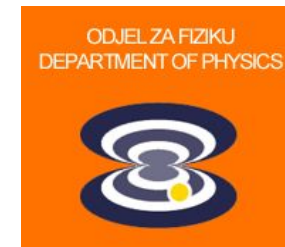


# Supercomputer 'Bura' as a software processing centre for LSST Vera C. Rubin observatory

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# Croatian Participation Group @ LSST (CRO-RBI in-kind contribution)

1. Institute Ruđer Bošković, Zagreb  
(group leader Lovro Palaversa)
2. University of Zagreb (Hvar observatory)
3. University of Rijeka (Faculty of Physics)



## In-kind contribution

- Software development (RBI, UniZg-HO)
- Software processing centre (UniRi – HPC 'Bura')

# Bura @ University of Rijeka



# Scientific collaborations

CPG is active in (but not exclusively focused to):

- 1. Transients and variable stars (TVS)**
2. Stars, Milky way and local volume (SMWLV)
3. Any other scientific collaboration, group or individuals are welcome

## Computer resources in-kind contribution

### **SPC (Software processing centre)**

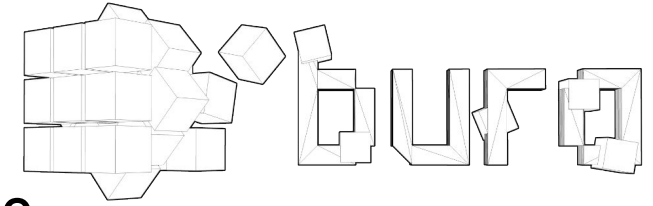
- Dedicated computer resources for CPU(GPU)-intensive analysis & processing
- Demands for CPU(GPU) power, lower disk storage → HPC (high-performance computing) facility

# Software processing centre

HPC 'Bura' at University of Rijeka as SPC:

1. Contribution with substantial amount of CPU-hours for (mainly) stellar astrophysics
2. Cooperation with Slovenian lite IDAC in Maribor
3. Astrophysicist domain support
4. Analysis of large amount of data + small-scale computing of individual groups

# "Bura" supercomputer



**High performance computing facility** → top 500

Rmax: 233.565 TFlop/s

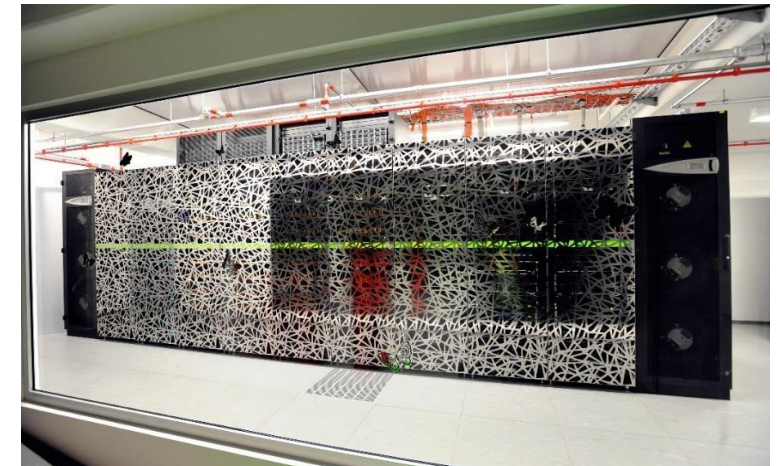
Rpeak: 287.539 TFlop/s

Peak Power (kW): 108.48

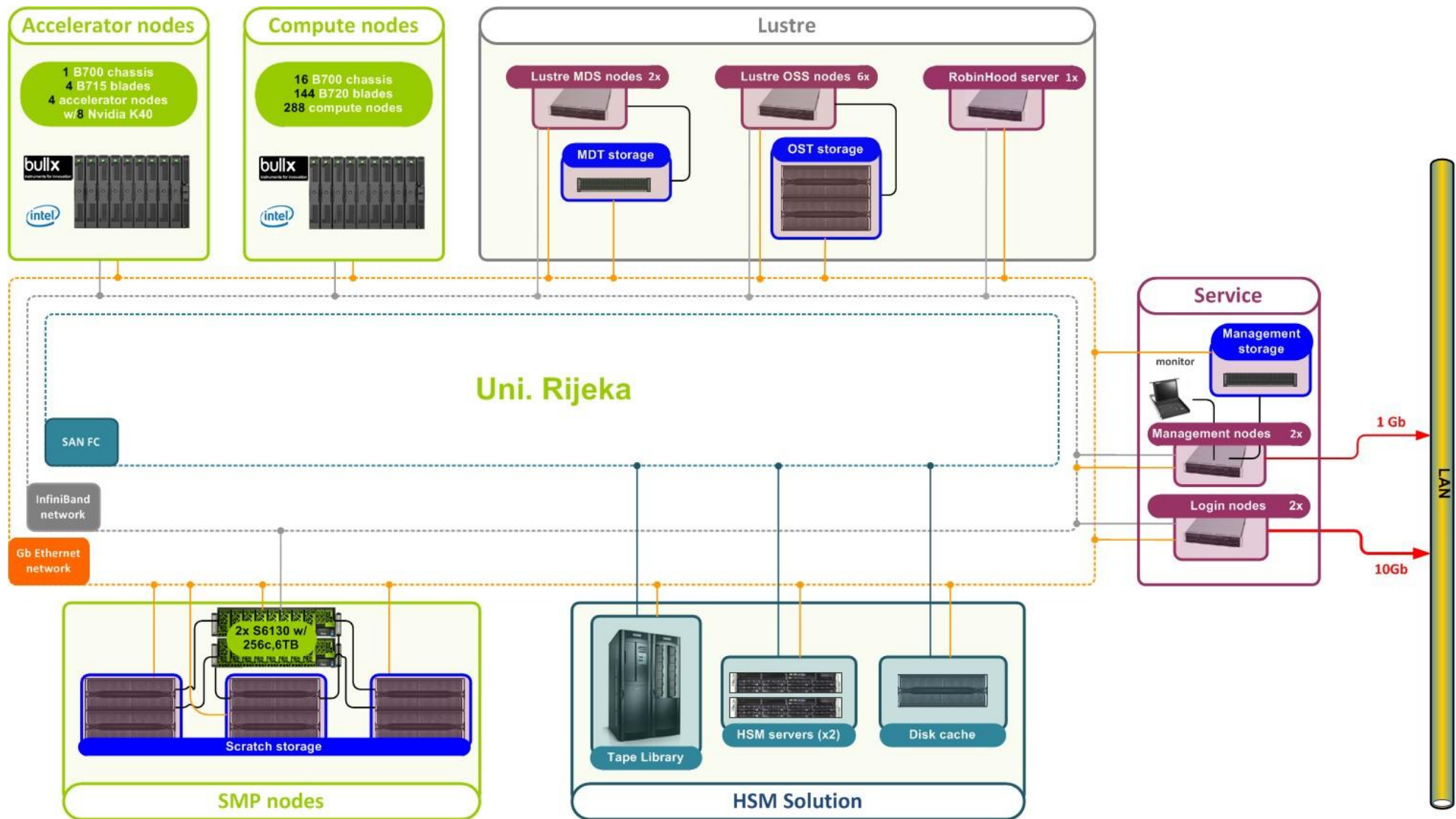
Processor: Xeon E5-2690v3  
(12 cores @ 2.6 GHz)

Cores per Node: 24

Nodes: 288



# Schematic Architecture



# HPC resources @ Bura

## Cluster (compute nodes)

- 288 nodes, 2 x Xeon E5-2690 (12c 2.6 GHz)/node, 24 cores/node → **6912 cores**
- **64 GB** memory/node, **320 GB** disk space/node → **18 TB total memory, 95 TB total disk space**

## SMP (2 nodes)

16 x Xeon E7-8867 (16c 2.5 GHz)/node → **512 cores, 12 TB total memory, 245 TB total disk space**

## GPGPU (4 accelerator nodes)

Each node: 2 x Xeon E5-2650 CPUs (8c 2.6 GHz) + 2 x Nvidia TeslaK40, 64 GB memory, 320 GB disk space



## **OS**

Redhat Linux + Slurm Workload Manager

## **Data centre:**

**1 PB** (Lustre scratch file system)

**Archive: 2.5 PB** (tape library)

Disk storage extension through **regional LSST cooperation grant** (Heising-Simons Foundation, 'Preparing for Astrophysics with LSST Program')

# Science cases

## **Dashboard/TVS portal: a data portal for preliminary investigation and analysis of LSST-based light curves (Lovro Palaversa & Olexandra Razim)**

- CRO-RBI in-kind contribution
- Front-end server for data access and visualisation
- HPC 'Bura' as back-end for more computer-intensive calculations (e.g. statistics, periodicity, classification ... )

# Science cases

## Periodicity mining pipeline

(Andjelka Kovačević, Dragana Ilić, Luka Popović & Viktor Radović)

- SER-SAG in-kind contribution
- 2DHybrid: correlation of time series + wavelet transform + statistics (+ machine learning for gaps)
- Calculations on large amount of data
- Cross-correlation with other surveys (e.g. AXS)
- Different periodicity-finding techniques (?)

**Thank you for your attention!**

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Croatia