



Price Coupling of Regions – PCR

“System Design” to be used in NWE

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Objective and approach

- Price Coupling of regions (PCR) is a price coupling project.
- The PCR initiative is focused on the delivery of a common European price coupling solution* where this solution can be implemented in a variety of local regulatory/governance settings.
- Its philosophy is to build on the existing contractual, regulatory and operational solutions, setting at the European level the needed harmonization and governance principles.
- It's consistent with PCG principles and AHAG/ASAEG proposals, and Florence Forum has welcomed it.
- To this aim it is based on three main principles.

One single algorithm



it encompasses as much already existing local requirements, respecting local regulations and building on existing liquidity

Decentralized governance



it builds on existing contractual frameworks and institutional arrangements, accelerating the implementation process

Decentralized operation



it decentralizes liabilities between PXs and TSOs, supporting decentralized governance



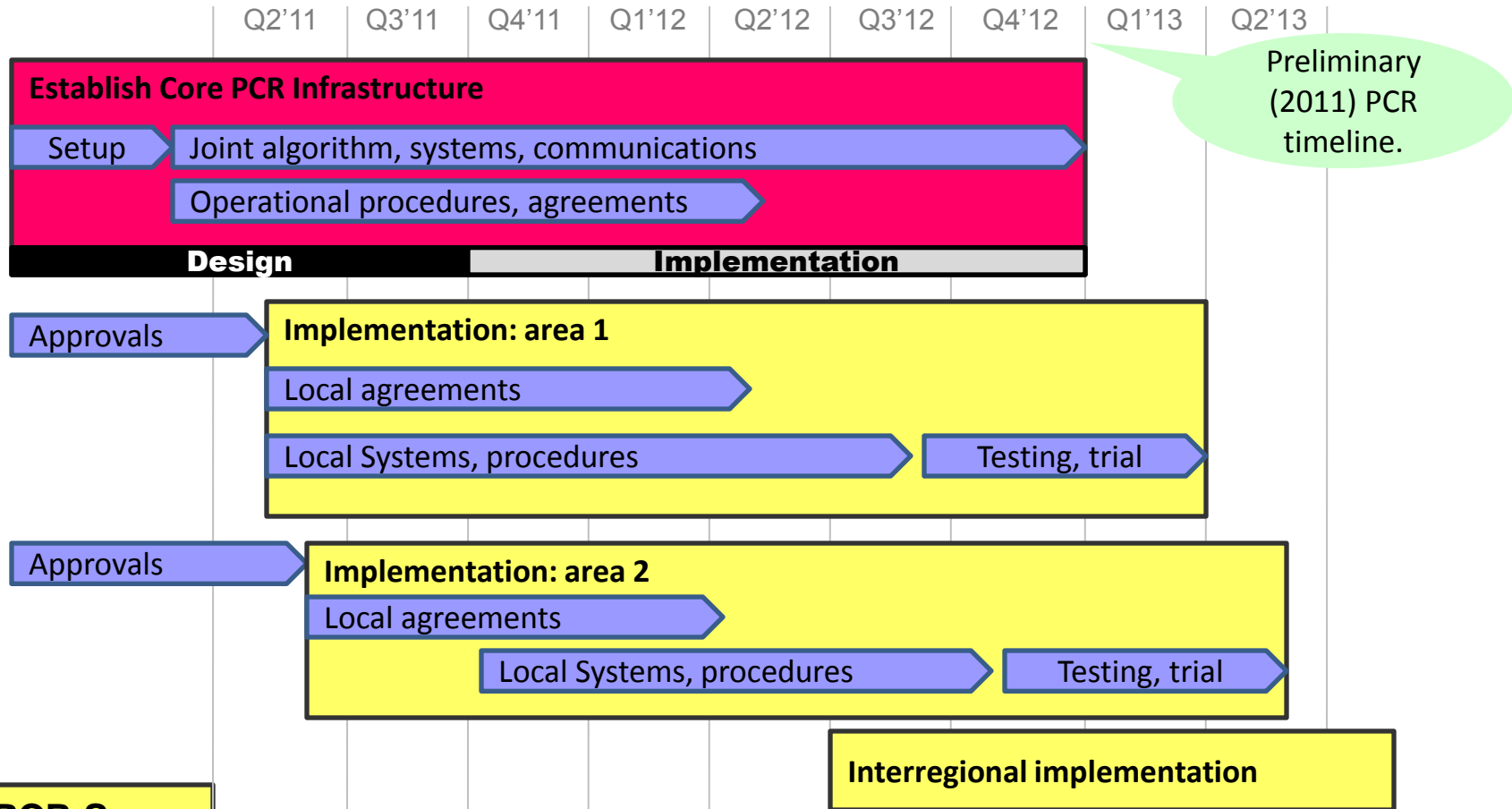
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Objective and approach

- The PCR project is currently the only European coupling project
 - It's the widest with respect to any other implemented or announced coupling projects
 - With full and associate Members, it includes all the PXs operating spot power markets
 - It is developing an algorithm encompassing nearly all the market requirements of both PXs full and associate members
 - It is consistent with different local solutions (institutional and organizational)
 - It's "easily extendable" to any country, as soon as they are ready to join in on the basis of "who's ready first" principle
- The PCR project has been widely introduced at the EU level
 - Florence Forum appreciated its proposal (May '11)
 - ACER required Entso-E to validate both PCR Starting Point and PCR system design
 - Common work is ongoing with NWE TSOs on PCR Starting Point and PCR supported in writing by Regulators and common work in preparing the implementation is ongoing in the SWE Region

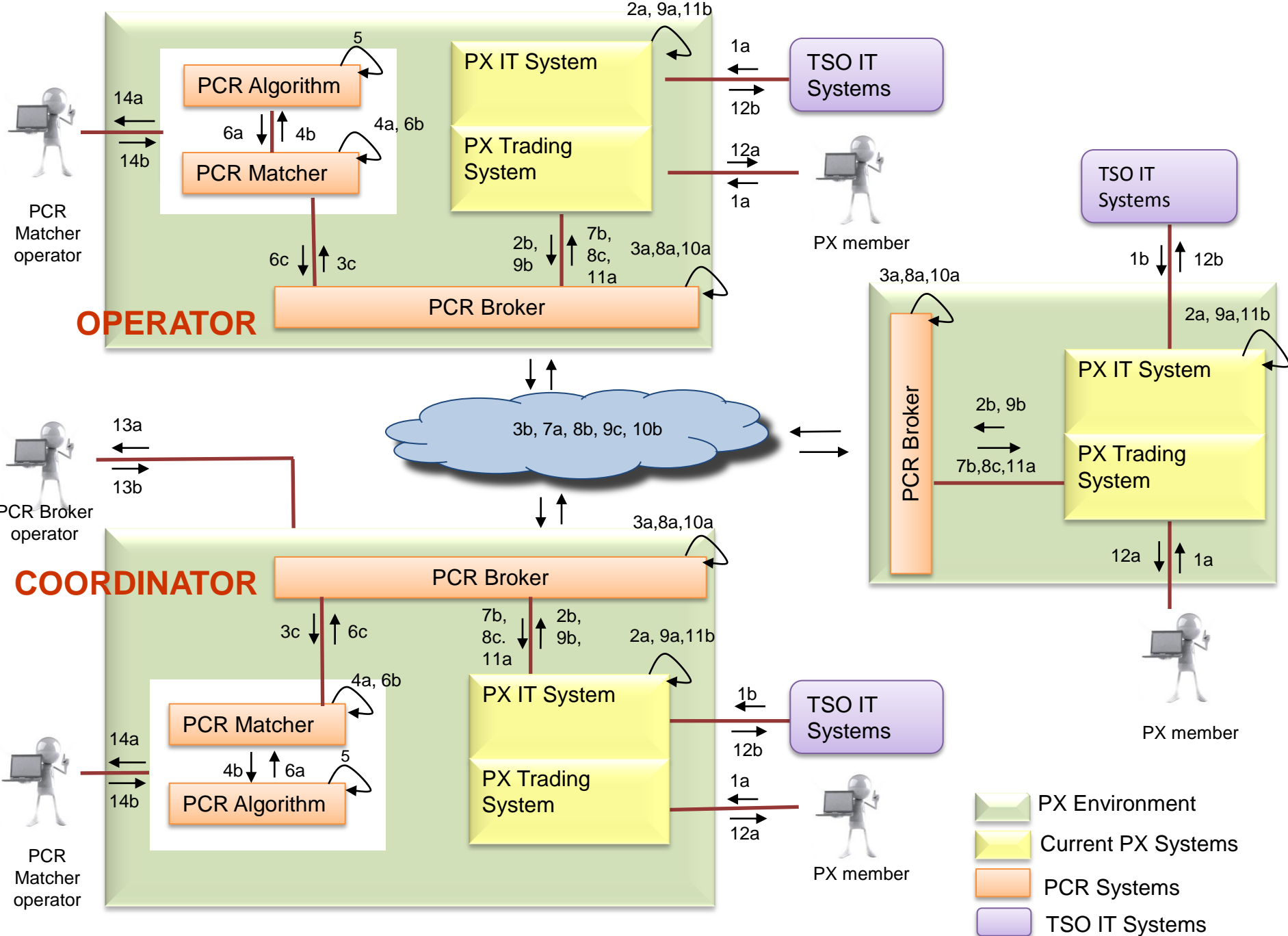
IN scope and OUT of scope of PCR

In Scope of PCR: Common algorithm, core systems and procedures, joint PX governance



OUT of PCR Scope:

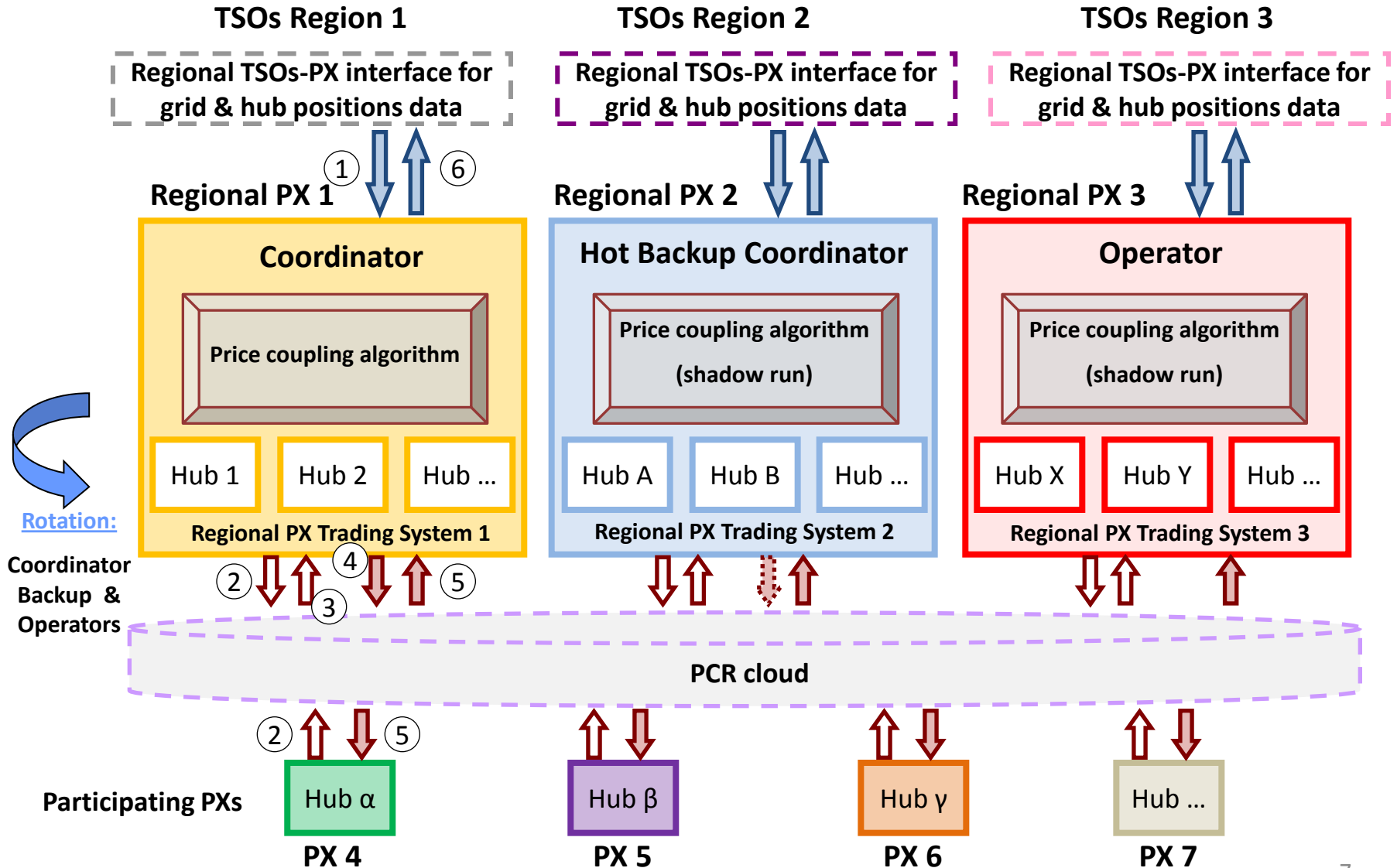
local governance arrangements, local nominations, clearing & settlement, cross border shipping...



PCR Operation High Level Process

1. Regional TSO systems send their capacities to the corresponding PX system
2. Regional participating PXs send their order books and capacities to the PCR Cloud
3. Coordinator, hot back-up coordinator and operators receive all capacities and order books from the PCR Cloud
4. Coordinator runs the algorithm and sends the market results to the PCR Cloud
 - Hot back-up coordinator runs the algorithm in parallel (shadow run for backup purposes)
 - Operators can also run it in parallel (for internal purposes, and validation process)
5. All PXs receive the results from the coordinator and validate them
6. PXs send agreed information to the National/Regional TSO systems according to their privately agreed content and mechanisms

Conceptual representation of the Technical solution with a European scope



PCR High Level System Design: Technical Principles

- **All PXs are connected** to each other through MPLS (or alternative mean) using secure channels
- **Each PXs is connected to the related TSOs** for receiving capacity information and sending the required information (nominations, clearing info,...) as today
 - This is **responsibility of** each particular/regional **PX**
- A **data sharing solution** is created based in the implementation at each PX of a PCR Connection Broker (**PCR Broker**) which is responsible of interfacing the PX systems with the rest of the PXs
 - Together, all the PXs' PCR Brokers form the **PCR Cloud**
- Each PCR Broker is in **continuous connection** to the other PCR Brokers, **access** to the internal PX market information, **validates it, and publishes it** to the PCR Cloud
- Several **validation layers** to ensure the detection of potential errors or problems as soon as possible in the information flows
- The **PCR Matcher** wraps the algorithm and ensures that each exchange runs the **same common algorithm** with the same data and the same configuration parameters
- **PCR results** provided by the **Coordinator PX**. Operator PXs may verify results through a shadow matching for internal and validation purposes

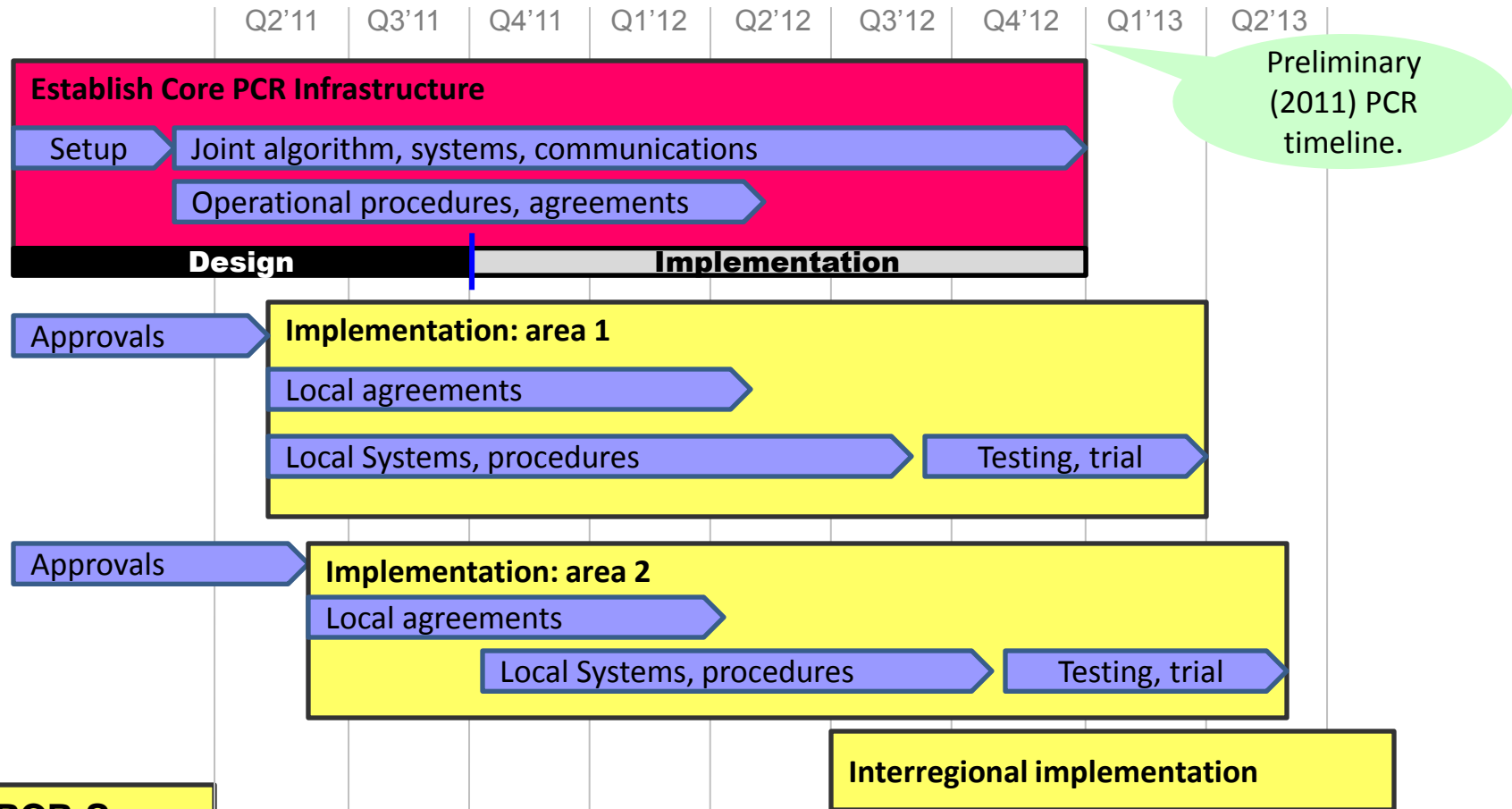
The Coordinator-Operator rotational responsibility concept

It is based in the following general principles:

- There is a **rotating Coordinator role**, among the PXs that decide to be involved in the Coordinator-Operator responsibilities. It takes care of two basic functions:
 - In normal operation, to produce the PCR results, giving to all PXs the green light to publish them (or continue with pre-established operational procedures, in case needed prior to publication)
 - In emergency or abnormal situations, to coordinate all PX's actions, being in charge of investigating the problem, evaluating in which state the different market areas are, communicating predefined emergency actions and, in general, be the central contact point in case of emergencies
- All **Operators** can run in parallel a **shadow matching algorithm**, and have the possibility of verifying the results
- All PXs receive the results from the coordinator and validate them
- Everyday, one Operator acts as **Hot Backup Coordinator**, being ready for an eventual failure of the Coordinator
- In case of decoupling, all PXs have a **continuously used infrastructure** to run the algorithm in their areas of influence

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OUT of PCR Scope:

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