THE UNIVERSITY OF QUEENSLAND
AUSTRALIA
CREATE CHANGE

The UQ Image Processing Portal (IPP):

Scalable web-based microscopy data analysis- Containerization, Orchestration, and HPC integration

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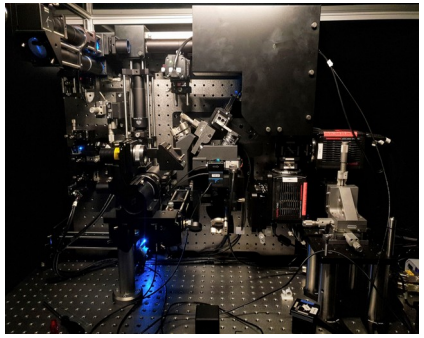
Outline

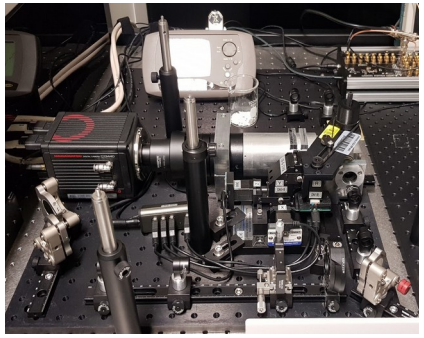
- Image Processing Portal Introduction
- Container orchestration services for IPP
- Wiener to Bunya migration
- Future work

Modern light-sheet microscopes for big data

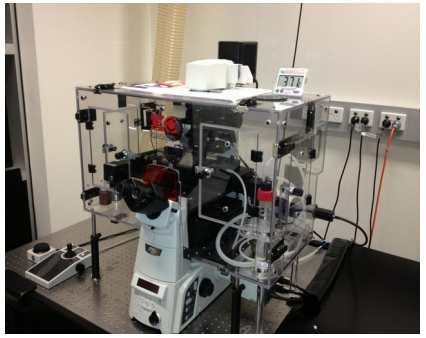


Lattice Light-Sheet
- Dual 4MP sCMOS
- Routine long time-lapse
- .sld filetype

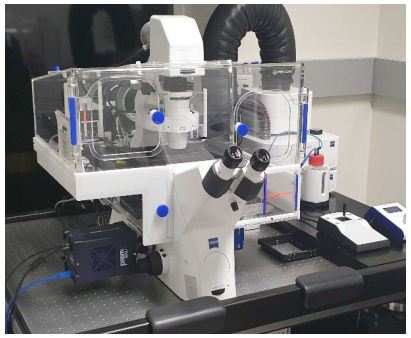
Andor Dragonfly
- Dual 4MP sCMOS
- Large tile scans
- Time-lapse
- .ims filetype



Open SPIM
- Single 4MP sCMOS
- Large volume scans
- Time-lapse
- .tif or custom



Nikon Widefield
- Single 4MP sCMOS
- HC-Screening
- Time-lapse
- .nd2 filetype

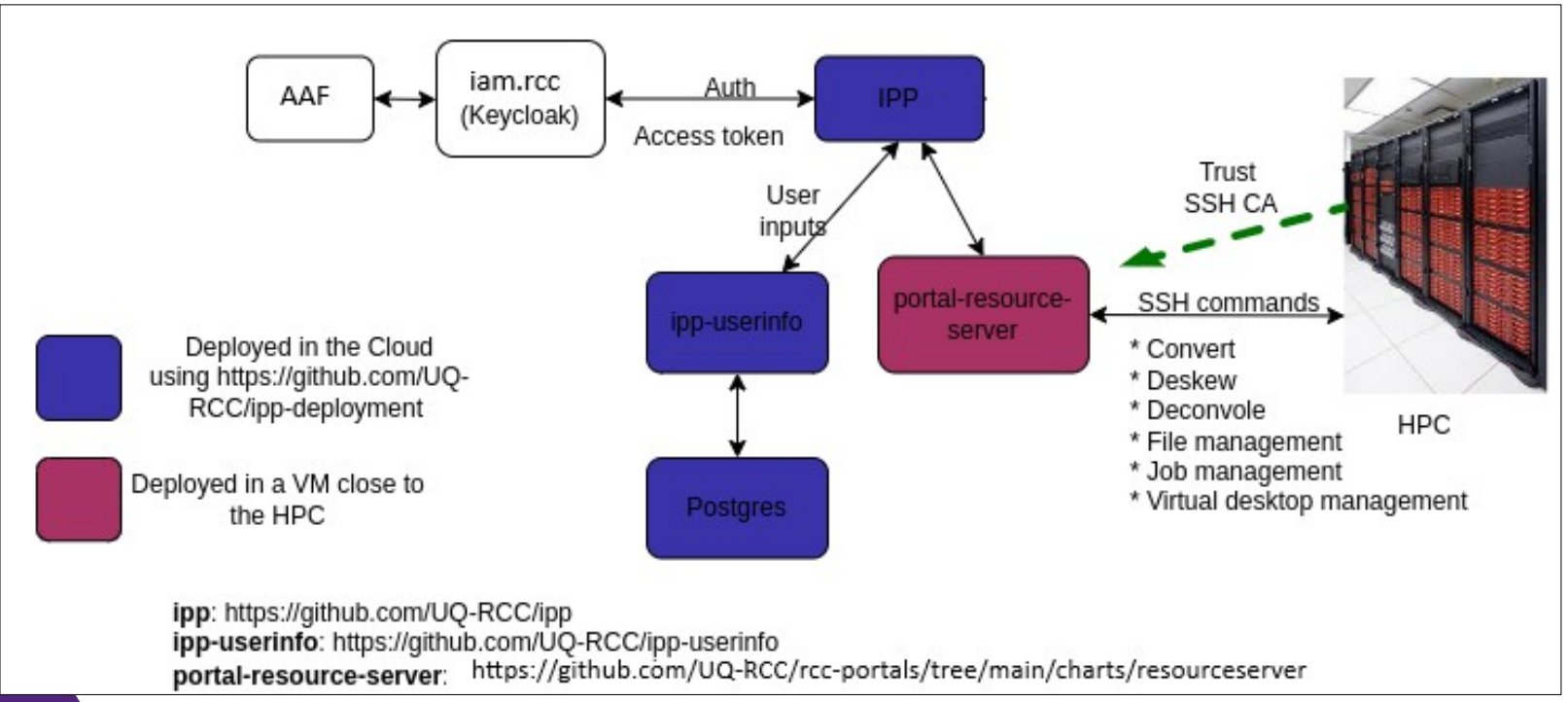


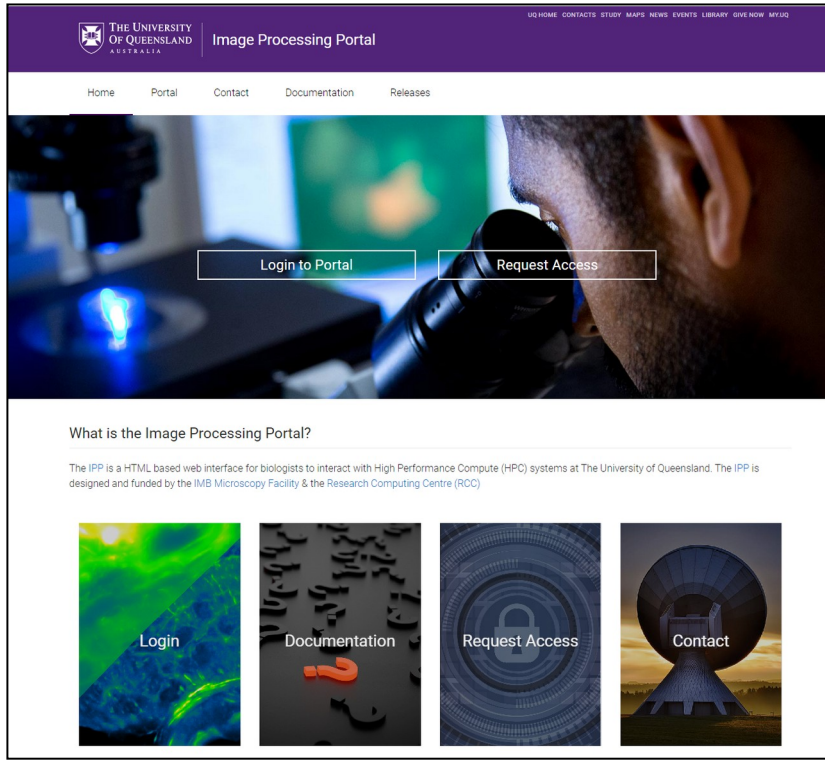
Zeiss Widefield
- Single 4MP sCMOS
- Multi-position
- Time-lapse
- .czi filetype

Large format sCMOS cameras are driving the generation of big (often multi-terabyte) data-sets.

Challenges:
- Storage and data management
- Complex processing workflows
- High barrier to entry (command line tools, HPC expertise required)

Image Processing Portal





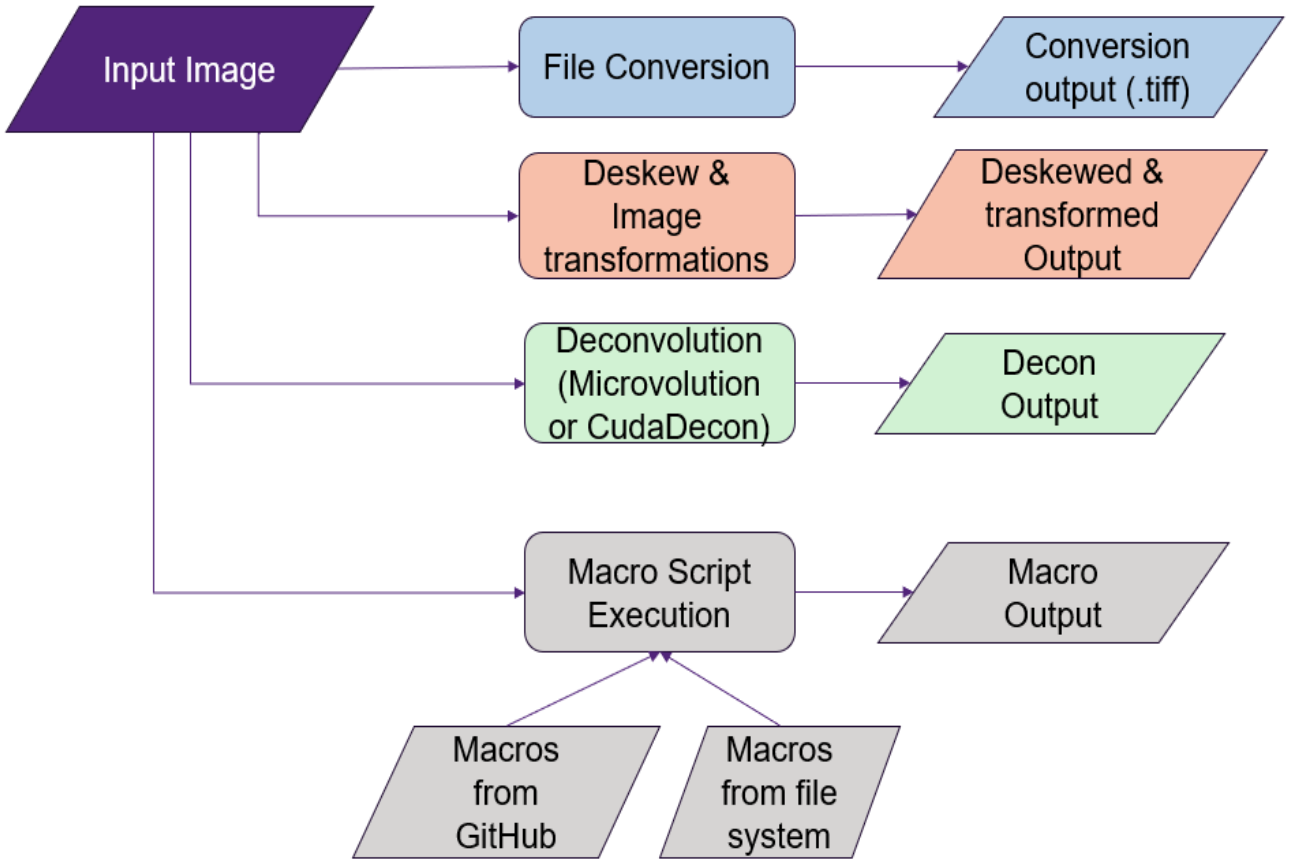
Developed in partnership with the Research Computing Centre's Metropolitan Data Caching Infrastructure (MeDICI)

IPP– Key features & Workflows

Key features

- GPU accelerated processing
- User friendly web interface
- Interactive HPC file system access

Workflows



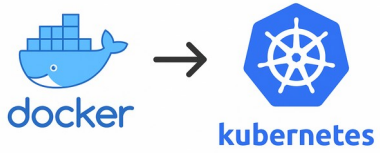
IPP – 2024/2025 Key Enhancements

1. Migration from Docker compose -> Kubernetes

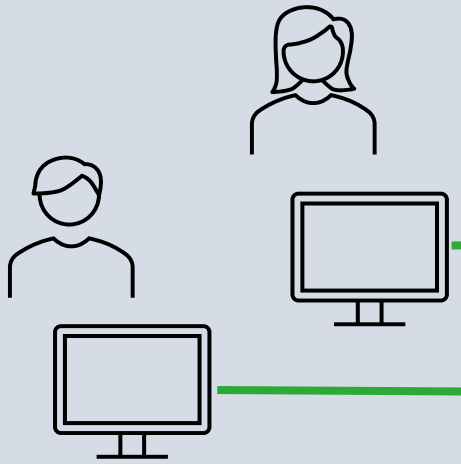
2. Transition from Wiener supercomputer -> Bunya supercomputer

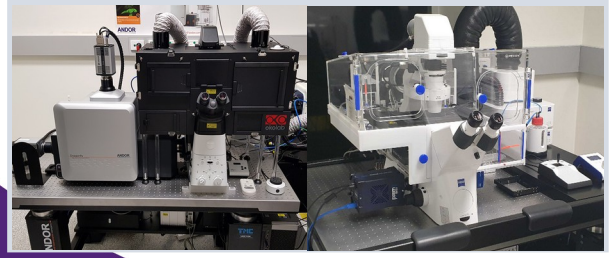
IPP Deployment Overview

HPC Integration



Researchers/Collaborators and Microscopy Labs





Kubernetes Cluster

Interactive

IPP

Frontend Pod 1

Backend Pod 2

Gateway

Resource Server

HPC Cluster

HPC User Jobs

slurm workload manager

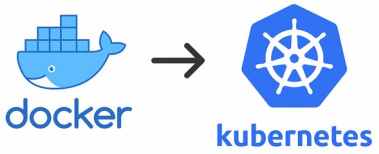
OPEN OnDemand VDI

Research Data Manager

Researcher Data Collections

Deployment

Using Helm and Kustomize

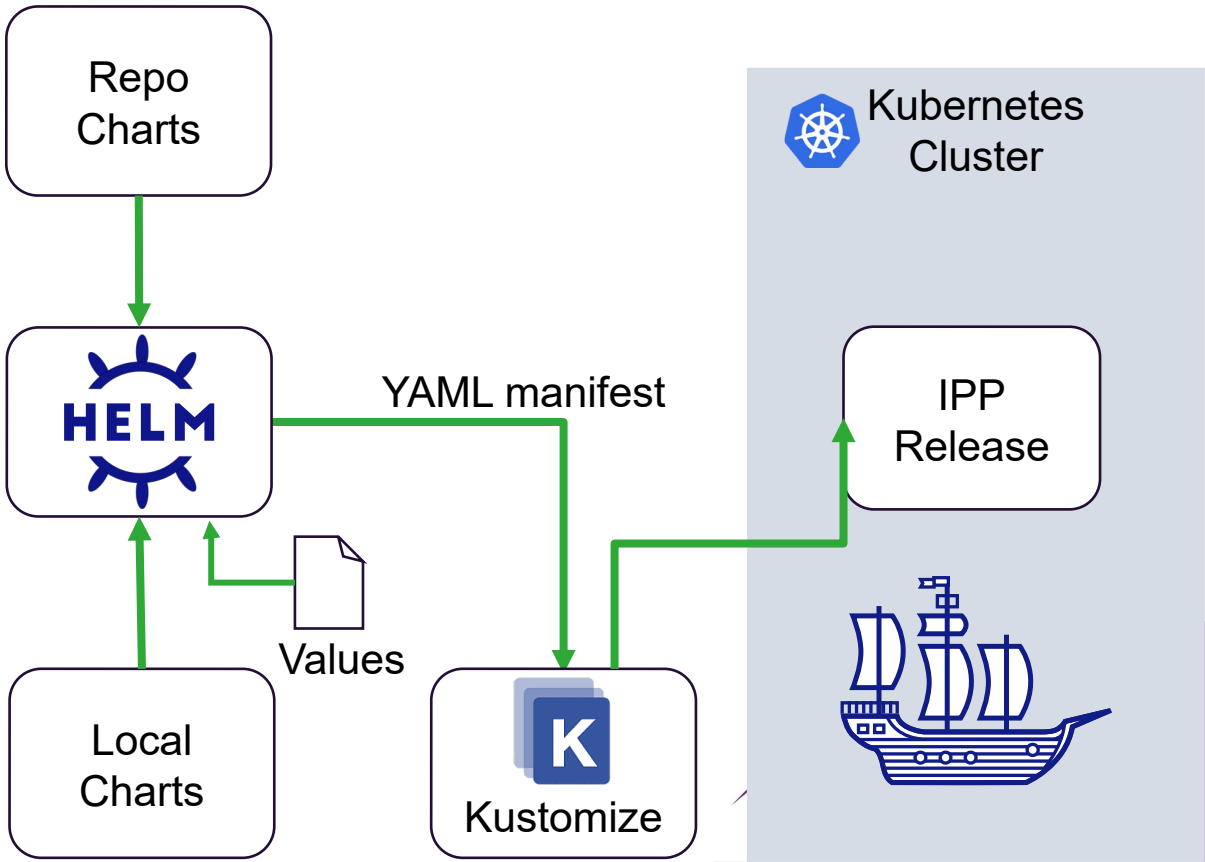


Benefits

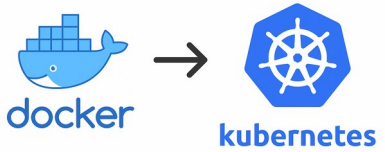
- Quick deployments
- Public repos
- Re-use across environments and teams

Challenges

- Secret management
- Edge cases – use kustomize
- Check deployment manifests



Kubernetes services for IPP



- Backup - Using duplicity
- Logging - Using EFK (Elasticsearch, Fluent-bit, Kibana)
- Monitoring - Using Prometheus and Grafana
- Notifications - Using Postfix for close monitoring
- Secret Management - Using Bitnami SealedSecrets

Wiener to Bunya – IPP backend updates

	Wiener	Bunya
Virtual desktop	Guacamole	Redirection to OnBunya system
Resource server	Standalone server	Co-hosted with app on K8s cluster
Slurm commands	Login nodes cmds	• Login node cmds -> Compute node cmds • Debug QoS • QoS & wall time integration
Keycloak	• auth.rcc (UQSSO authentication) • Wiener realm	• iam.rcc (AAF authentication) • Bunya realm
File path	• /scratch folder path /scratch/<wiener_group>/<username> • File system - AFM	• /scratch/user/<username> • AFM → NFS
Microvolution licence server	Wiener	Bunya

Wiener to Bunya – IPP feature enhancements

- HPC quota limit display on Home page
- IPP Accelerated desktop dedicated for IPP users
- Slurm schedule estimates
- GPU resource limit display for deconvolution jobs

Future work

- Moving from fixed tabs web UI to workflow engine
- Integrating other scripting options similar to ImageJ Macros
- Huygens core integration
- Terasticher integration
- Integrated metadata exaction pipeline
- Slurm Rest API as a replacement for resource server

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Thank you

Homepage: https://ipp.rcc.uq.edu.au/homepage/
Github: https://github.com/UQ-RCC/ipp/
Doco: https://uq-rcc.github.io/ipp-docs/

Contact: https://uq-rcc.github.io/ipp-docs/#/contact
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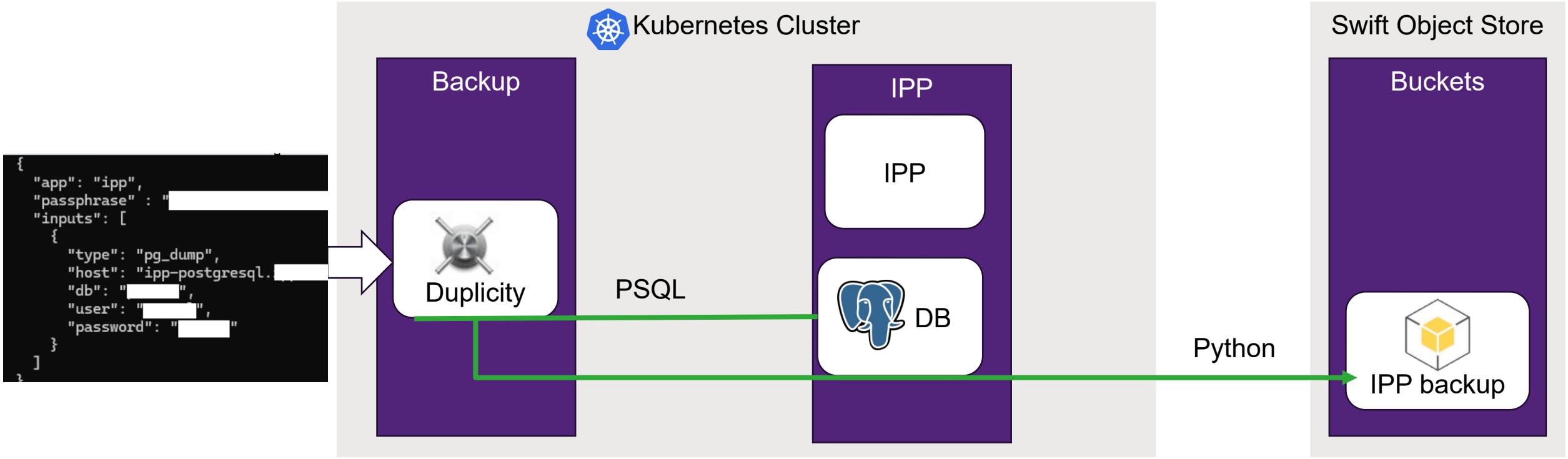
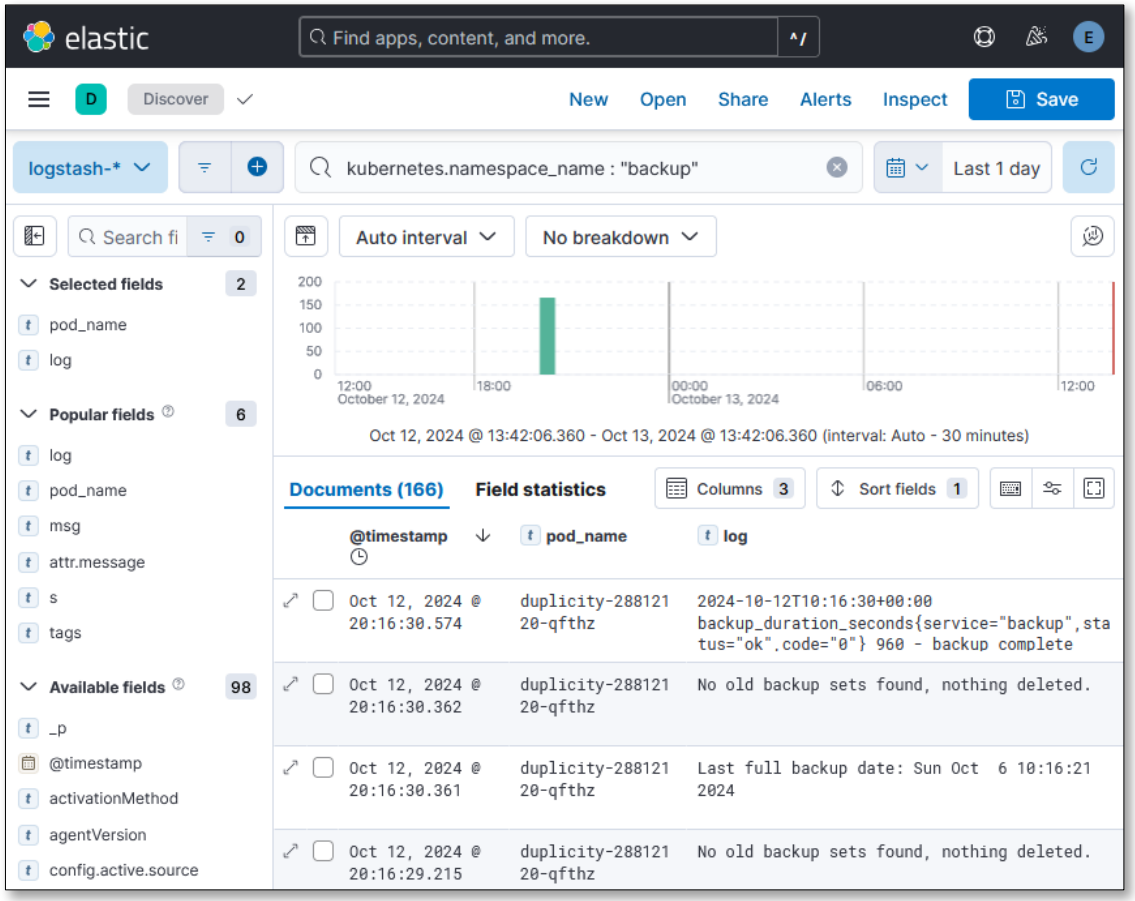
Backup

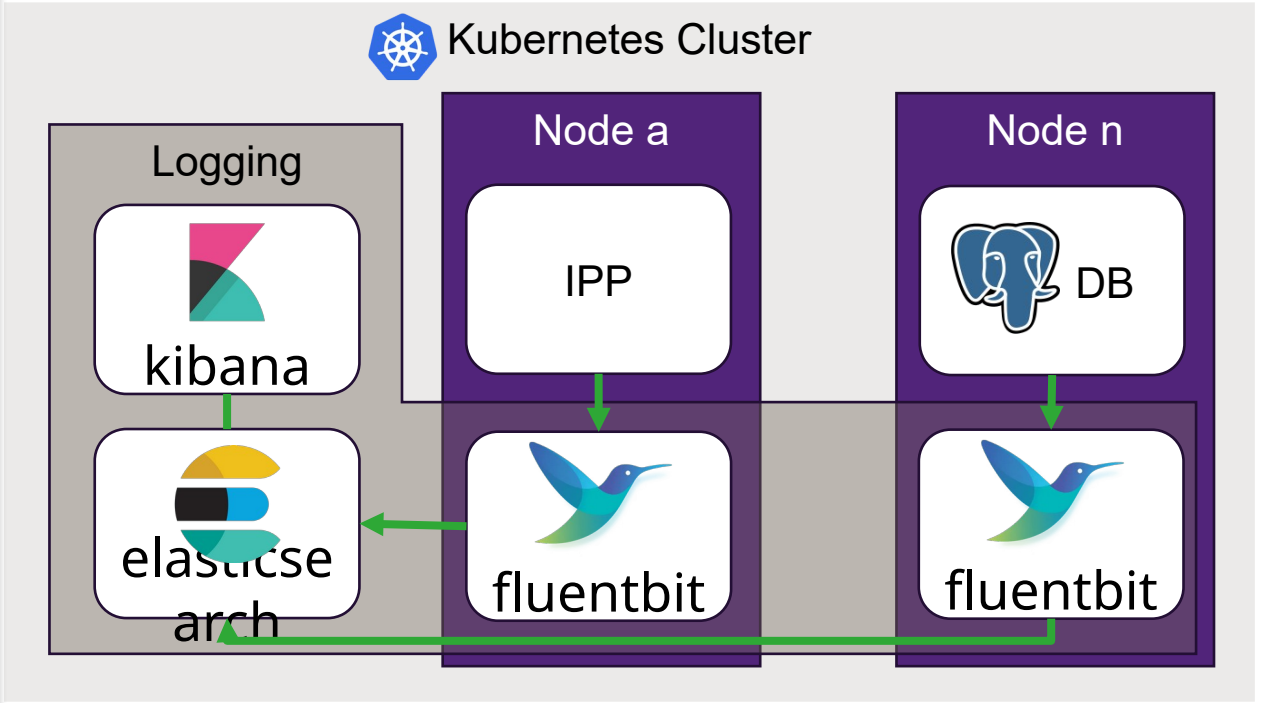
Using Duplicity



Logging

Using EFK (Elasticsearch, Fluent-bit, Kibana)





Monitoring

Using Prometheus and Grafana