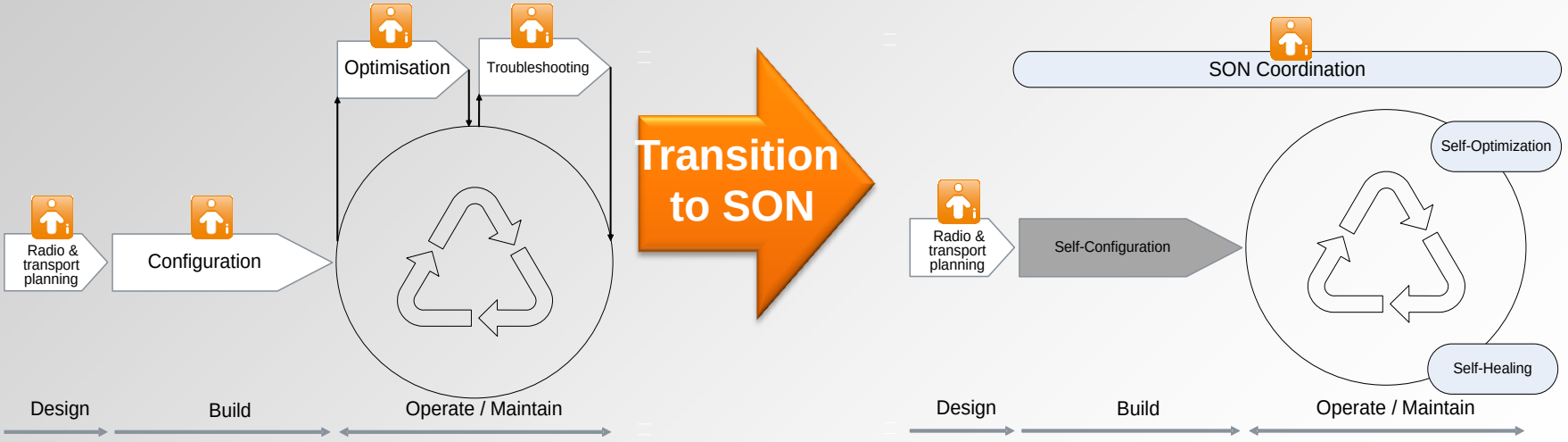
# Operational challenges for SON

## Chapter 3.6

# Transition from manual/semi-automated workflows to SON

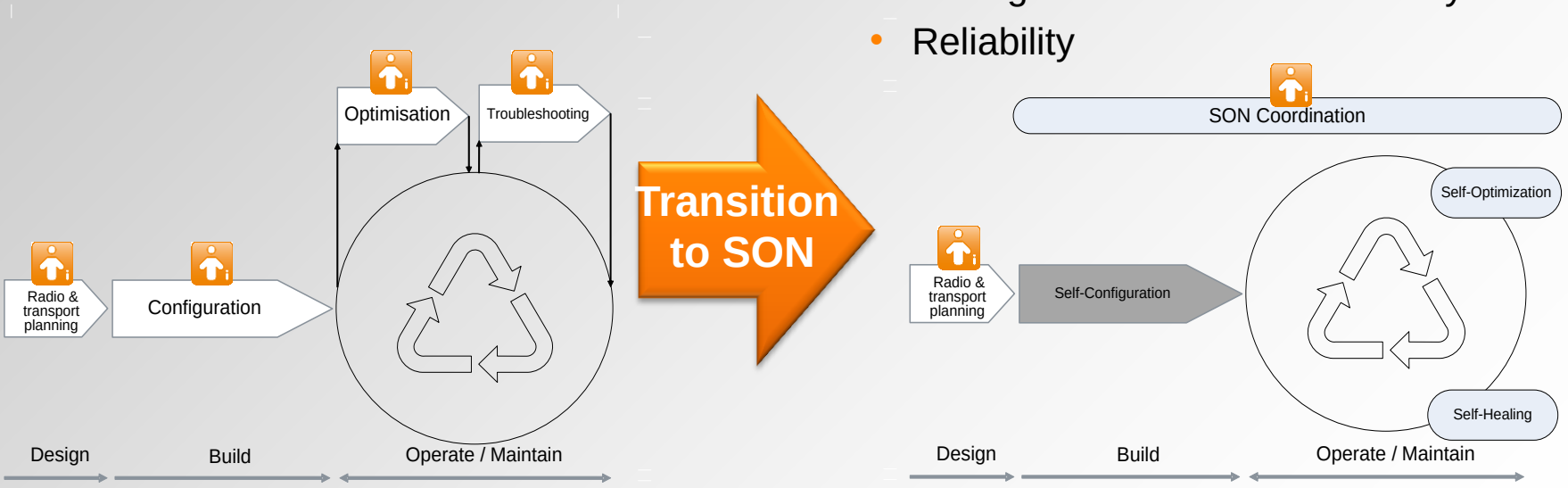
- In traditional operational life-cycle
  - Execution of the workflows decoupled from network operation
  - For optimisation PM and CM data are aligned to an offline tool where algorithms execute on data
- In SON life-cycle
  - Workflows are automated and realised with orchestration of SON function
  - Self-configuration and self-healing are triggered by incidents
  - For self-optimisation individual SON functions are embedded into the ongoing network operation rather than being executed offline



# Operational challenges for SON

Introduction of SON will introduce challenges due to

- **Transition of operational process to SON**
  - Knowledge acquisition
  - Operator acceptance
  - Changes in human level processes
  - Conflict avoidance between human operator and SON
- **Technical challenges**
  - Moving from offline operation to online SON
  - Acquisition and processing data
  - Moving from centralised to distributed execution
  - Knowledge management
  - Security
  - Management of SON enabled system
  - Reliability



# Challenges in transition to SON

**Knowledge acquisition**

- Today, most of the (critical) domain knowledge for OAM is held by the human operators
- Ways have to be found to acquire and capture all of this knowledge to be part of SON solutions

**Operator acceptance**

- Human operators must gain trust in the SON-enabled system
  - System enabling tracking of SON actions by a human operator
  - The human operator stay in control and thus be able to override SON actions
  - Trust is gained in a step-by-step process
- Shift human operator work from low-level repetitive tasks during operation to more high level task during preparation of system
  - New type of work becomes more creative and challenging
  - New type of work requires an increased skill set with learning curve
  - Employees may perceive automation as a threat to their particular job

# Challenges in transition to SON

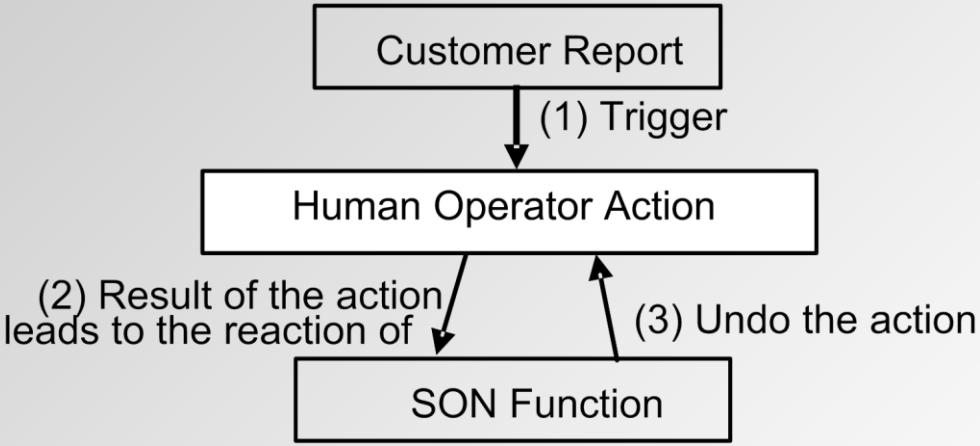
**Changes of human-level processes**

- Integration of the automated workflow parts into existing operator processes causes some initial complexity at the process level
  - Adaptation of human level process cycles to changed time intervals in which network planning, operation, optimisation and troubleshooting can be performed with SON
- Changed impact due to human errors
  - Automating low-level and manual processes leads to less human-induced errors
  - However, human error in higher level management may case more damage due to wider impact
  - Therefore a higher skill level is required for these crucial decision making tasks
- Impact to operator organization as boundaries as boundaries between a network planning, network operation, and network optimisation departments are blurred or may even disappear
- Fine tuned operator processes may become as a hurdle for adopting some of the SON functionality

# Challenges in transition to SON

**Conflict avoidance between human operator and SON actions**

- Conflicts between workflows induced by human operator and SON are possible
  - SON function may react erroneously on an action performed by the human operator



# Technical Challenges due to SON

**Moving from offline operation to online SON**

- Event orientation
- Algorithm execution in incremental way
- Retro-fitting SON solutions to legacy system
- Degree of detail for planned data

**Acquisition and processing of data**

- Needs to be embedded into the regular system operation
  - e.g., drive testing to acquire data from mobile terminals
- Protocol support needed, and thus additional standardization
  - e.g., X2 to support self-optimization, DHCP in self-configuration

**Moving from centralised to distributed execution**

# Technical Challenges due to SON

**Knowledge management**

- Acquisition of knowledge: This is particularly difficult, e.g., in the diagnosis part of self-healing
- Representation and maintenance of knowledge: proper support in information models / ontologies is required
- Evolution of knowledge: learning methods allow the on-line acquisition of knowledge
- Decision making: technologies like policies, probabilistic graph models, decision theory are required

**Security**

- Setting up secure connectivity between a NE and its OAM system is crucial because
  - increasingly physical security (dedicated physical backhaul links; base stations installed in dedicated, locked cabinet) is replaced by virtual security (virtual backhaul links, base station installed in public environment).
  - Automation means inherently reducing human interaction which from a security perspective means to reduce human monitoring of security-related aspects of the system.

# Technical Challenges due to SON

**Management of SON enabled system**

- Instrumenting the system to ensure human operator control and maintainability
  - logging, tracking, reporting
- Operability of the SON-enabled system
  - The operability of new higher-level tasks should also be assured by providing the proper tools which allow to reduce the number of different operating policies and workflows to be maintained

**Reliability**

- Consistent behaviour in all network configurations and environments
- Controlled behaviour (e.g., escalation to human operator) in case of errors
- Feature interaction related to the interaction between SON features but also between legacy OAM features and SON.