ATLAS Software Build System
Part 2 - Infrastructure

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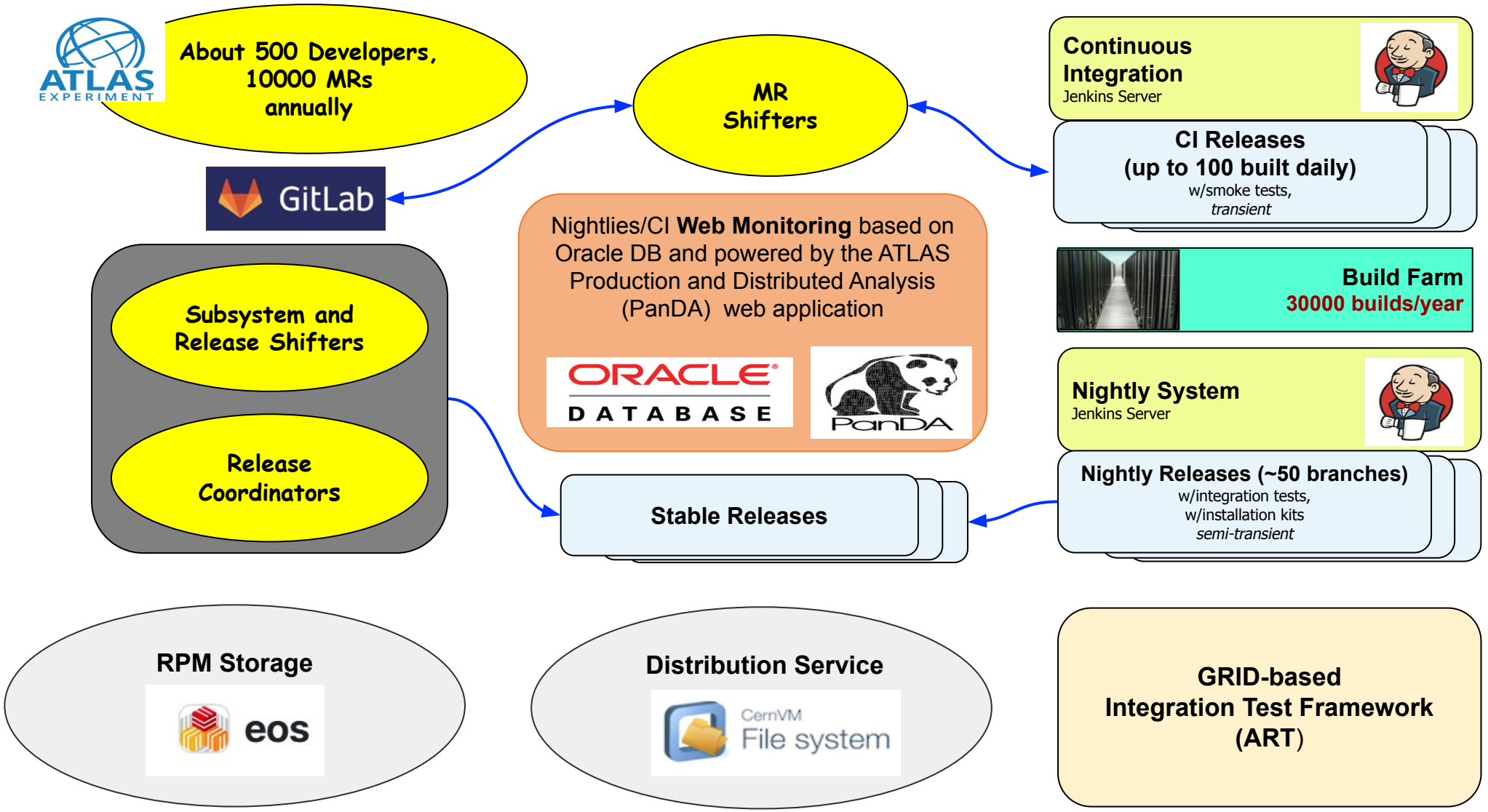
This Talk

- Outlines the infrastructure of the CI and Nightly systems
- Details installation procedures for ATLAS offline software releases
- Describes tools and techniques for release testing
- Provides insights into dynamic monitoring

Offline Software Development Workflow at a Glance



ATLAS CI System

- **Key component of ATLAS offline software workflow since 2017**
- **Jenkins based build and testing system interconnected with GitLab**
- **CI build for each GitLab Merge Request (MR) creation/update**
  - Up to 100 CI jobs daily
  - ~16500 CI jobs completed in 2024
- **Rapid unit and integration testing**
- **Efficient pipelines with dynamic optimization of build and test scale**
- **Comprehensive feedback to developers**
  - Dynamic monitoring is based on the Oracle DB technology and integrated with the ATLAS BigPanDA web service
  - Job results are posted directly to GitLab MR views
- **ATLAS teams use CERN GitLab CI for smaller projects**

ATLAS Nightly System

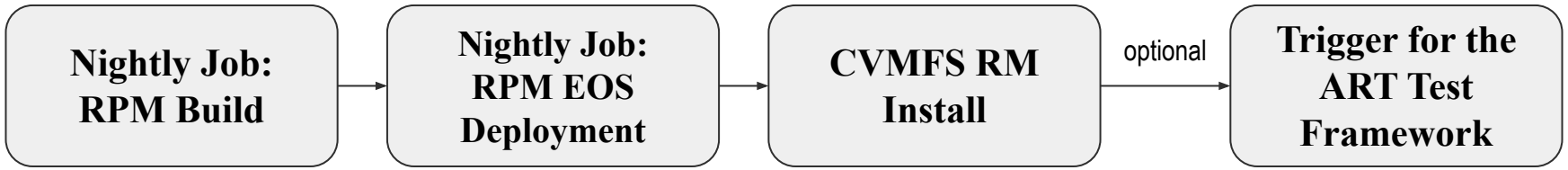
- **Validates accepted code changes every night**
- **Dedicated Jenkins automation server (separate from the CI system)**
- **~ 50 branches -** production, experimental, testing new externals, legacy
  - Optimized scheduling - some branches do not run daily
- **Support for Alma9 and ARM platforms**
  - Legacy builds within CentOS7 containers
- **~ 13200 Nightly jobs completed in 2024**
- **Employs the same dynamic monitoring as the CI system**
- **Release installation on the CVMFS file system**
  - Worldwide accessibility
  - See details in the next slides
- **Rapid fast unit testing, executed locally on build nodes**
- **Comprehensive GRID-based integration testing in the ART framework**
  - See details in the next slides

ATLAS Software Build Farm

- **18 powerful 64-core Alma9 BM nodes**
  - 251 GB RAM, 1.7 TB SSD
- **10 16-core Alma9 VM nodes**
  - 114 GB RAM, 160 GB SSD, 490 GB eph SSD, 490 GB Ceph
- **4 20-core ARM VM nodes**
  - 57 GB RAM, 200 GB SSD, 490 GB Ceph
- **Efficient use through sharing nodes between the CI and Nightly systems**
  - Priority for CI jobs at day time, nightly jobs at night time

Release Installation

- **Nightly installations**
  - Executed on **three CVMFS release managers**
  - Created from **RPM files** using **dnf5**
  - Procedure based on **Bash shell scripts**, featuring:
    - **Parallelization mechanisms**, including lock-based synchronization
    - Support for **all CVMFS transaction types**, with results analysis and notifications
    - **Storage space management**
      - Standard nightly release retention policy: 30 days



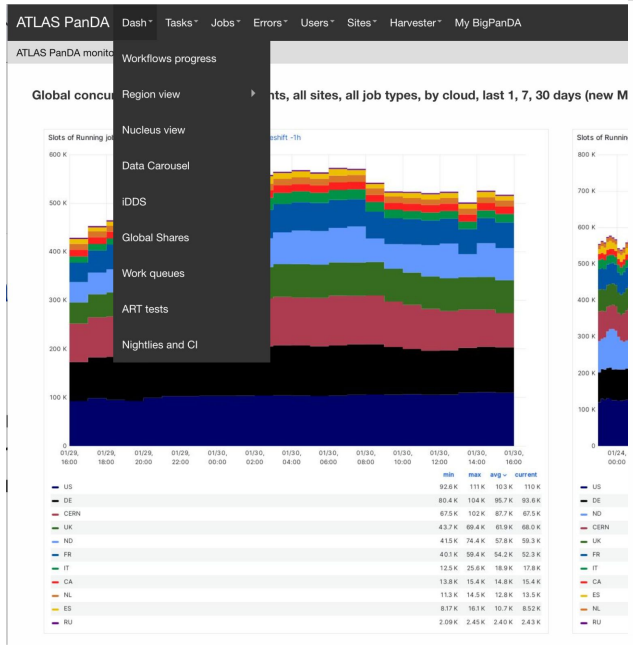
- **Stable releases installations** performed on a separate CVMFS server
- **Additional installations maintained**
  - Data files for test frameworks
  - External packages and tools
- **Key statistics**
  - **Release installation time:** 10 to 100 minutes, depending on system load and release size
  - **Peak Activity:** About 40 release installations on peak days
  - **Storage utilization:** 7.2 TB out of 15 TB available

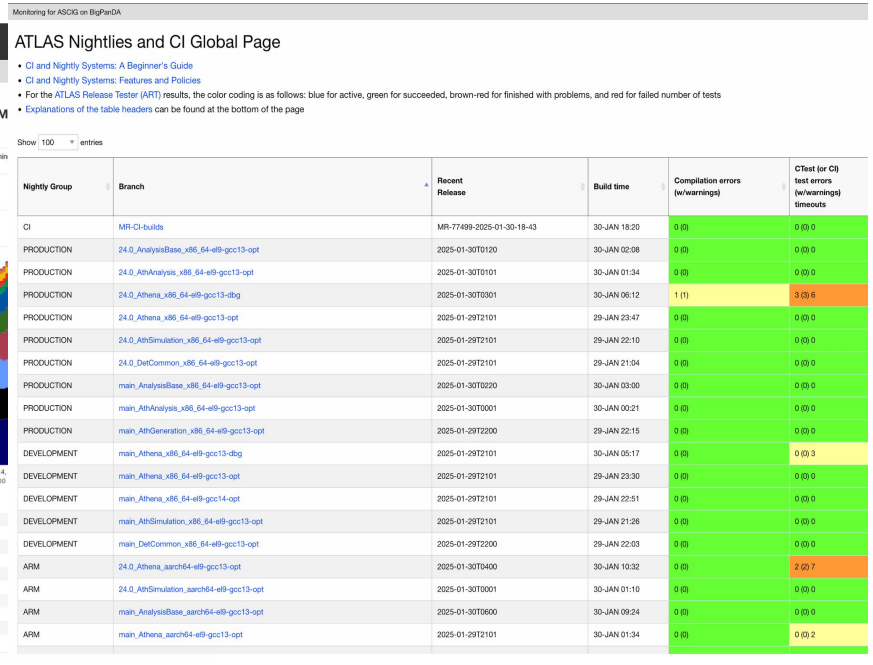
ART: ATLAS Release Testing Framework

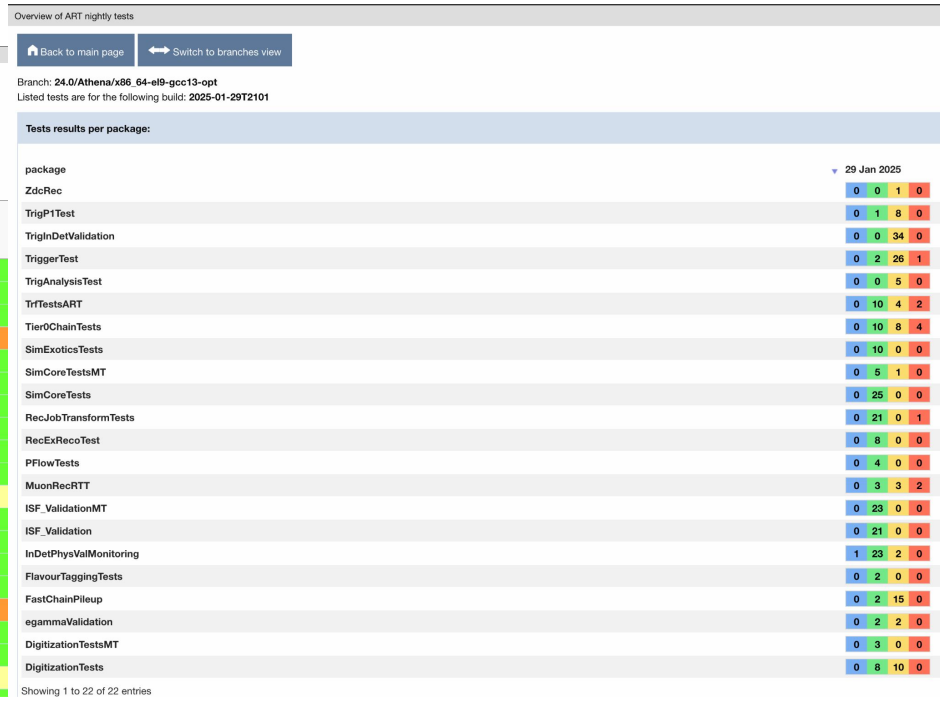
- **Python testing framework** designed to detect defects and bugs in nightly builds
- Executes tests locally on the **dedicated VMs or on the GRID**
- **Triggered by Jenkins Nightly Server** and runs on nightly builds installed on CVMFS
- **Jenkins initiates the GitLab-CI API** to start a pipeline
- **Jobs can run for up to 24 hours**, processing a high number of events, which helps uncover rarer bugs
- **Current operations:**
  - Runs for approximately 20 nightly releases each day
  - Executes thousands of grid jobs and hundreds of local node jobs daily
  - GRID job results are published to the BigPanDA web service
  - Local job results are hosted on EOS local web but will soon be integrated into BigPanDA

ATLAS BigPanDA Monitoring System

- **Django-based web application** that aggregates data from **Oracle DB** and other sources
- Provides a **wide range of dashboards**, from high-level summaries to detailed views of individual computational jobs and their logs
- **Supports dashboards for ART, CI, Nightly Systems, and many other workflows**







Conclusion

ATLAS Offline Software Build System Overview – Part 2 provided insights into:

- The infrastructure supporting the CI and Nightly systems
- Key aspects of testing and monitoring
- For details on build tools, external dependencies, platforms, and compilers, refer to **Part 1**

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