Contribution ID: **90** Type: **not specified**

Implementing DevOps practices at the control and data acquisition system of an experimental fusion device

Monday, 17 September 2018 11:00 (2 hours)

The stellarator Wendelstein 7-X (W7-X) is a fusion device designed for steady state operation. It is a complex technical system. To cope with the complexity a modular, component-based control and data acquisition system has been developed.
During operation phases of W7-X components steadily evolve. For instance measurement devices for diagnostics get improved, technical processes are optimized, experienced limits of the machine have to be taken into account or simple "bug fixing" is done. This requires continuous further development of the components while operating them at W7-X – a typical use case for DevOps practices.
DevOps is a software engineering practice. The term is a compound of development and operations. It aims at shorter development cycles, while the quality of the changed system must stay at a high level. This is achieved by using a highly automated tool chain.
DevOps at W7-X does not (only) mean deploying new software packages. It also comprises setting up new configurations, changing rules and constraints, improving experiment planning views etc. of components, based on new scientific and technical experiences. One crucial step of the DevOps tool chain at W7-X is the release and reconcile process. It is a well defined and automated process that commits a change in the components configuration (Release) to the control and data acquisition system with minimal impact. During the process all existing experiment programs are adapted to this change (Reconcile). For newly added configuration parameters default values are added. Thus it is guaranteed that experiment programs are still executable at W7-X. The quality is ensured by preceding unit and integration test, configuration consistency and version checks.

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Session Classification: P1

Track Classification: Plasma Engineering and CODAC