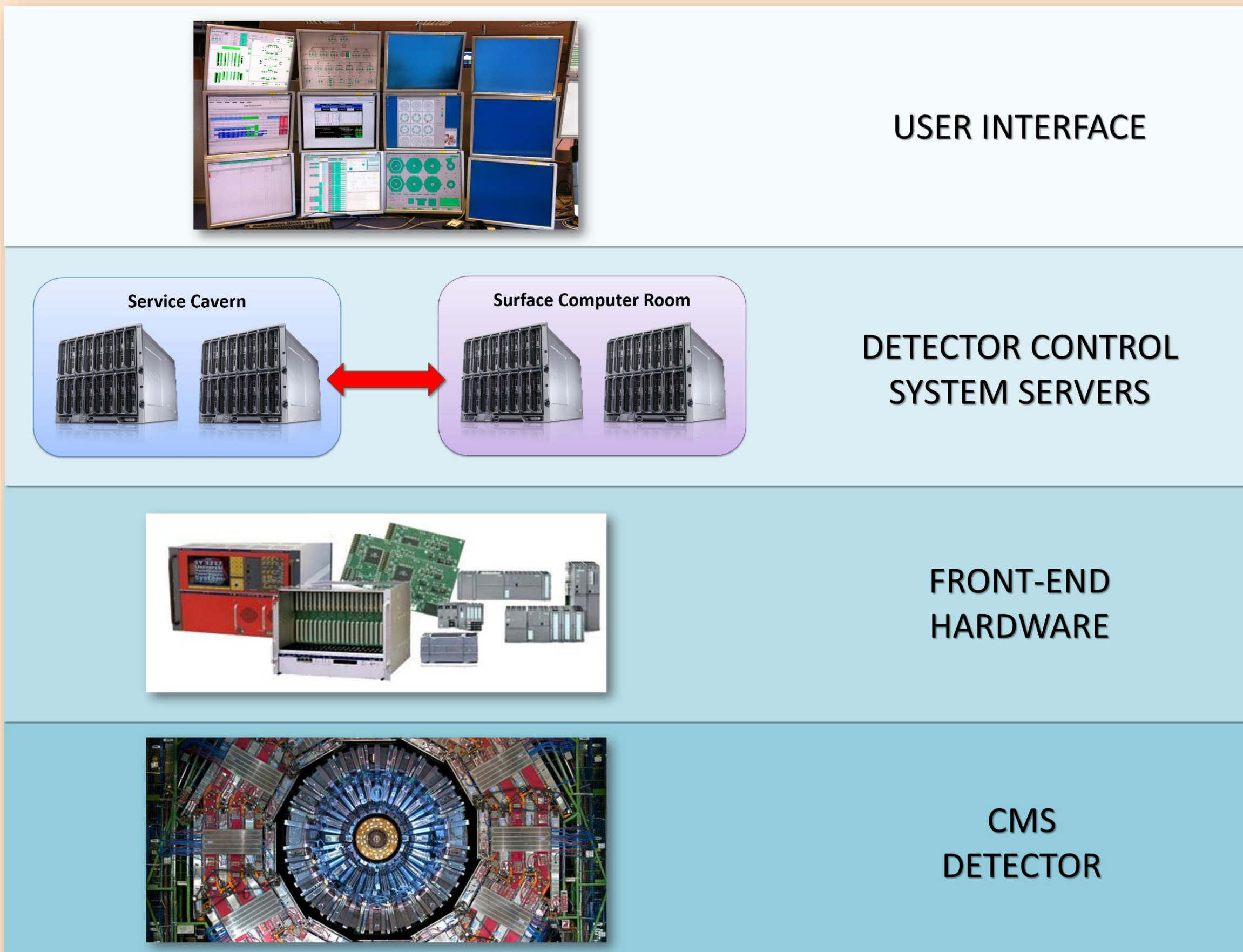
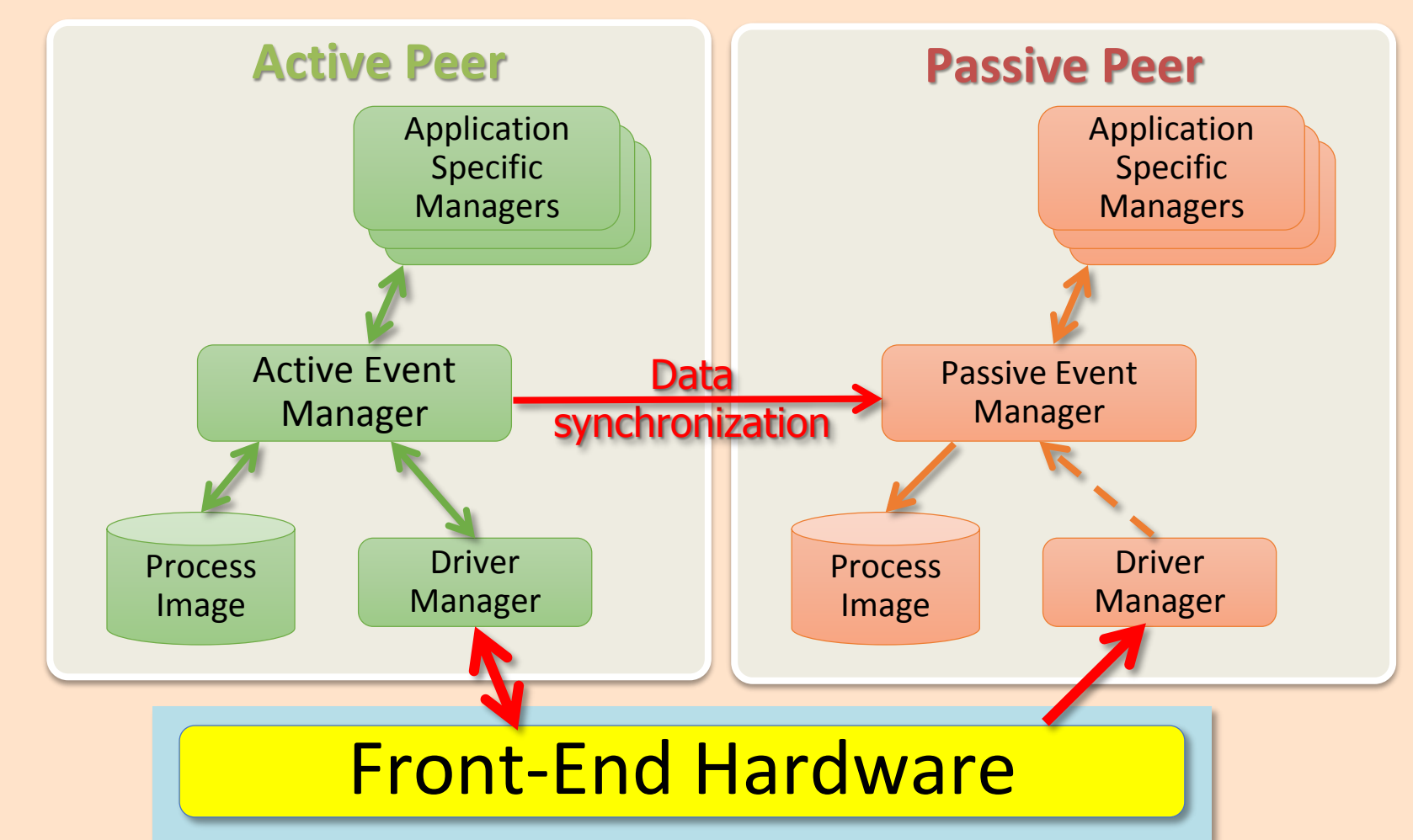


L. Masetti, A. Andronidis, O. Chaze, C. Deldicque, M. Dobson, A. Dupont, D. Gigi, F. Glege, J. Hegeman, M. Janulis, R. Jiménez Estupiñán, F. Meijers, E. Meschi, S. Morovic, C. Nunez-Barranco-Fernandez, L. Orsini, A. Petrucci, A. Racz, P. Roberts, H. Sakulin, C. Schwick, B. Stieger, S. Zaza (CERN, Geneva, Switzerland), P. Zejdl (CERN, Geneva; Fermilab, Batavia, Illinois), U. Behrens (DESY, Hamburg, Germany), O. Holme (ETH Zurich, Switzerland), J. Andre, R. K. Mommsen, V. O'Dell (Fermilab, Batavia, Illinois, USA), G. Darlea, G. Gomez-Ceballos, C. Paus, K. Sumorok, J. Veverka (MIT, Cambridge, Massachusetts, USA), S. Erhan (UCLA, Los Angeles, California, USA), J. Branson, S. Cittolin, A. Holzner, M. Pieri (UCSD, La Jolla, California, USA)

## Redundancy in WinCC OA

- WinCC OA provides a built-in mechanism for achieving high availability through redundant systems.
- Two complete, identical instances of each project run on two separate computers, called *peers*
- One project runs as the active peer, the other runs as a hot standby or passive peer



## The goal in CMS: Minimize the downtime due to a single server failure

DCS is **crucial** to ensure the operation of CMS and maximize data taking time.

In the non-redundant setup (used in Run 1) a single server failure could cause significant downtime. Each WinCC OA system now running in a **pair** of redundant servers.

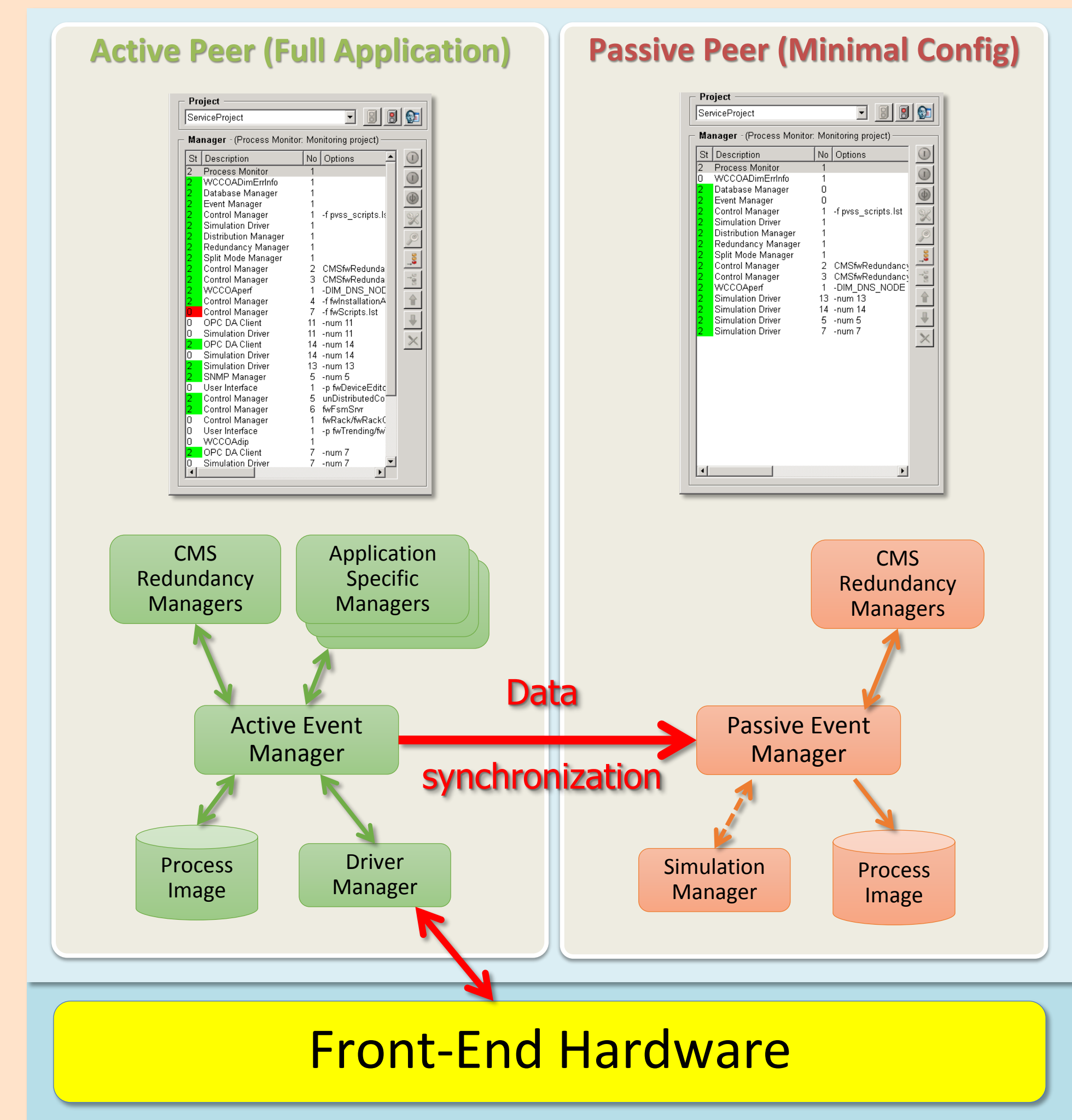
### Problem: Running two identical peers is not feasible in CMS

- Some external components difficult to adapt to redundant environment
- Hardware devices not supporting multiple connections

## CMS Redundancy Solution

- Full application running in the active peer
- Minimal Configuration ready to take over in the passive peer
- When an inconsistency is detected between the manager configuration and the WinCC OA configuration: logic to move to a stable situation

	CMS Active	CMS Standby
WinCC OA Active	Normal (Active)	Restart as CMS Active or wait for the other to become active
WinCC OA Passive	Restart as CMS Standby or Force Active	Normal (Passive)



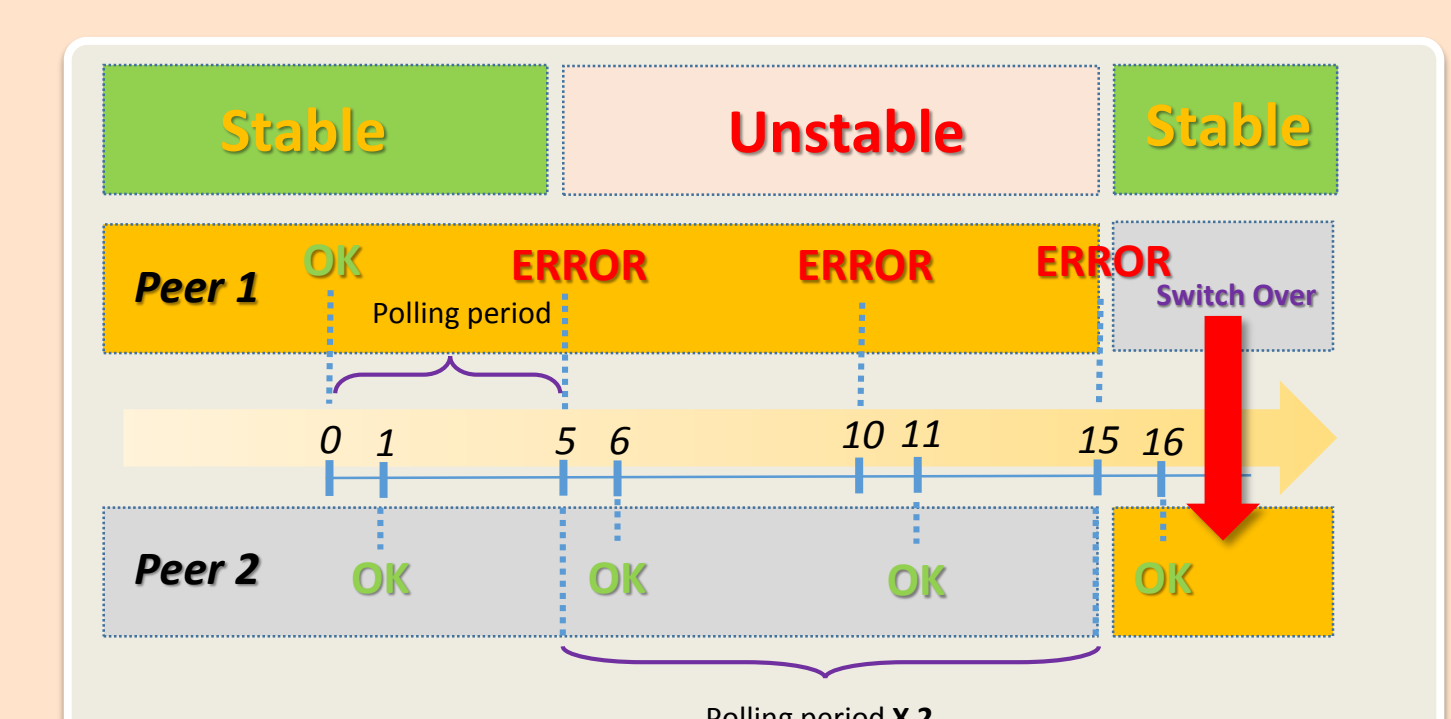
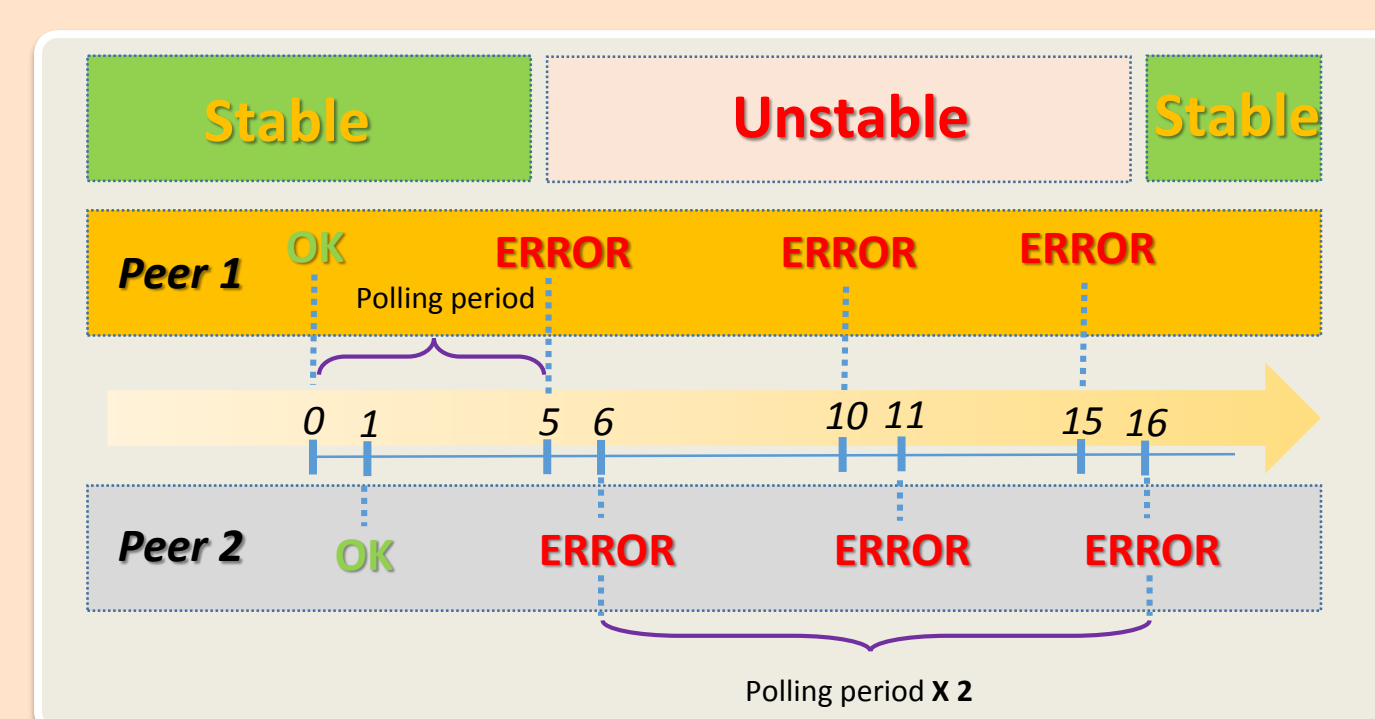
## Installation and Upgrades

- CMS DCS systems frequently evolve with time
- Smooth handling of component installation is essential
- Service interruption during upgrades tolerated
- Installation in active system → changes propagated automatically to passive system
- Specific actions (e.g. related to OS configuration) taken into account in special scripts triggered in case of switchover

## Switchover conditions

A switchover can be triggered by server health conditions (not only complete failover)

- e.g. low memory, low disk space, network problems
- Switchover triggered when condition is **stable** (evaluated on both peers) and **bad only on the active peer** (to avoid unnecessary switches in case the error is present on both peers)
- Implemented in OO-architecture (see *CMSfwClass* - MOPGF025)



## CMS DCS now runs redundantly

- Fully automated switchover to a hot-standby
- Provides robustness against total hardware failure and other common errors
- Minimized adaptations required to individual DCS applications
- Additional complexity due to redundancy was kept to a minimum
- Expected to guarantee high availability and reliability during the Run-2 phase of the LHC accelerator