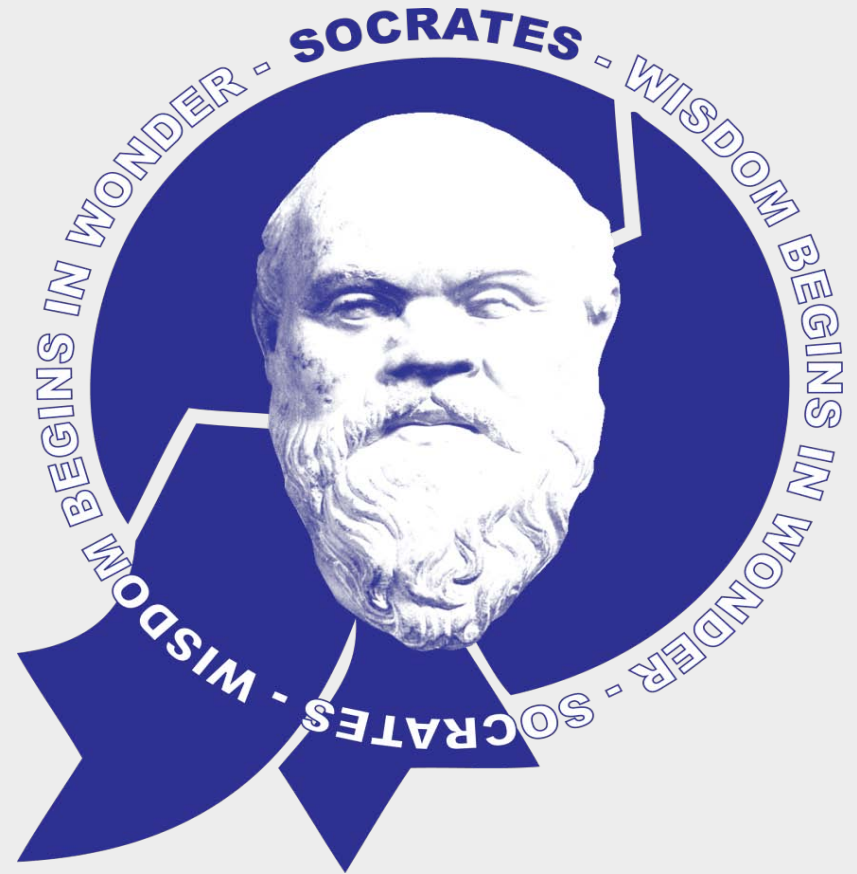


# SON Coordinator – SOCRATES Approach

Lars Christoph Schmelz  
Nokia Siemens Networks  
October 20th, 2010



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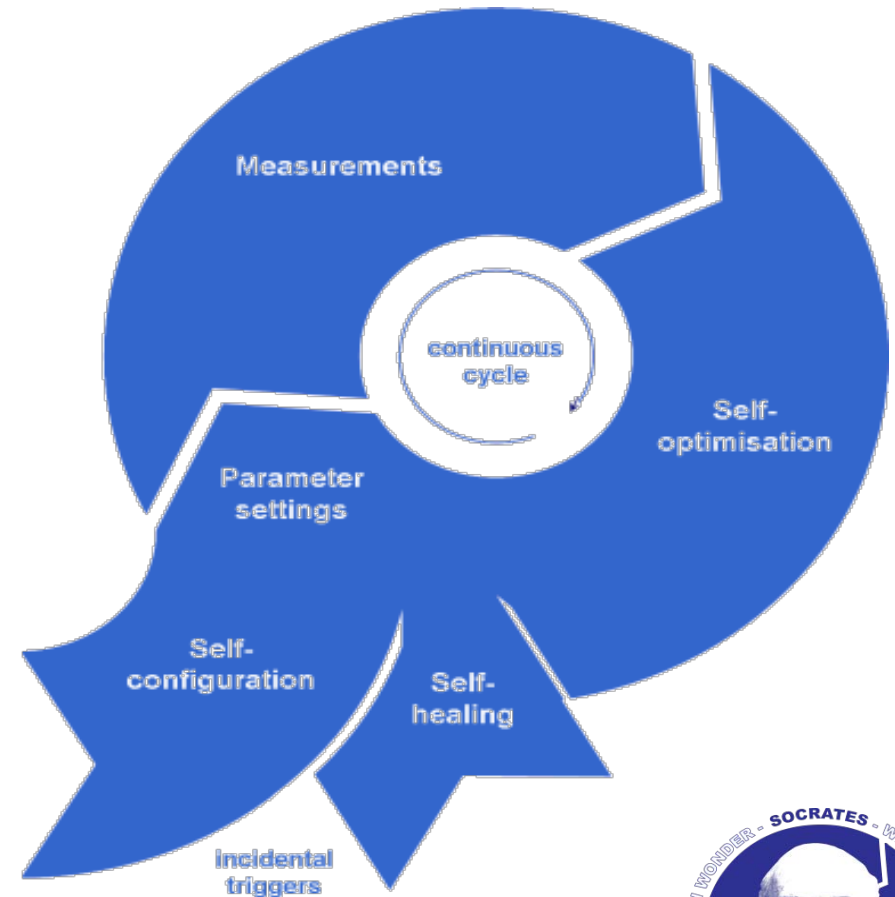
Nokia Siemens  
Networks



# Self-Organising Networks (SON) – the SOCRATES project

## ■ SOCRATES

- Self-Optimisation and self-ConfiguRATION in WirelEss networkS
- Project duration: From 01/01/2008 to 31/12/2010
- Self-Optimisation
  - Optimising **existing** base stations
  - Antenna, power, neighbour lists, resource management parameters
- Self-Configuration
  - By including **new** base stations
  - Plug-and-play fashion for radio parameters
- Self-Healing
  - Response to site **failure**
  - Adjusting parameters of surrounding sites
- Measurements
  - Indicator for **current** network state



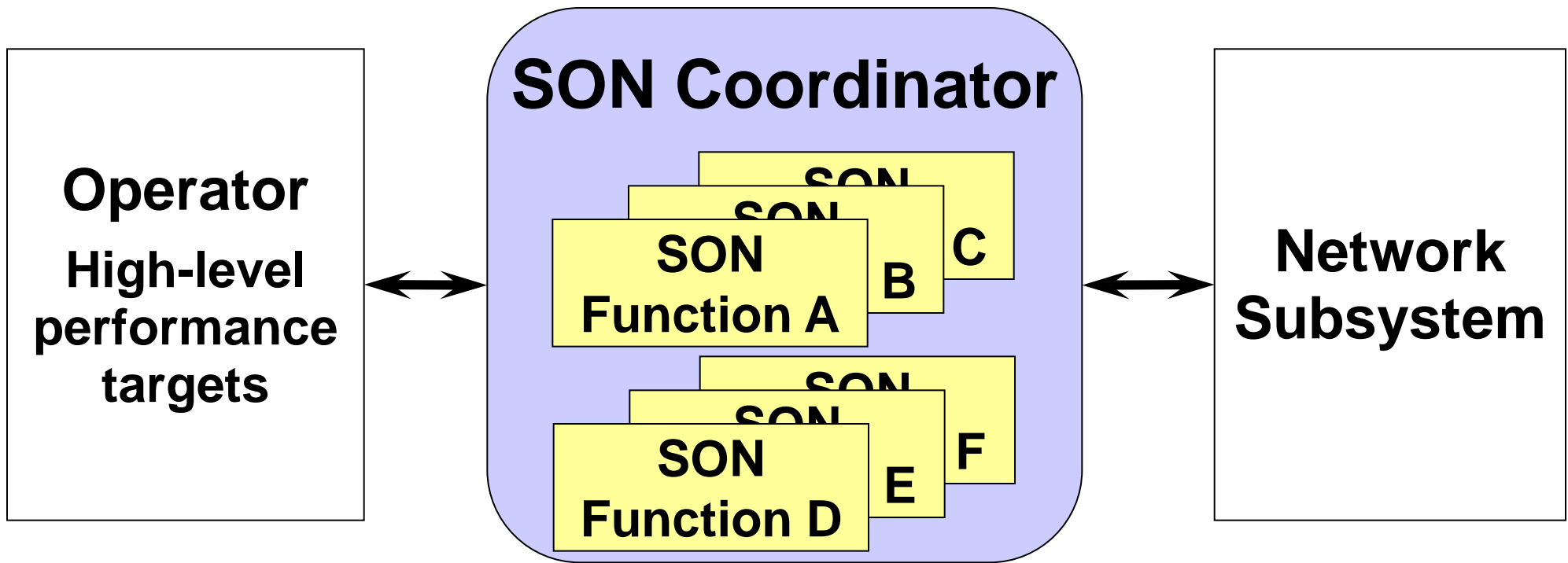
- Why SON Coordination?
- Conflict types
- Harmonisation approaches
- SOCRATES SON Coordinator Framework
- SON Coordinator functional roles
- Arrangements
- Open Issues
- Summary & Conclusions



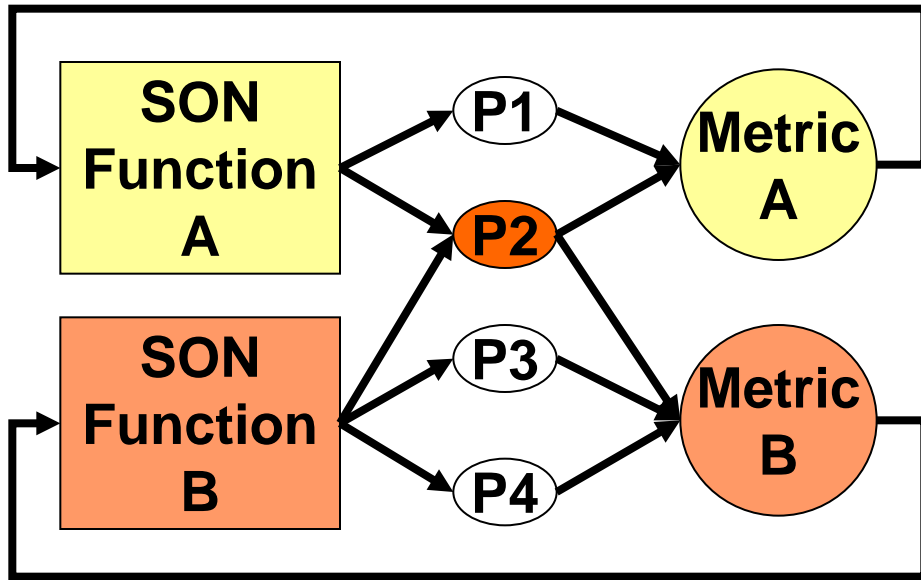
# Why SON Coordination?

- The research and development work on self-organisation for mobile wireless networks has up to now mainly **concentrated on stand-alone functions**
- With an **increasing number of SON functions** implemented in the networks the likeliness of conflicting goals and targets of the individual SON functions also increases
  - For example: Mobility Robustness Optimisation may have different targets regarding interference as Coverage and Capacity Optimisation
- A general goal of SON is to reduce the operational expenditure for operation, administration and maintenance of mobile wireless networks – hence, the introduction of SON functions should **NOT cause additional manual configuration tasks**
- The **goal of SON coordination** is to detect potential conflicts, avoid them by adequately harmonising the policies and targets of SON functions, automatically resolve conflicts if they occur, and provide a single interface towards the operator regarding policies and targets setting, and SON system feedback



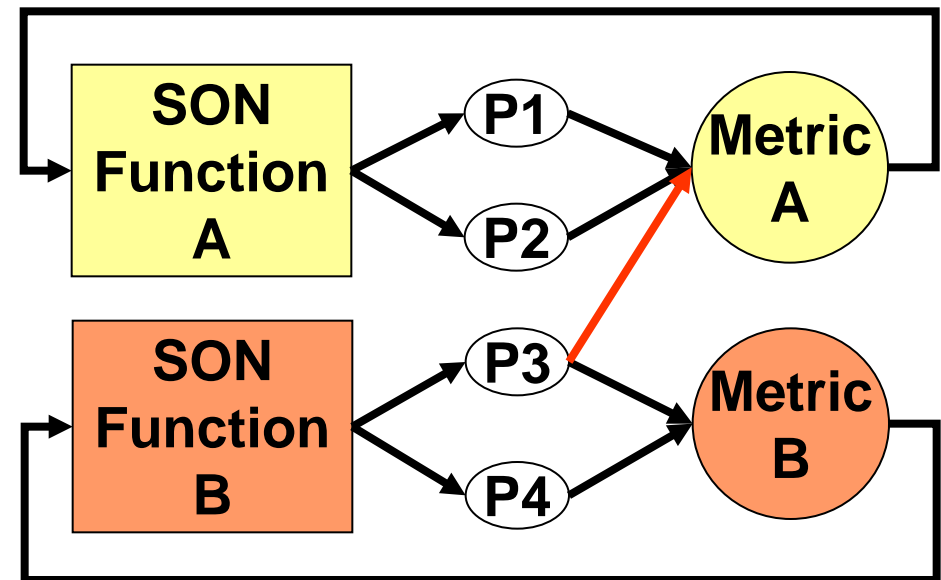


The figure shows a SON system, comprising a number of SON functions interfacing with the operator and network subsystem via the SON Coordinator. The functional view does not define where SON Coordinator functionality will be implemented – at network element, domain management or network management layer.



## *Control Parameter Conflict*

- Directionality Conflict: decrease vs. increase
- Magnitude Conflict: large vs. small modification



## *Observability Dependency*

- Metric used as input by one SON function is affected by modifications through other SON Func.

## ■ Heading Harmonisation

- *Prevent conflicting parameter changes* by ensuring conflict-free SON function policies such that the SON functions do not produce conflicting parameter changes
- The degree of heading harmonisation that can be achieved depends on the number of implemented SON functions, the degree of interaction between these SON functions, and the dynamics of the network system

## ■ Tailing Harmonisation

- *Resolve conflicts* that may occur in case heading harmonisation and thus conflict avoidance could not prevent all interdependencies between SON functions
- All modifications requested by SON functions are checked and committed / rejected by an Alignment function, or changes are requested for the modifications

- Heading and tailing harmonisation *complementary interact* with each other. This can be expressed such that, the more harmonisation is performed through the policies, the less harmonisation is required through conflict resolution





# Policy Levels

**Operator Policy**  
High-level performance objectives

E.g., targets for cell edge performance, cell average performance, fairness between users, and minimum user performance

**CELL TYPE**

**Cell Specific Policy**

Version of the operator policy tailored to a specific cell type, e.g., macro, micro, femto; location type, e.g. urban, rural, commercial, highway

**SON Function Specific Policy**

Decision logic and behaviour of individual SON functions and SON Coordinator functions

**SON Coordinator Specific Policy**





## ▪ Policy function

- Converts the operator's high-level performance objectives into SON function specific policies and SON Coordinator function specific policies
- Provides the interface between the network operator and the SON system, for the definition of policies, setting of constraints (e.g., thresholds), and regarding feedback from the SON system on its functioning
- The policy function is not necessarily an inherent part of the SON Coordinator, i.e., the SON Coordinator must also work without the policy function

## ▪ Alignment function

- Responsible for resolving control parameter conflicts

## ▪ Autognostics function

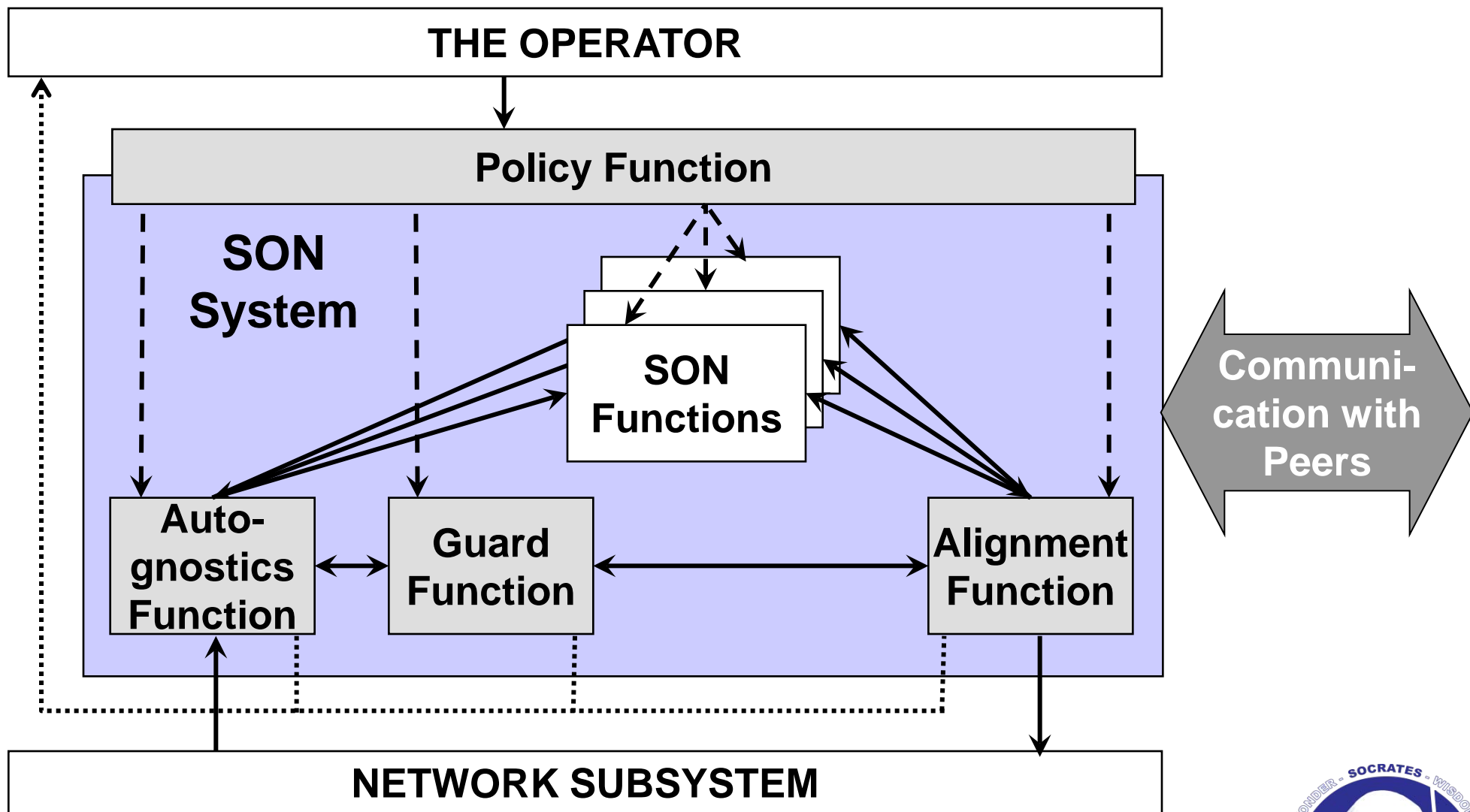
- Provides processed measurements, alarms, and configuration changes to the SON Functions and the SON Coordinator functions

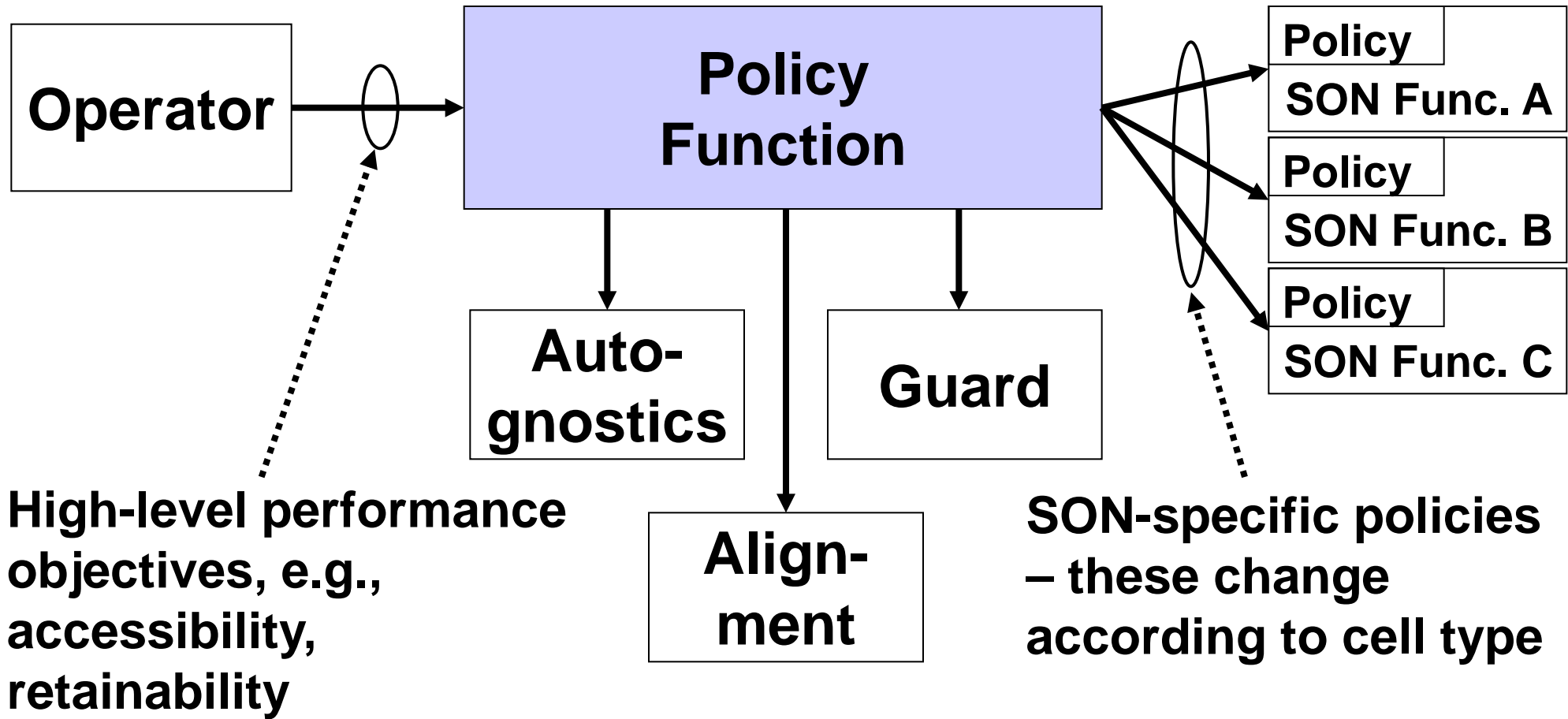
## ▪ Guard function

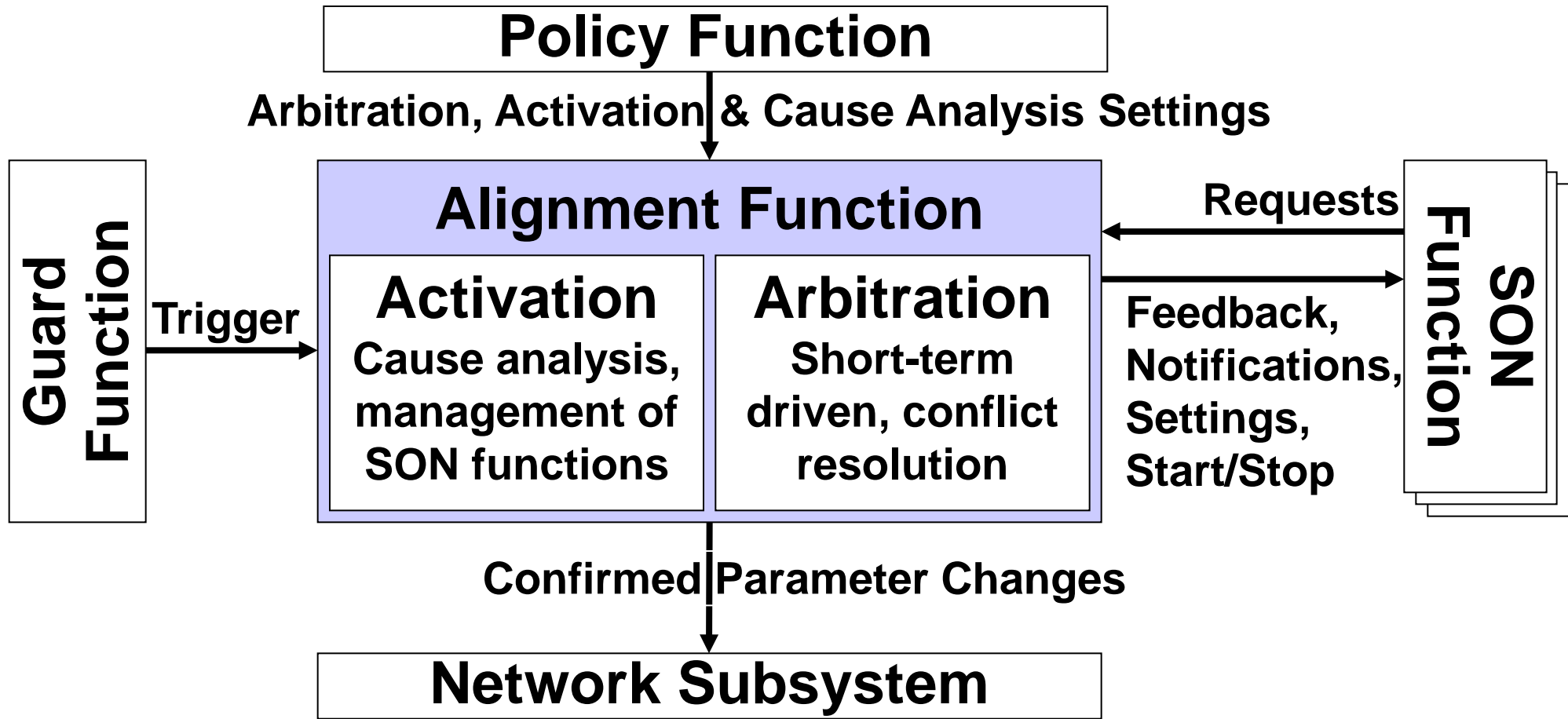
- Monitors overall network performance and identifies possible undesired (SON-induced) performance degradations and triggers their adjustment

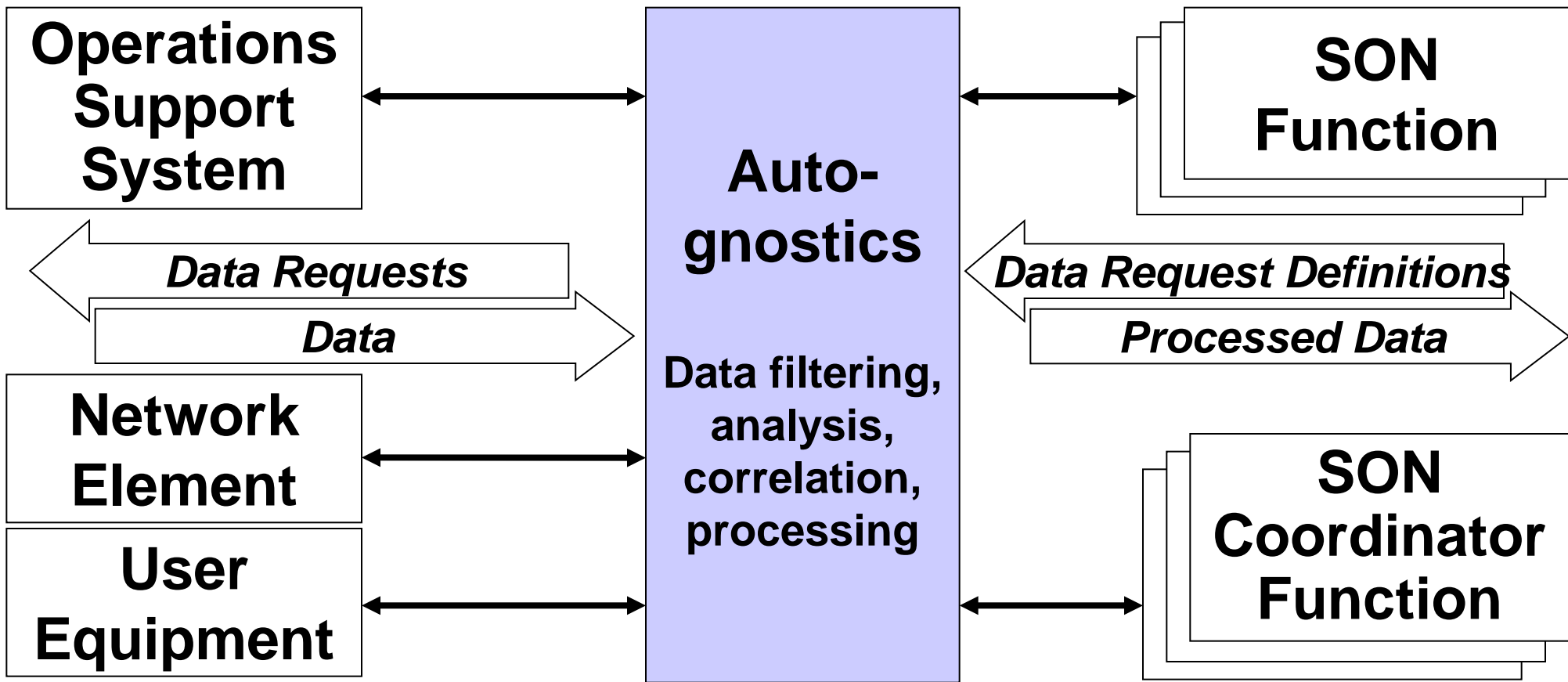


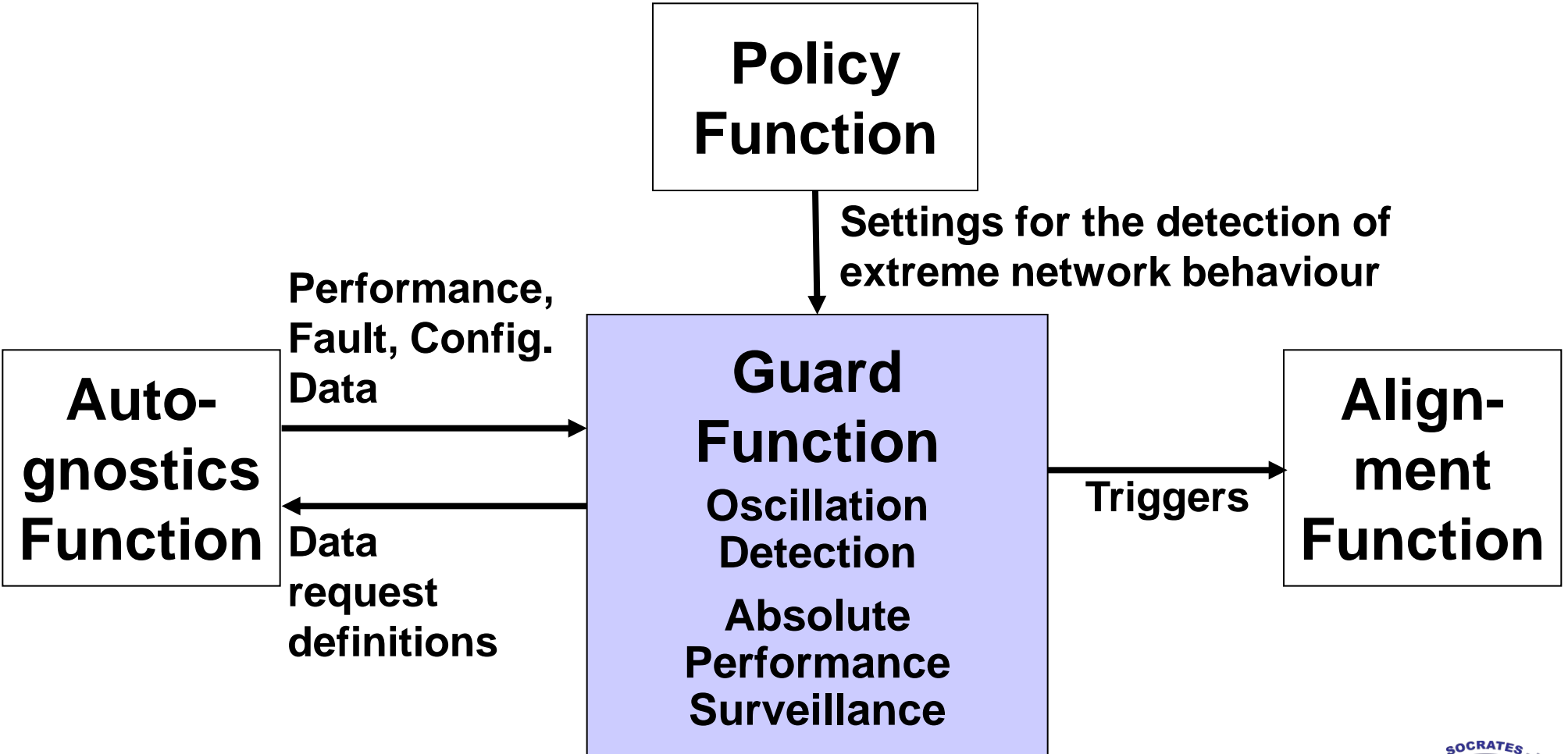
# SON Coordinator Framework - Overview





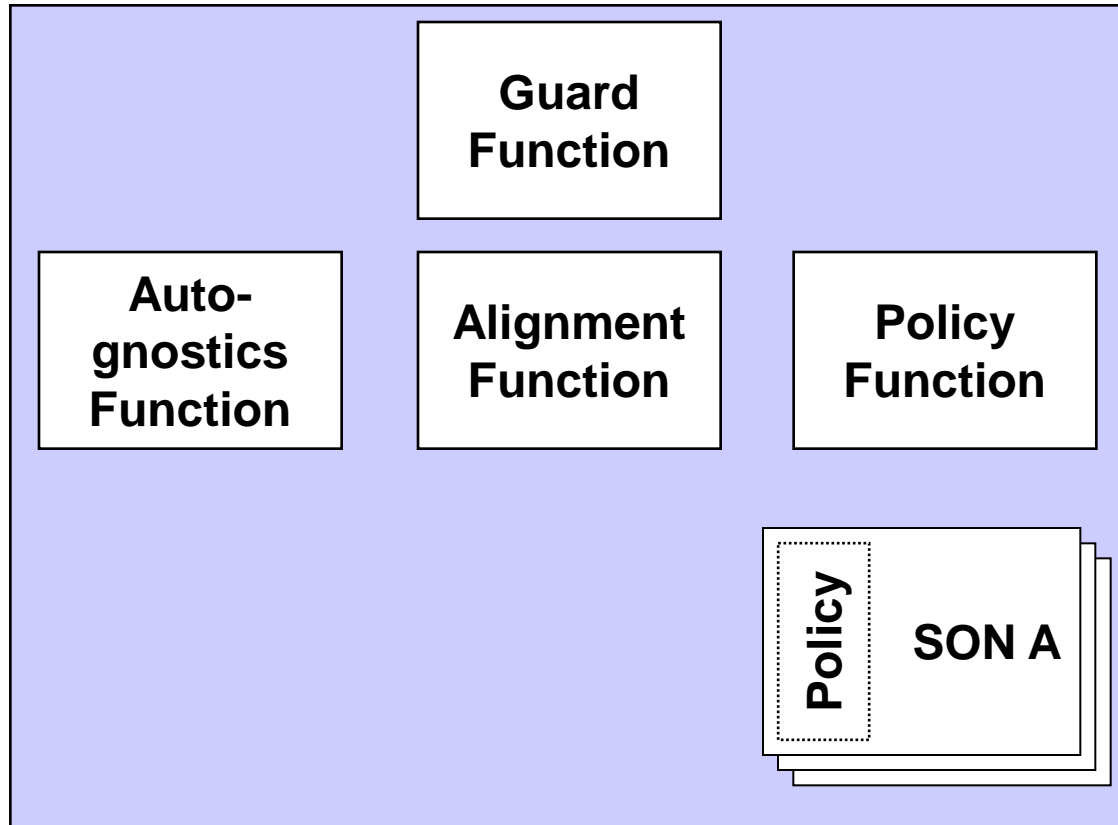






# Arrangement: Global SON function coordination

## THE OPERATOR



- High coupling between single SON Functions
- Global coordination required to ensure the system working towards the same goal, and avoid negative impact of coupling
- Modifications in case of SON function updates / enhancements only required at central Policy or Alignment, but potential high complexity of this central Policy or Alignment

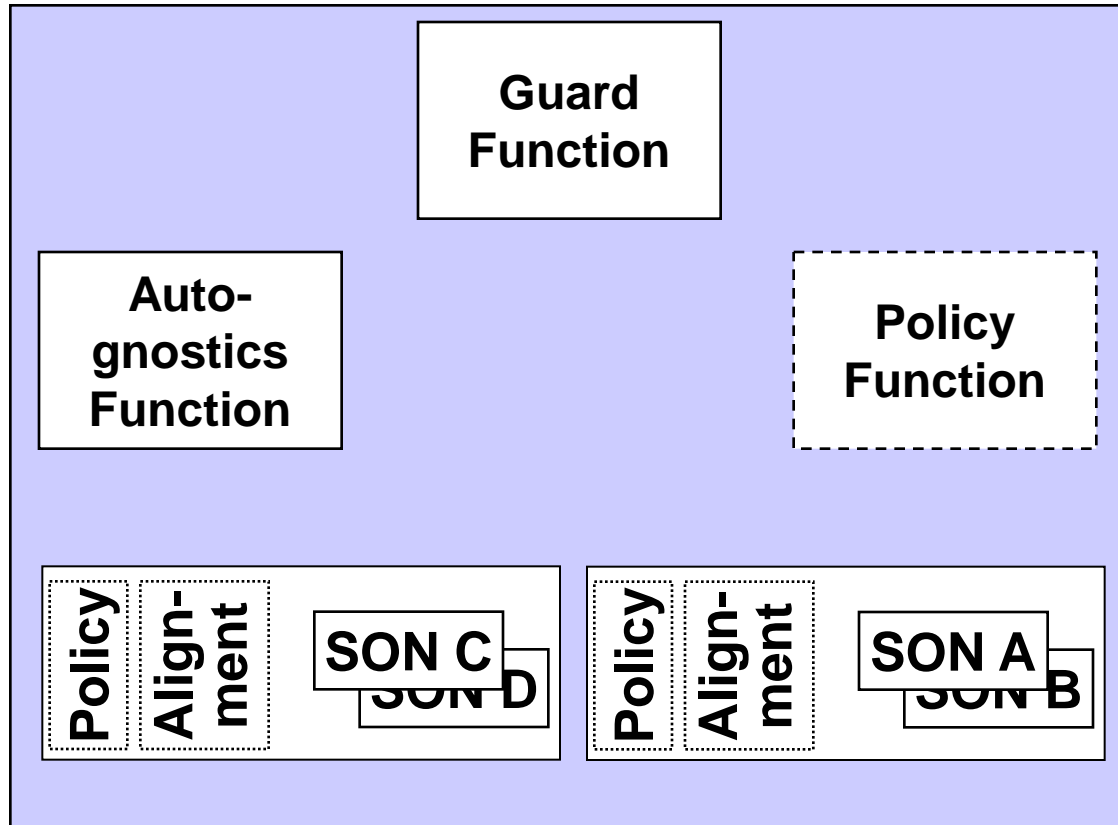
## THE NETWORK SUBSYSTEM





# Arrangement: Coordination of groups of SON functions

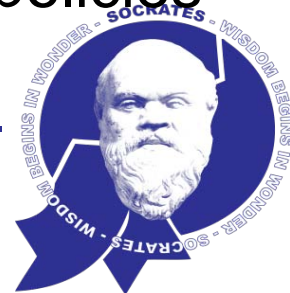
## THE OPERATOR



- High coupling within groups of SON Functions, but no or low coupling between groups
- Group local Policy and Alignment instances
- Global Policy only for breaking down global (high-level) policies to group local policies
- Modifications in case of SON function updates / enhancements only required at local Policy or Alignment, but potential re-grouping of SON functions necessary

## THE NETWORK SUBSYSTEM

- **Policy conversion:** operators know their business and high-level targets, low-level SON function policies are defined or even standardised – but the gap between these is to be filled → conceptual work is still necessary here
- **Operational processes:** current (manual) operation processes have to be changed with the introduction of SON in general, but also for SON coordination – especially the role of the human operator changes from performing management tasks towards defining management targets
- **Performance Targets:** in case the operator defines unrealistic performance targets (e.g., 99,9% coverage, 0,01% drop call rate), conceptual work is necessary how the SON Coordinator can determine realistic targets and create corresponding policies



- The need or benefit of SON coordination depends on various properties of the SON functions in operation
  - *Design of SON functions*: a careful design of the SON functions may result in few or no coupling or dependencies at all
  - *The number and type of the implemented SON functions*: many interacting SON functions increase the potential of conflicts ← these factors are operator dependent
- Further research work, simulations and field testing are required to determine potential conflicts, also because the network reacts much different with automated SON functions as with manual (classical) performance management

