

# TSS Monitoring System Systems Engineering

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# ICS process control system development: From idea to implementation

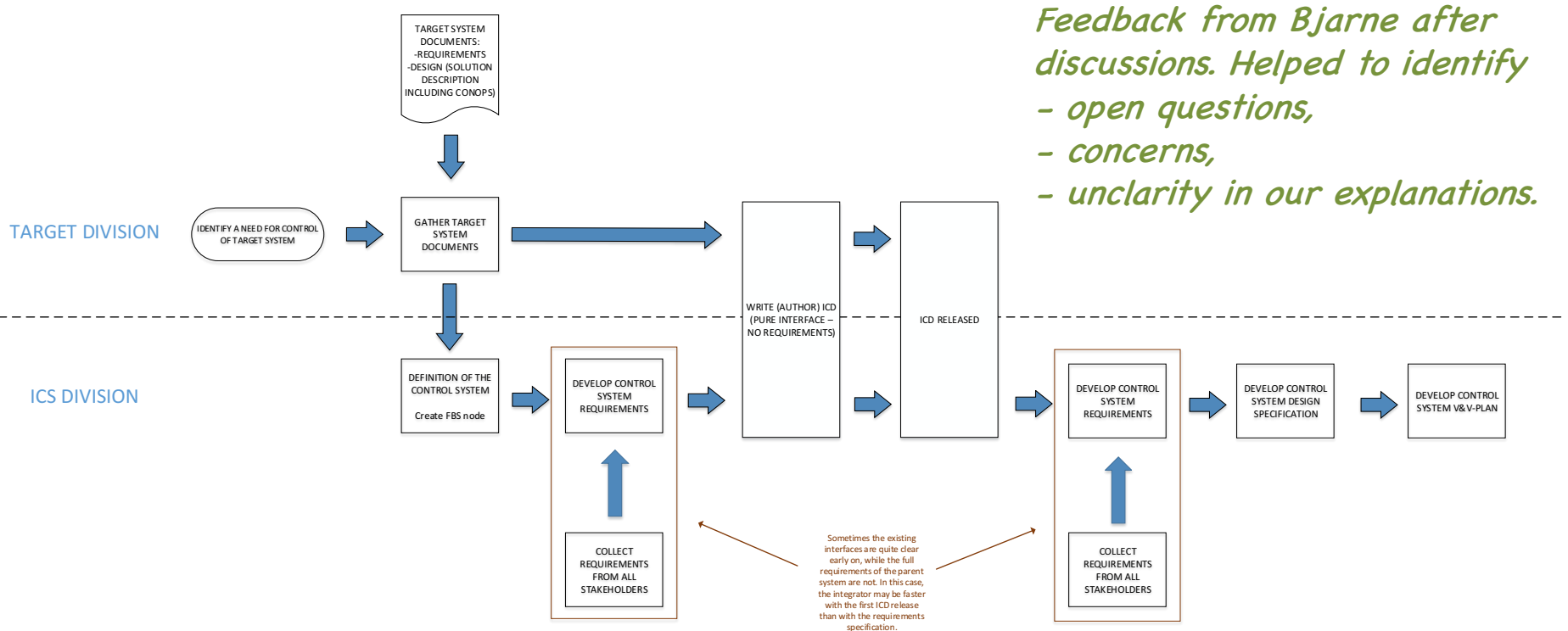


- To explain how ICS applies its SE approach
  - also: to explain how we recently work together to improve mutual understanding
- example case “TSS Monitoring System”
  - still in concept exploration
  - Today is not about solving TSS monitoring specific issues.

*Any technical architecture shown here  
may look quite different eventually !*

# Example for *feedback* after discussions, for improving mutual understanding: How has ICS been understood?

## ICS DIVISION VIEW OF THE I&C (INSTRUMENTATION AND CONTROL) SYSTEM DEVELOPMENT (AS INTERPRETED BY TARGET DIVISION)



- Ideation
  - of function and system
- ICS decision to start a system development, FBS
- Requirements Engineering
- Design
- Interface descriptions
- Changes

Initial ideas, Target team:

Issue: “SSM requires << ... TSS monitoring ... >>”

-> SSM-ch4-C3

Idea: “EPICS can archive, and may solve this.”

*Sounds reasonable.*

*Let's explore further.*

Initial ideas, Target team:

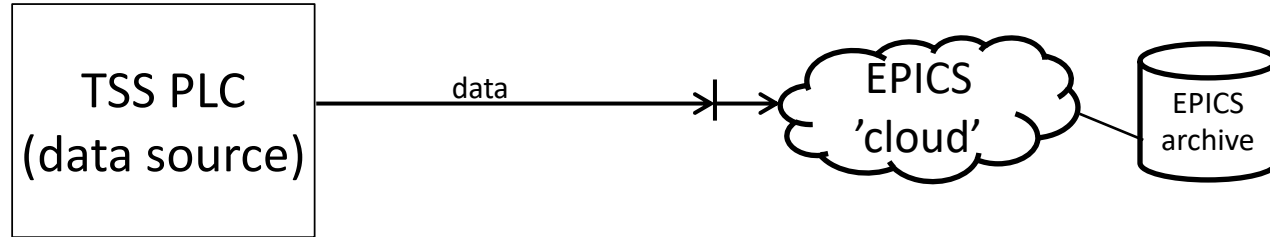
Issue: “SSM requires << ... TSS monitoring ... >>”

Idea: “EPICS can archive, and may solve this.”

Additional idea (ICS): “Archiving TSS data in the EPICS archiver allows to correlate TSS history with all other recorded ESS system history. This should simplify and speed up the analysis of events, problems, etc.”

*Sounds also reasonable.*

# Ideation of function



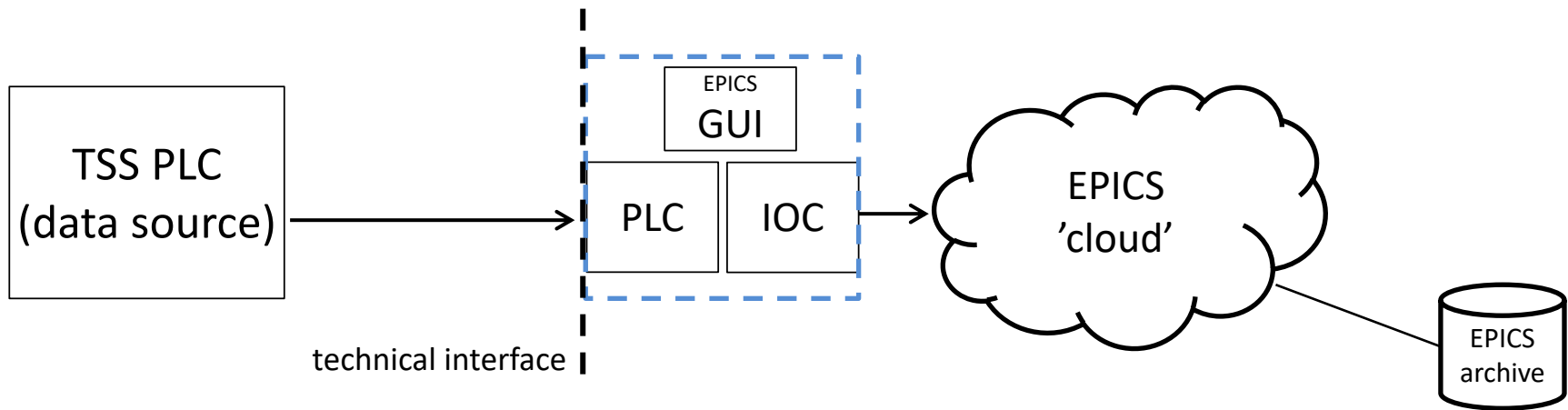
Function: To record a set of TSS data in the EPICS archiver.

Constraints:

... some kind of encapsulation of TSS is needed...

... hence one-way communication.

# Ideation of system “TSS Monitoring System”

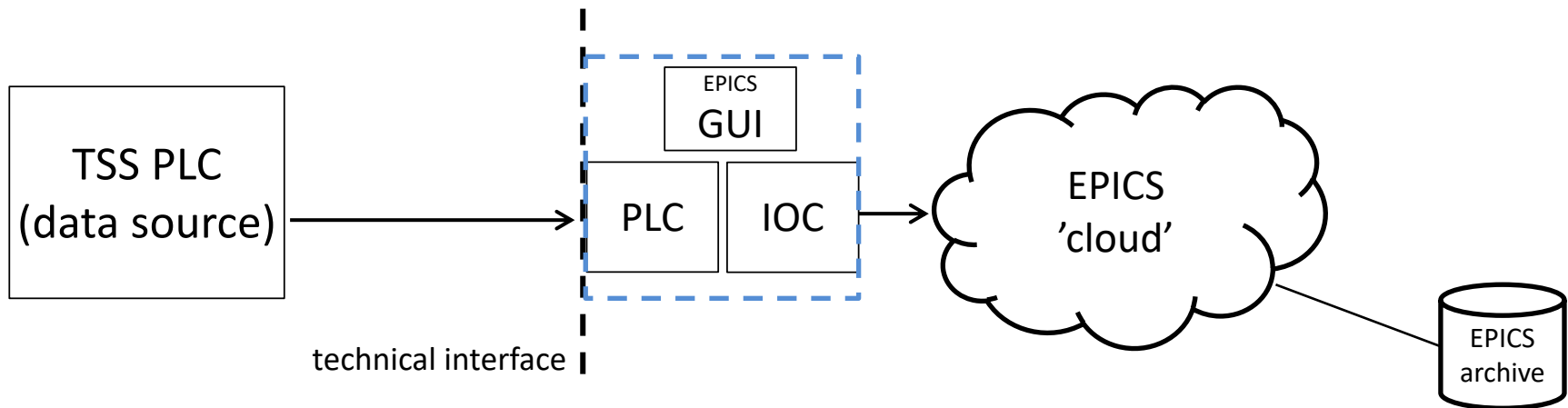


## NOTE:

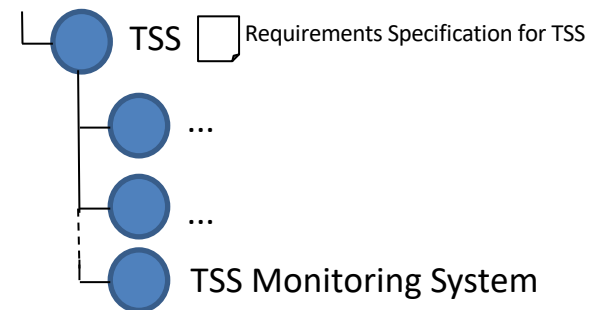
There are other architectures well possible.  
This was a start idea.



# ICS Decision: develop the “TSS Monitoring System”



1. Based on ideation, make decision (project management), as the mandate implies ('integration of x').
2. Allocate resources, assign ICS Integrator
3. Create FBS node & ESS Name
4. Execute life cycle for TSS monitoring system
  1. Analysis and specification of system requirements
  2. ...



# Requirements Analysis for TSS Monitoring System

Identify higher-level system requirement (trace up to):

Note: rev 4. is preliminary (in rev. 3 the id TSS-TSS-203 points to another requirement)

TSS Requirements Specification, ESS-0002776 rev. 4

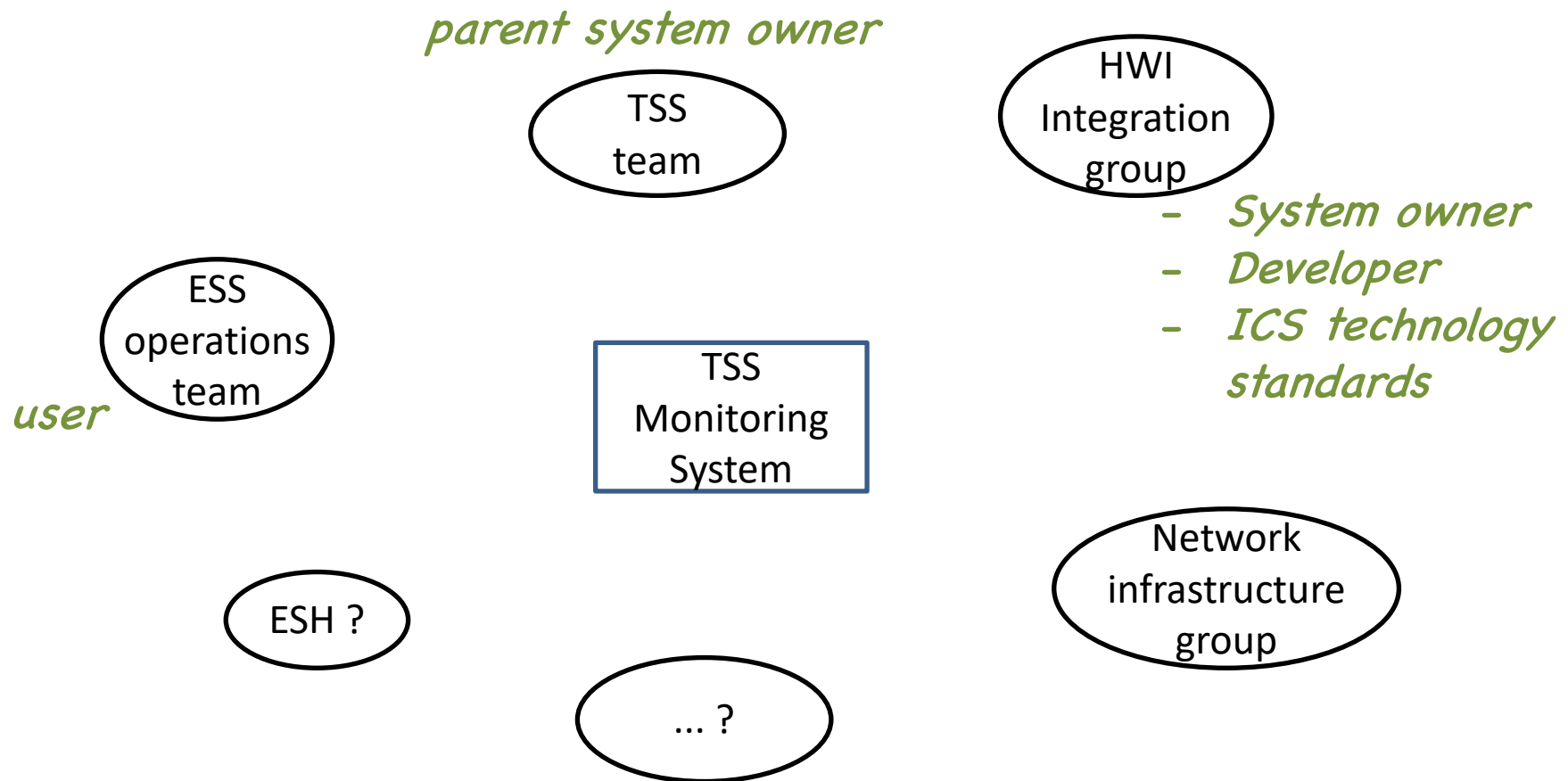
TSS-TSS-203: “It shall be possible to monitor the status of the TSS radiation safety functions. The status shall be accessible to the operator.

- Electrical and I&C class: No class
- Probability of failure on demand (PFD): N/A  
→ traces to SSM-ch4-C3”

TSS- <<n.a.(?)>> : “TSS shall allow the operator to analyse TSS historical data in relation to other ESS systems.”

# Requirements Analysis for TSS Monitoring System

Identify stakeholders (parties with a legitimate interest)



# Requirements specification for “TSS Monitoring System”

## Requirement for TSS

TSS-TSS-203: “It shall be possible to monitor the status of the TSS radiation safety functions. The status shall be accessible to the operator.

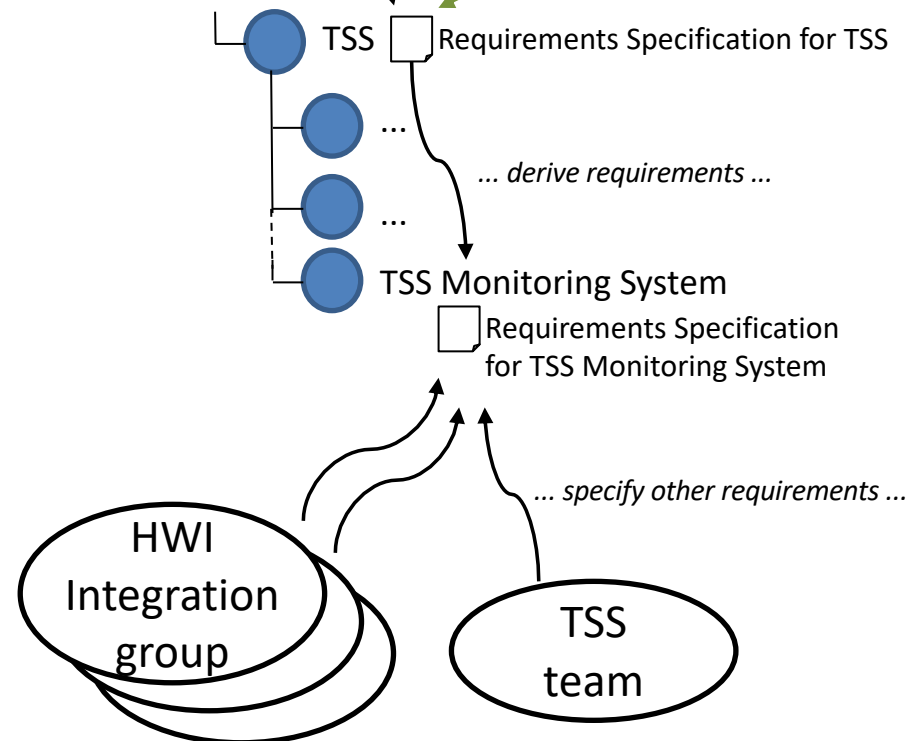
Electrical and I&C class: No class  
Probability of failure on demand (PFD): N/A

→traces to SSM-ch4-C3”

TSS- <<n.a.(?)>> : “TSS shall allow the operator to analyse TSS historical data in relation to other ESS systems.”

--- *... is documented in this document ...*

System requirements reviews should include all subsystem providers (stakeholders), including integrators.

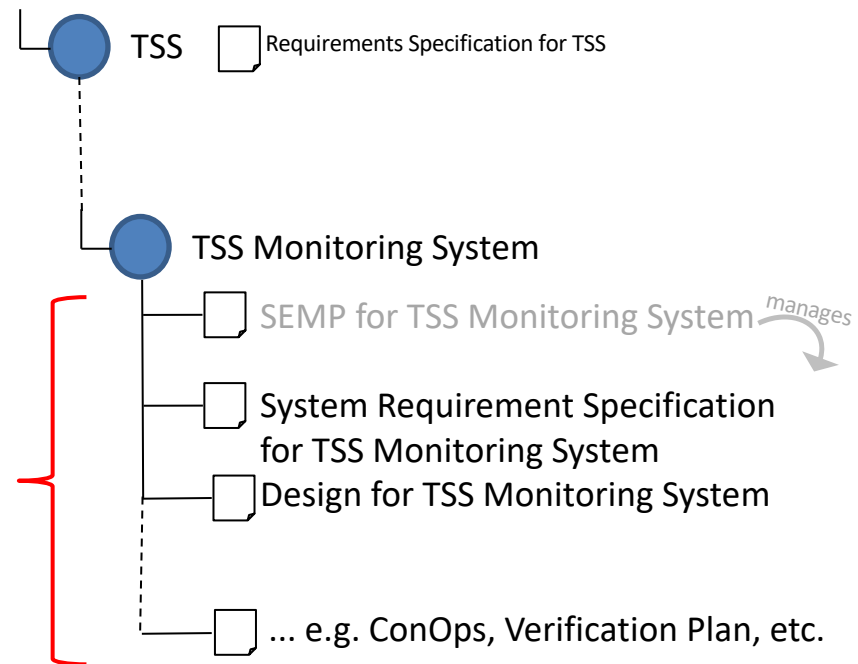


# Managing ICS documentation for “TSS Monitoring System”

ICS system specifications:  
owned & authored by ICS,  
as ICS is responsible for the  
quality of the content.

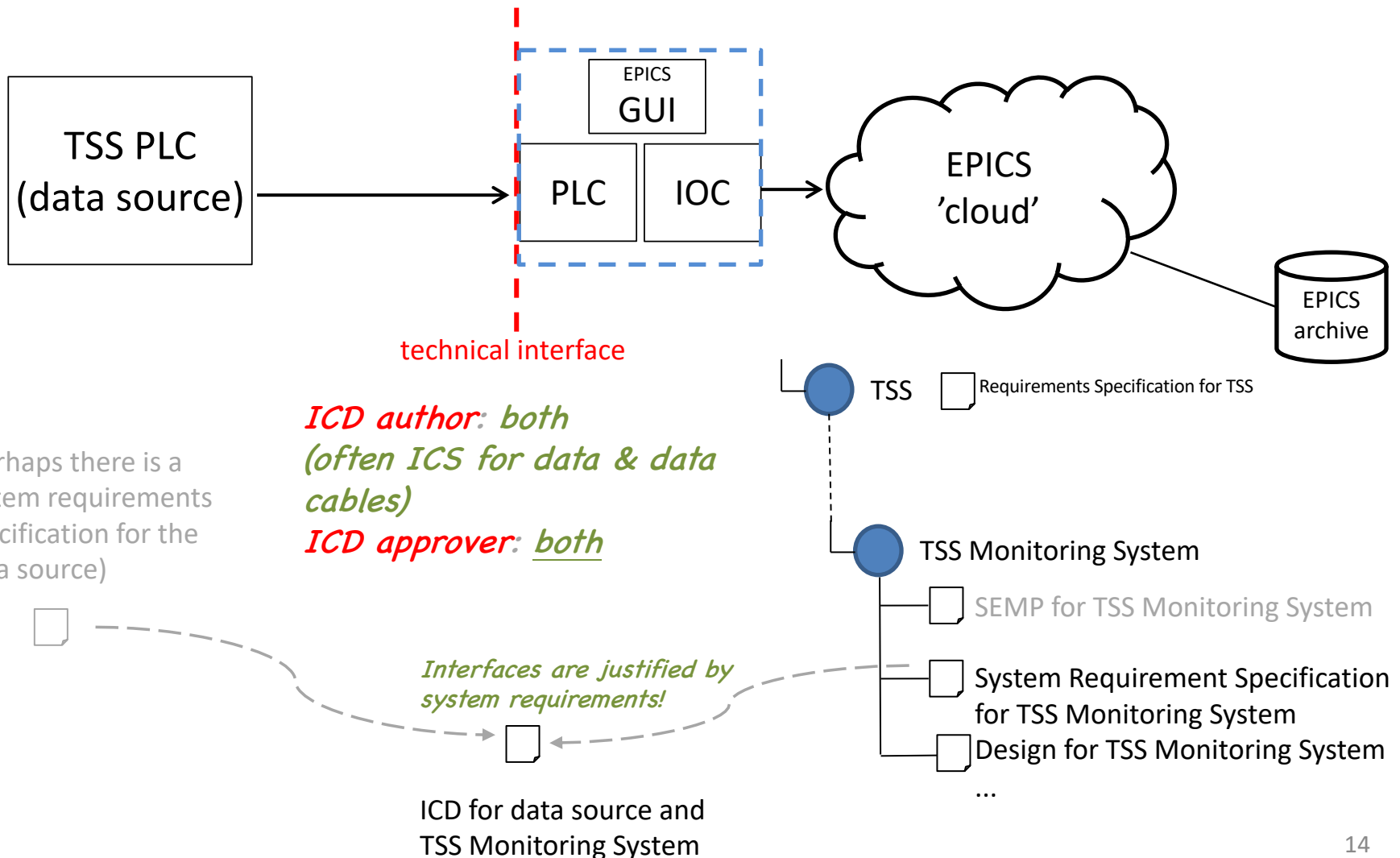
TSS team (as every stakeholder)  
is expected to review

- every single document,
- to the full content,
- for every new revision.



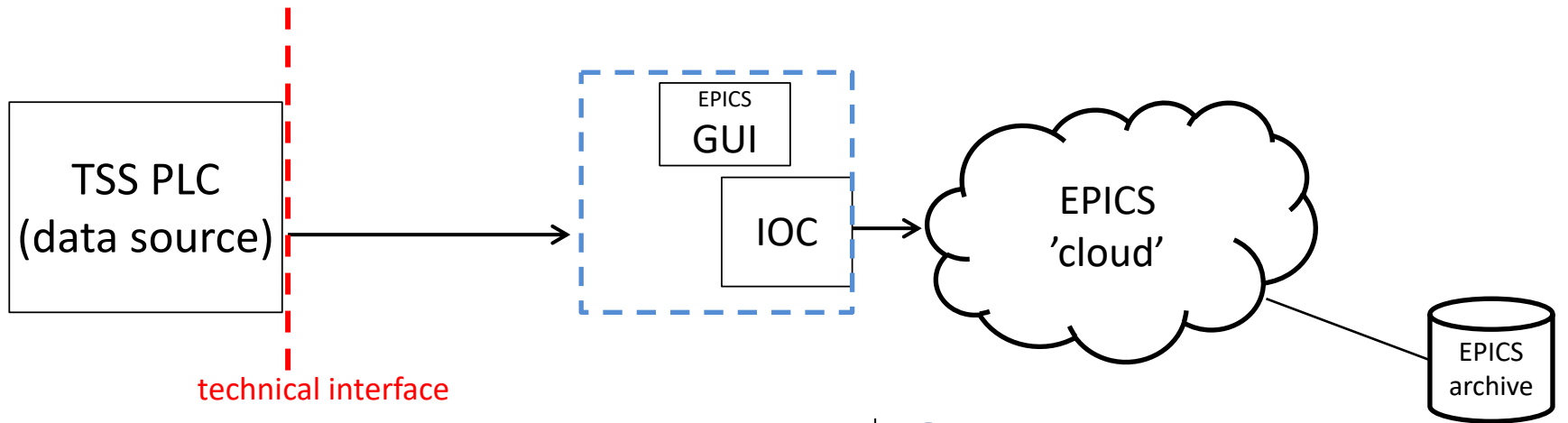
# Documentation of Interface descriptions

## “TSS Monitoring System”



# Documentation of Interface descriptions

## “TSS Monitoring System”



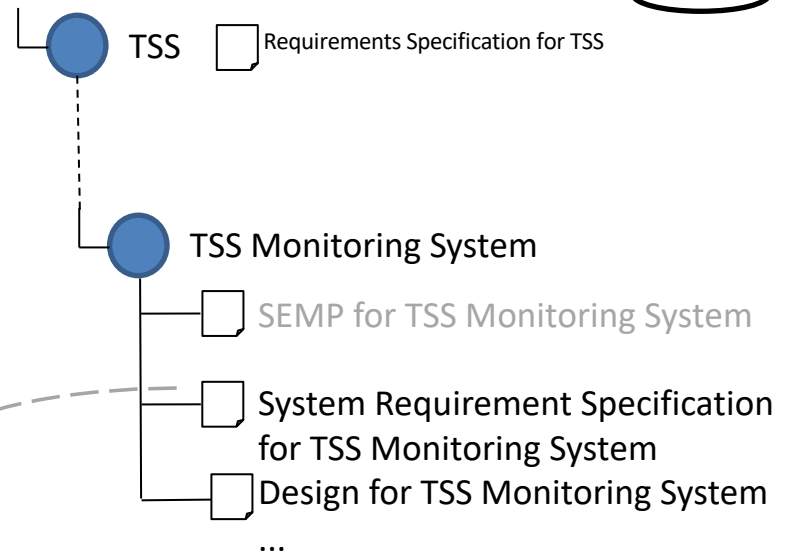
(Perhaps there is a system requirements specification for the data source)

**ICD author: both**  
*(often ICS for data & data cables)*

**ICD approver: both**

*Interfaces are justified by system requirements!*

ICD for data source and TSS Monitoring System



- temporal shifts are possible in practice
  - Sometimes the existing interfaces are quite clear early on, while the full requirements of the parent system are not. In this case, the integrator may be faster with the *first* ICD release than with the requirements specification.
  - Iterations.... In ICS projects, typically the system requirements specification, the ICD and the design are getting better, more detailed, in parallel.
    - A first design enters development.
      - A new requirement is identified during development.
        - ICD and system design are changed accordingly.