

ATLAS Software Build System Part 2 - Infrastructure

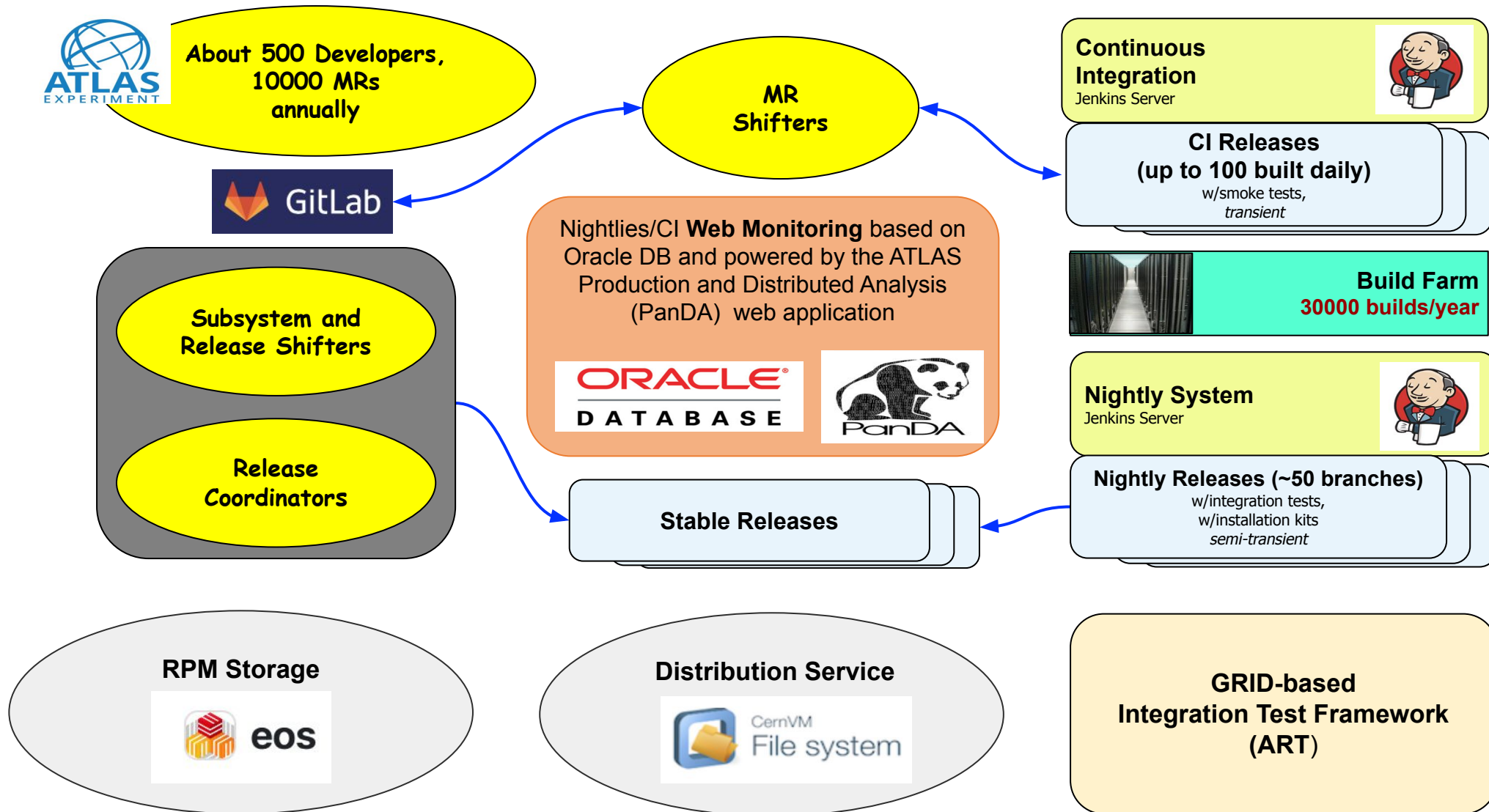
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This Talk

- **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

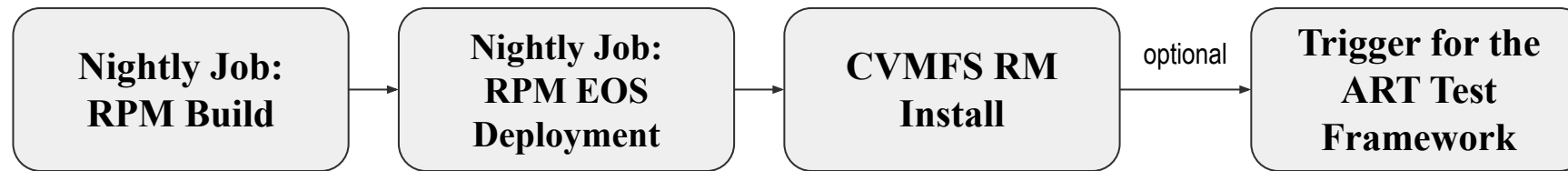
ATLAS Software Build Farm

- **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

The screenshot displays the ATLAS BigPanDA Monitoring System interface, which includes several key components:

- Navigation Menu:** ATLAS PanDA, Dash, Tasks, Jobs, Errors, Users, Sites, Harvester, My BigPanDA.
- Global concu...:** A dashboard showing global computational progress with a stacked area chart and a legend for regions (US, DE, CERN, UK, NO, FR, IT, CA, NL, ES, RU).
- ATLAS Nightlies and CI Global Page:** A table listing build results for various branches and packages.

Nightly Group	Branch	Recent Release	Build time	Compilation errors (w/warnings)	CTest (or CI) test errors (w/warnings)/timeouts
CI	MR-CI-builds	MR-77499-2025-01-30-18-43	30-JAN 18:20	0 (0)	0 (0,0)
PRODUCTION	24.0_AnalysisBase_x86_64-el9-gcc13-opt	2025-01-30T0120	30-JAN 02:08	0 (0)	0 (0,0)
PRODUCTION	24.0_AthAnalysis_x86_64-el9-gcc13-opt	2025-01-30T0101	30-JAN 01:34	0 (0)	0 (0,0)
PRODUCTION	24.0_Athana_x86_64-el9-gcc13-dbg	2025-01-30T0301	30-JAN 06:12	1 (1)	3 (3,6)
PRODUCTION	24.0_Athana_x86_64-el9-gcc13-opt	2025-01-29T2101	29-JAN 23:47	0 (0)	0 (0,0)
PRODUCTION	24.0_AthSimulation_x86_64-el9-gcc13-opt	2025-01-29T2101	29-JAN 22:10	0 (0)	0 (0,0)
PRODUCTION	24.0_DeCommon_x86_64-el9-gcc13-opt	2025-01-29T2101	29-JAN 21:04	0 (0)	0 (0,0)
PRODUCTION	main_AnalysisBase_x86_64-el9-gcc13-opt	2025-01-30T0220	30-JAN 03:00	0 (0)	0 (0,0)
PRODUCTION	main_AthAnalysis_x86_64-el9-gcc13-opt	2025-01-30T0001	30-JAN 00:21	0 (0)	0 (0,0)
PRODUCTION	main_AthGeneration_x86_64-el9-gcc13-opt	2025-01-29T2200	29-JAN 22:15	0 (0)	0 (0,0)
DEVELOPMENT	main_Athana_x86_64-el9-gcc13-dbg	2025-01-29T2101	30-JAN 05:17	0 (0)	0 (0,3)
DEVELOPMENT	main_Athana_x86_64-el9-gcc13-opt	2025-01-29T2101	29-JAN 23:30	0 (0)	0 (0,0)
DEVELOPMENT	main_Athana_x86_64-el9-gcc14-opt	2025-01-29T2101	29-JAN 22:51	0 (0)	0 (0,0)
DEVELOPMENT	main_AthSimulation_x86_64-el9-gcc13-opt	2025-01-29T2101	29-JAN 21:26	0 (0)	0 (0,0)
DEVELOPMENT	main_DeCommon_x86_64-el9-gcc13-opt	2025-01-29T2200	29-JAN 22:03	0 (0)	0 (0,0)
ARM	24.0_Athana_aarch64-el9-gcc13-opt	2025-01-30T0400	30-JAN 10:32	0 (0)	2 (2,7)
ARM	24.0_AthSimulation_aarch64-el9-gcc13-opt	2025-01-30T0001	30-JAN 01:10	0 (0)	0 (0,0)
ARM	main_AnalysisBase_aarch64-el9-gcc13-opt	2025-01-30T0600	30-JAN 09:24	0 (0)	0 (0,0)
ARM	main_Athana_aarch64-el9-gcc13-opt	2025-01-29T2101	30-JAN 01:34	0 (0)	0 (0,2)
- Overview of ART nightly tests:** A summary page for ART tests, showing a list of packages and their test results for a specific build (2025-01-29T2101).

package	29 Jan 2025
ZdcRec	0 0 1 0
TrigP1Test	0 1 8 0
TrigHDeValidation	0 0 34 0
TriggerTest	0 2 26 1
TrigAnalysisTest	0 0 5 0
TrfTestsART	0 10 4 2
TierOChainTests	0 10 8 4
SimExoticsTests	0 10 0 0
SimCoreTestsMT	0 5 1 0
SimCoreTests	0 25 0 0
RecJobTransformTests	0 21 0 1
RecExRecoTest	0 8 0 0
PFlowTests	0 4 0 0
MuonRecRTT	0 3 3 2
ISF_ValidationMT	0 23 0 0
ISF_Validation	0 21 0 0
InDetPhysValMonitoring	1 23 2 0
FlavourTaggingTests	0 2 0 0
FastChainPileup	0 2 15 0
egammaValidation	0 2 2 0
DigitizationTestsMT	0 3 0 0
DigitizationTests	0 8 10 0

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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