVR

**18 MIO EUR**

- 20 Mio €
- in 3 years, 1 big + 2 small - net
- infrastructure upgrade



# HPC RIVR

**17.5 MIO EUR**

- 20 Mio €
- in 3 years, 1 big + 2 small - net
- infrastructure upgrade
- training, mobility

# HPC RIVR

**16 MIO EUR**

- 20 Mio €
- in 3 years, 1 centre + 2 small
- infrastructure upgrade
- training, mobility
- operational costs
- 16 Mio:

**+ESFRI  
support  
funding**

~50 k cores, 20 PB HD, 1 PB SSD

# Mix'n'match...

CVMFS

Salt



Kubernetes

**KeyStone**

Globus Ceph

OpenCL

NorduGrid **ARC**

Cinder gLite

dCache

Torque

• VOMS

PKI

**OpenMP**

CUDA

**SLURM**

OpenStack

Glance

gFTP

OpenNebula

oVirt

science portals

**Puppet**

VRC



# Goals

## member-oriented



- Unified access  
(EduGain/x509 + VOMS)
- Unified interfaces  
(ARC + LoginNode, aCT++)
- Flexible environment  
(ARC RTE + HPC modules → RTE + Singularity)  
OpenMP, OpenCL, CUDA ...
- Flexible infrastructure  
experimental environment, flexible network



# General Design

- Dense HPC Nodes: 1/2U: 2/4 x Epyc
- Discrete GPGPU: 4 x NVidia
- Small HPC Islands: ~2000 cores
- High Throughput: CEPH + 25Gb/s
- ARC, SLURM, Singularity
- Servs + VM: OpenStack/Kubernetes
- ... Login nodes, provisioning, rmt cloud experimental partitions, Singularity HUB

# 3 Sites

- UM: Experimental Cluster
- FIŠ: VM, big mem, login
- IZUM:
  - HPC RIVR computing
  - 1 PB SSD scratch
  - HD storage: 20 PB
- Network + SLING:  
10 Gb/s → 100 Gb/s

# Univerity of Maribor

- 76 1U or 19 2U/4N  
2x AMD EPYC 7551 32c  
4864c / 9728th  
512GB RAM 8GB/core
- 5 GPGPU nodes  
4x NVIDIA Tesla P100 GPU  
20 GPGU accelerators
- 1TB SSD, 100 Gb/s IB
- 138TB SSD local storage
- support servers
- provisionning, VM

## CLUSTER IN NUMBERS

~4864 cores / 9728 threads

~138T storage

- largest node: 64 cores

- 25 Gb/s Ethernet

- IB or OmniPath

- also available:

Singularity, VMs,

remote storage





# FIŠ: Faculty for Information Studies

- Existing remote HPC infrastructure
- 100 Gbit/s links to SLING members
- Large memory servers
- Example nodes for experimental support
- Local all Flash infrastructure for VM support and data management

# HPC RIVR at IZUM

- 500 1U or 125 2U/4N  
2x AMD EPYC 7551 32c  
4864c / 9728th  
512GB RAM 4GB/core  
960GB SSD, 100 Gb/s IB
- 30 GPGPU nodes  
4x NVIDIA Tesla P100 GPU  
20 GPGU accelerators
- 22 x 46 TB SSD CEPH
- 22 x 1.080 TB HDD  
CEPH(90x12 TB)
- 30, support servers + VM

## CLUSTER IN NUMBERS

~45 k cores / 90 k threads

~20 P HDD storage

~ 1 P SD storage

- largest node: 64 cores

- 25 Gb/s Ethernet

- IB or OmniPath (2k full/8x)

- ARC, SLURM, CEPH  
modules + Singularity



# SLING Integration

- Common design
- Design, Training, Porting
- Common High Level Support
- Common managed SW repo  
CVMFS / Singularity HUB
- N x 100 Gb/s network
- CEPH ~ shared storage  
(IZUM/ARNES) + services



# **SLING Singularity HUB**

- Guaranteed Environment
- Persistent and Managed
- Tested and Documented
- Validated and Peer-Reviewed
- Portable and Accessible



# **SLING Singularity HUB**

- Guaranteed Environment
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- Portable and Accessible
  - **CVMFS, build hub,  
scientific FS + containers**

# Access Modes

- SLING:
  - Individuals
  - Projects
  - Organizations
- ARC client, API, aCT  
ARC client login node
- SLURM login node  
for experiments
- aCT AAS
- EGI, PRACE (PRACE T2?)
- Projects and infrastructures:
  - ATLAS, PierreAuger, CTA, HBA
  - ELIXIR, CLARIN, CECAM



# **SLING + RIVR Future**

- National Collaboration
- Industrial Involvement
- Tech: NorduGrid + ARC, CEPH, Singularity, mgm, project spec.
- Bi-lateral projects, Funding As
- ESFRI-related national funds
- Regional, EGI/PRACE, EuroHPC

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- National Collaboration
- Industrial Involvement
- Tech: NorduGrid + ARC, CEPH, Singularity, mgm, project spec.
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policy  
support





# Questions



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