

Incorporating Model Based Reviews into the life cycle of the Earth Return Orbiter

MBSE - 2021

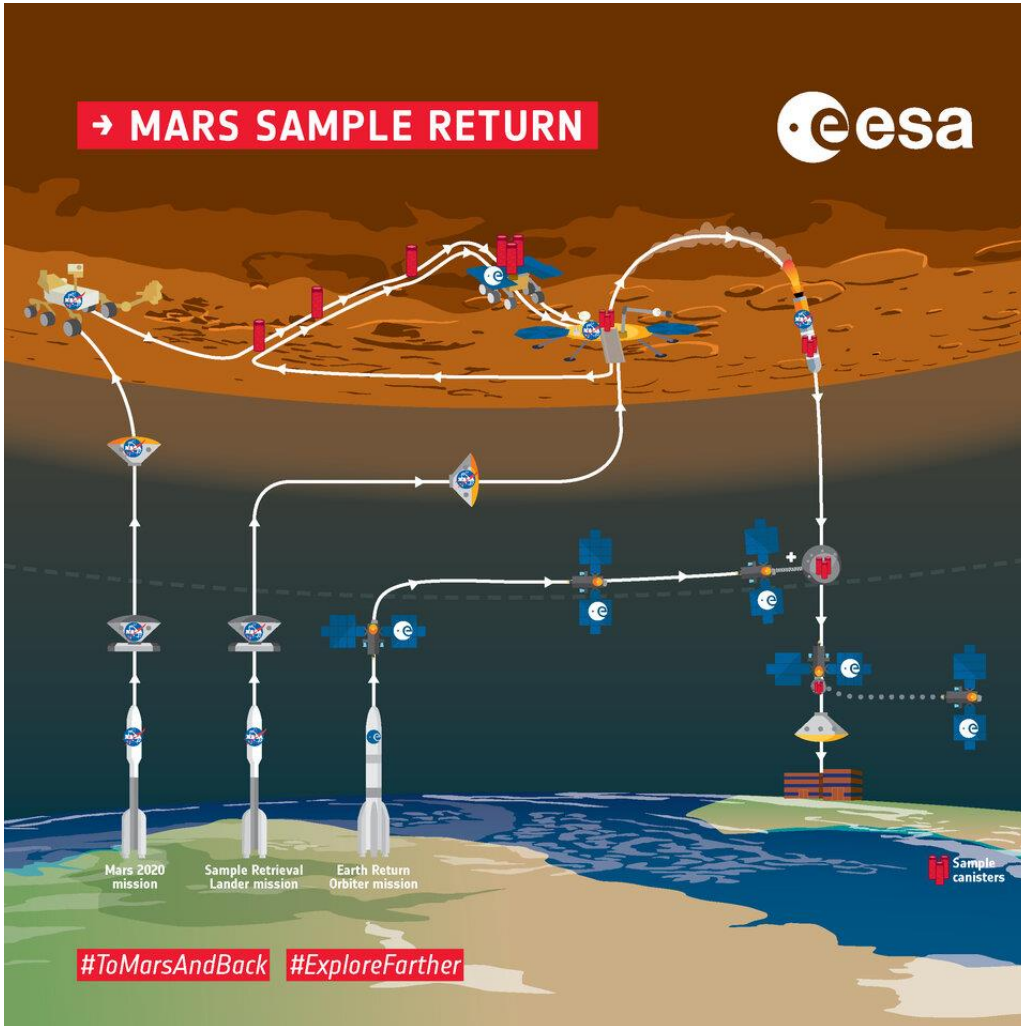
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ESA ESTEC

29/09/2021-30/09/2021

- The Earth Return Orbiter
- MBSE implementation within ERO
- Model Based Review process
- Model architecture and support tool
- Conclusion and Lesson Learned
- Q&A

The Earth Return Orbiter (ERO)



MSR Campaign goal

- Bring back Martian samples to be studied on Earth

ERO Mission goals

- Capture and contain samples in Martian Orbit
- Deliver samples to Earth

Organisation

- ESA's Human and Robotic Exploration Directorate (HRE)
- Airbus Defence and Space (ADS) as Prime contractor

Challenges

- Cross-agency program
- Complex technical challenges

Needs

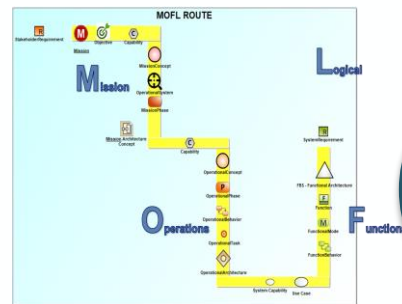
- Robust systems engineering
- Effective communication between stakeholders and all disciplines involved

Model content:

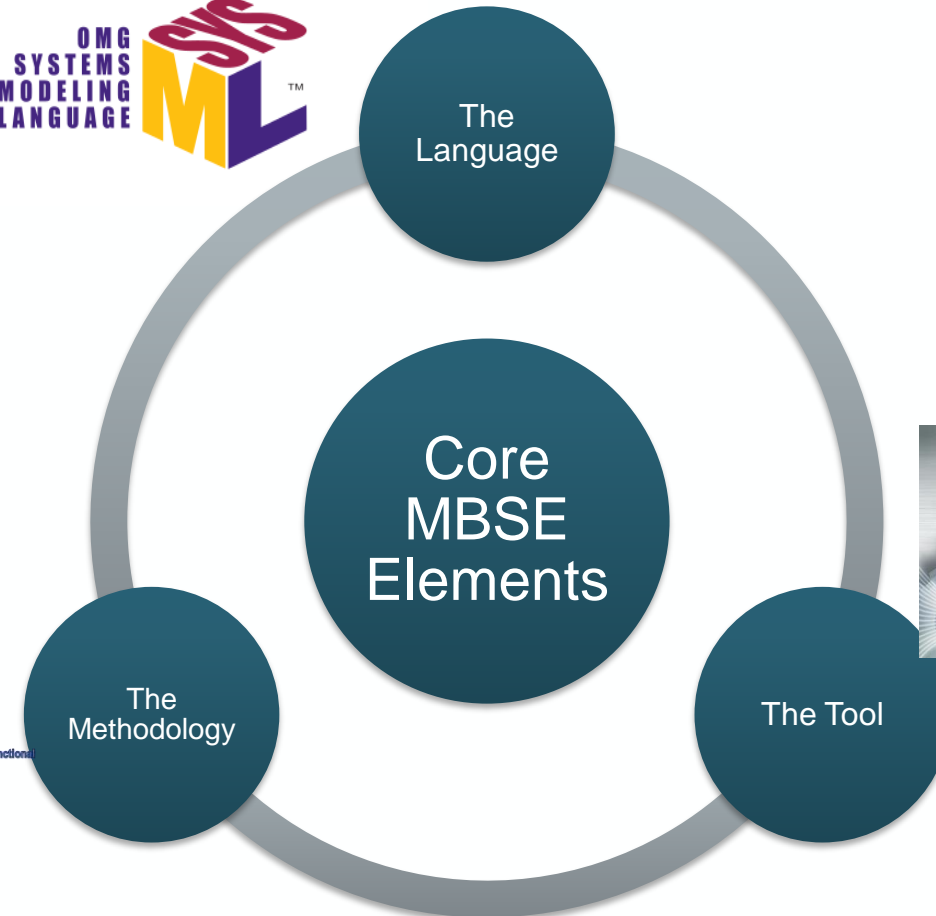
- Operation Analysis
- Functional Architecture
- Logical Architecture
- Linking between functional and logical architecture

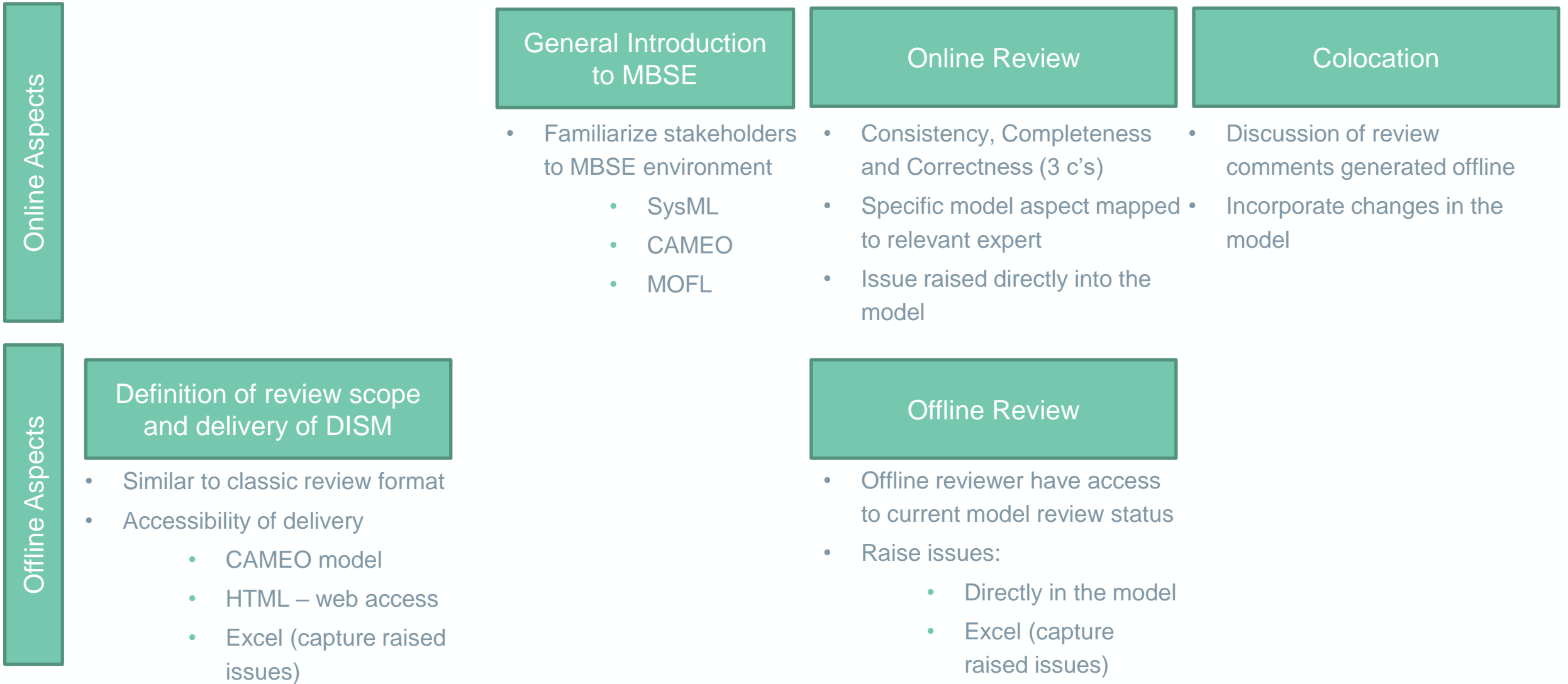
Workflow:

- Modeling activities started in Phase B2
- Model delivered for S-PDR
- Model Based Review not part of the PDR



Airbus MOFL





ESA ERO model - DISM

ERO-ESA System model



ERO-ESA Requirements model



IBM DOORS

ERO Review model



SysML

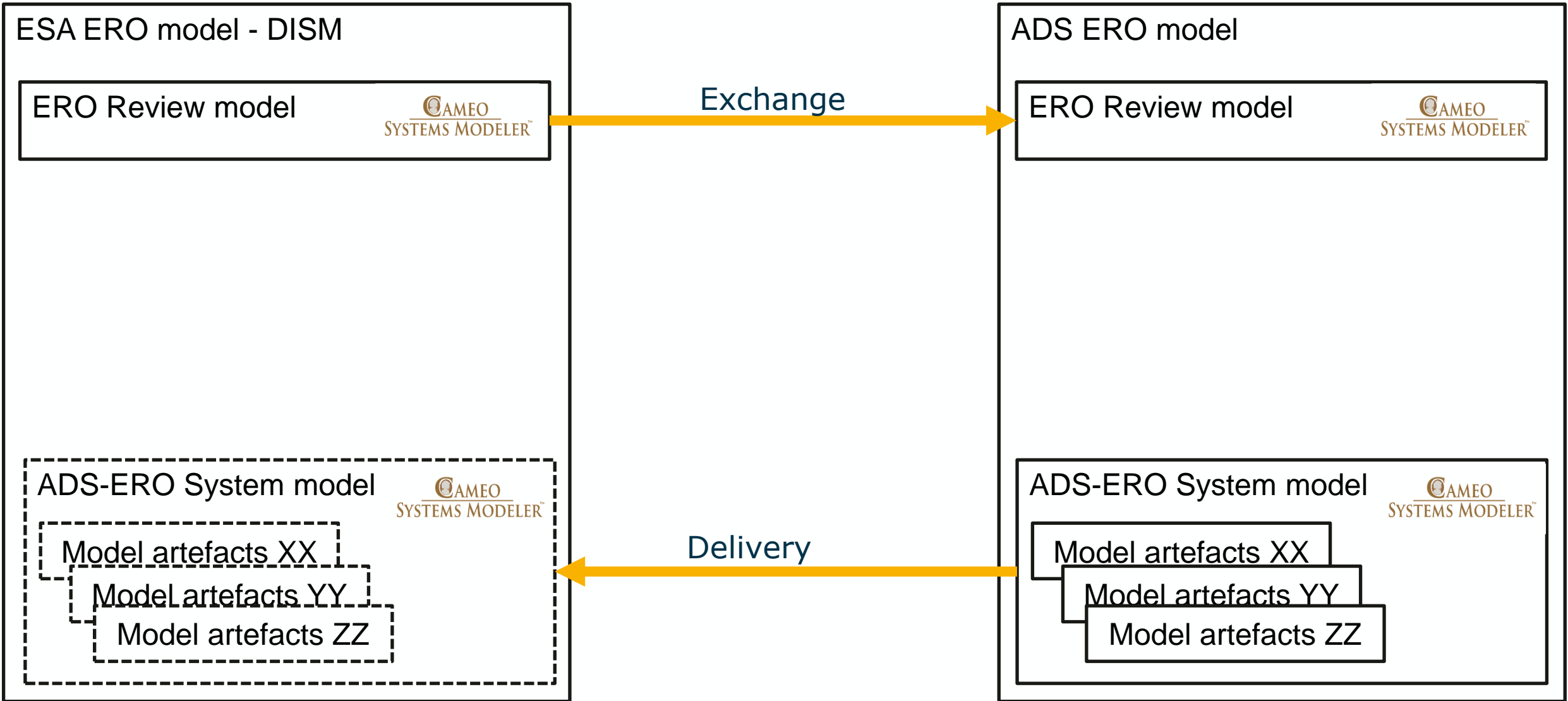
Review artefact AA

Review artefact BB

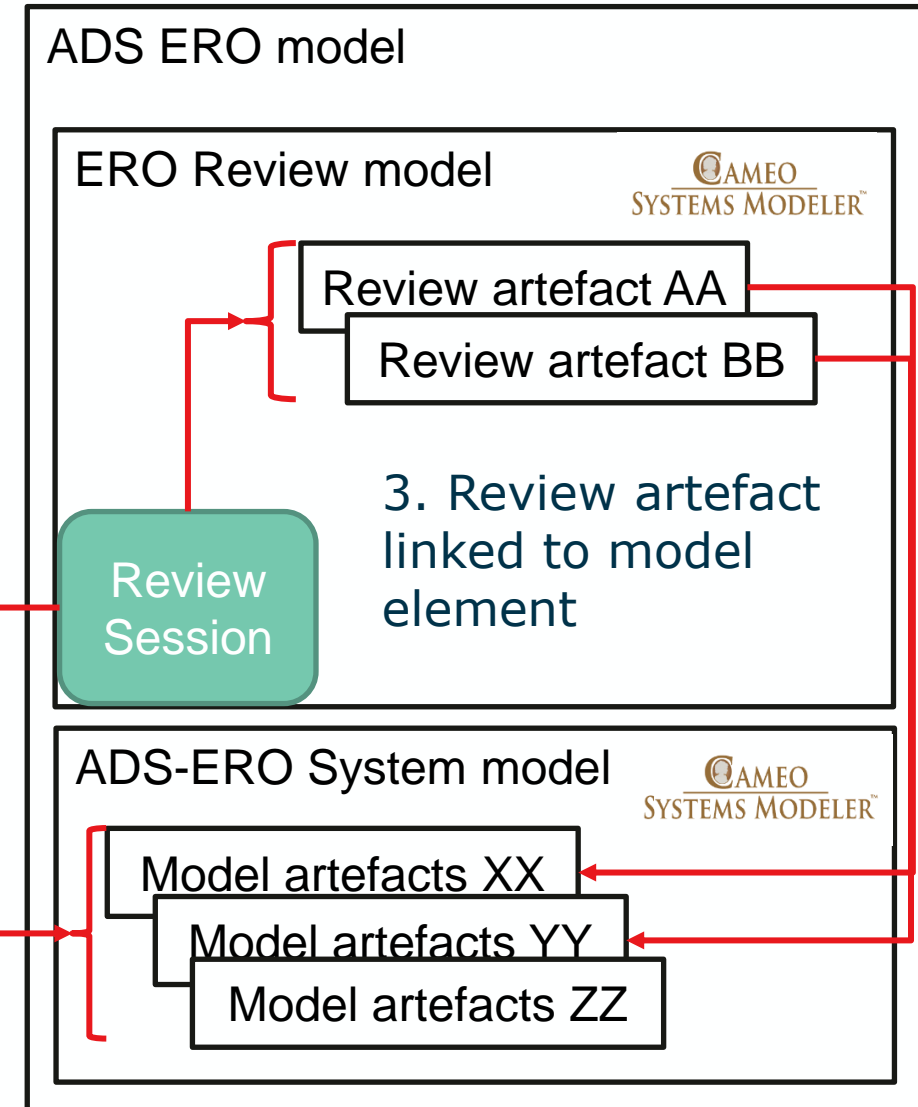
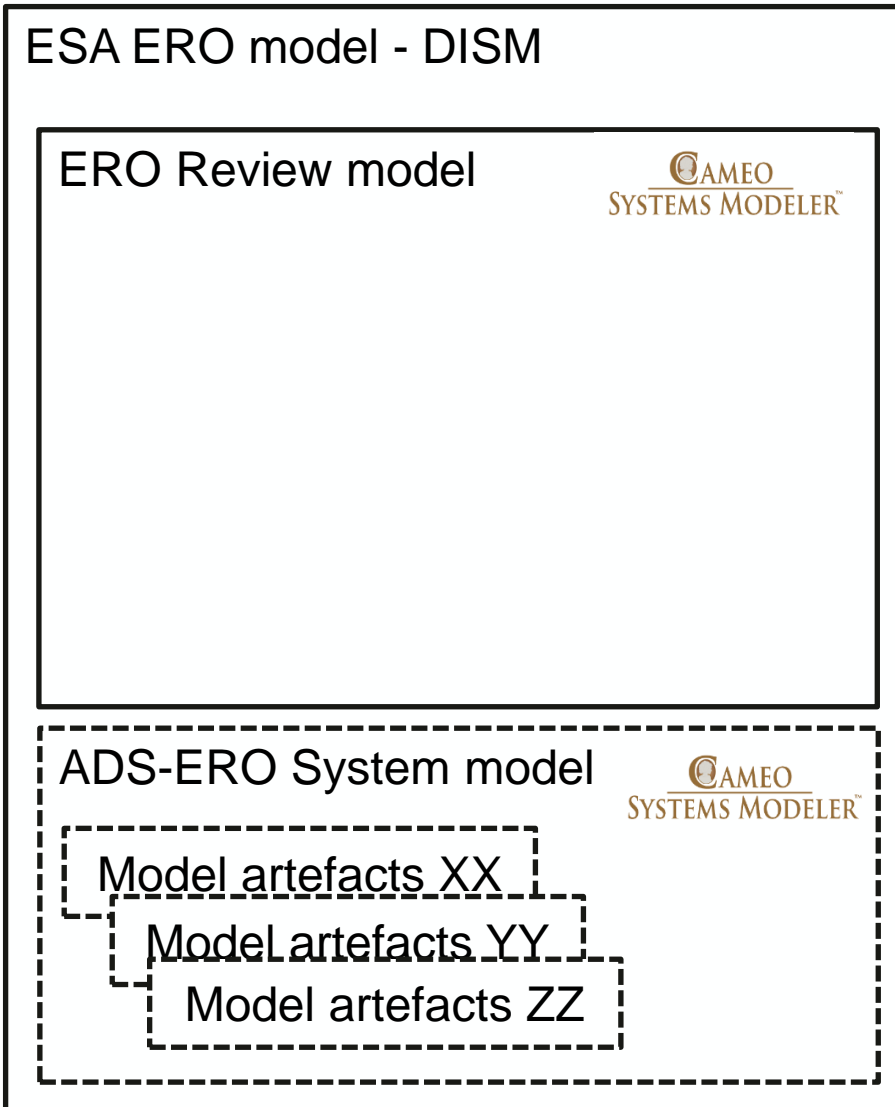
Review artefact CC

Will be used to annotate model elements during the review

Model Structure – Interface with ADS



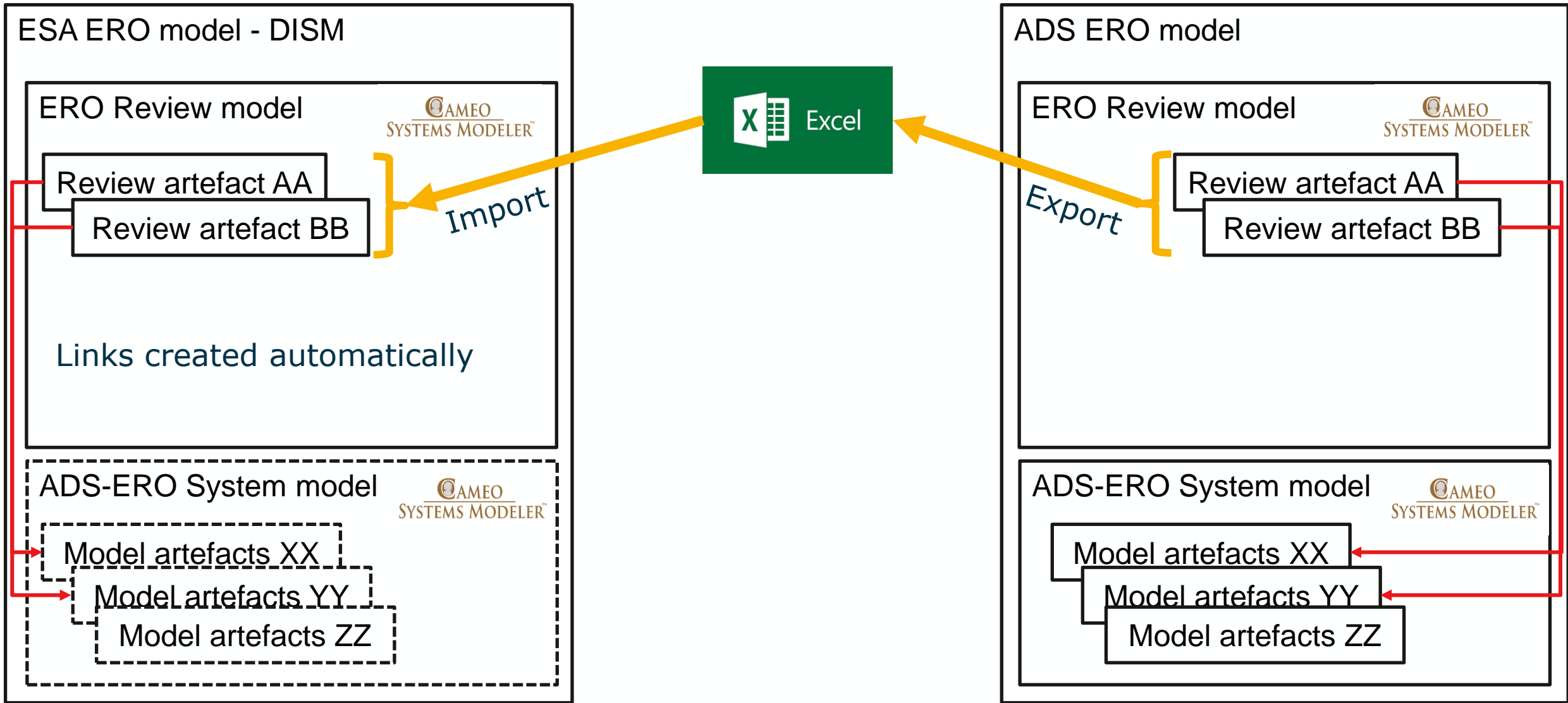
Raising Issues – Online Review



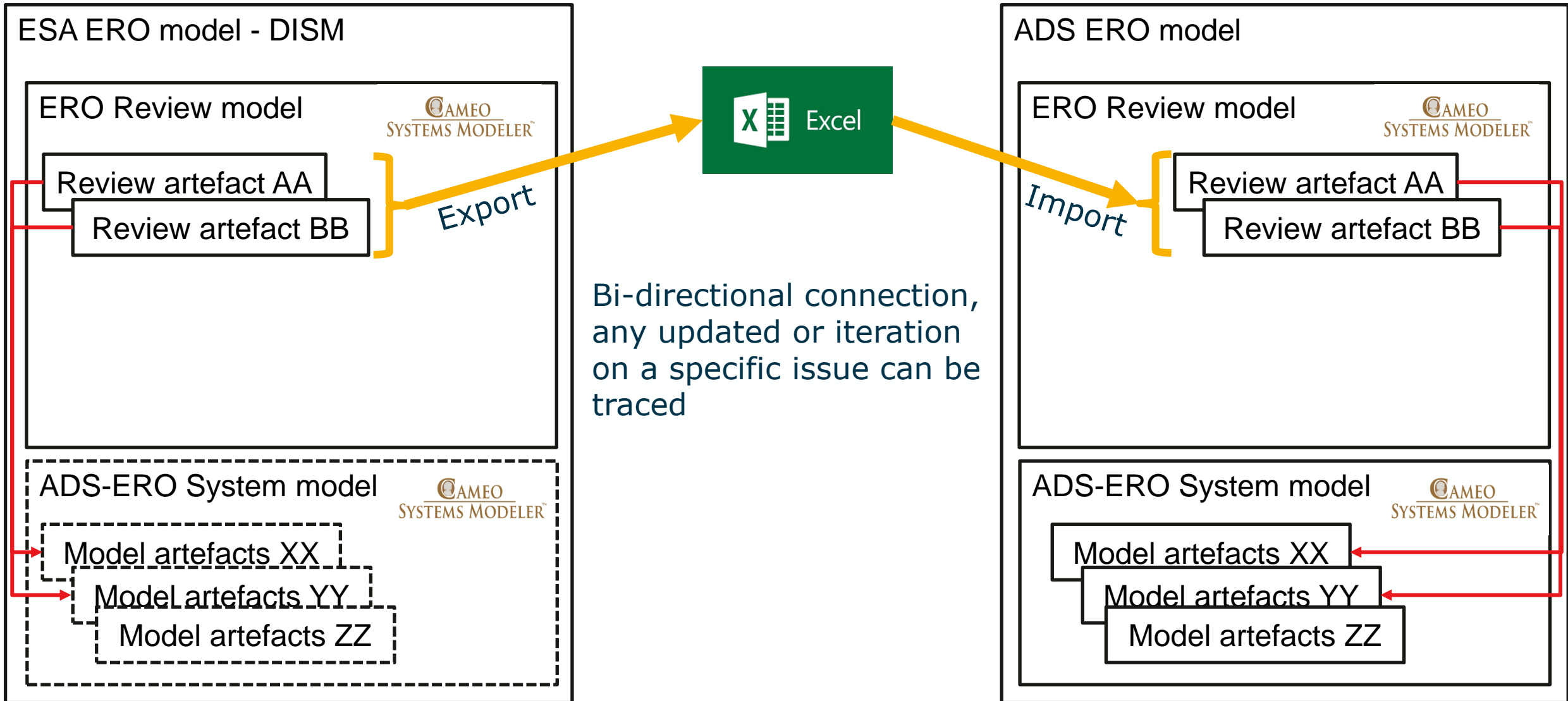
2. Raise an issue in the review model

1. Review specific aspect of the model

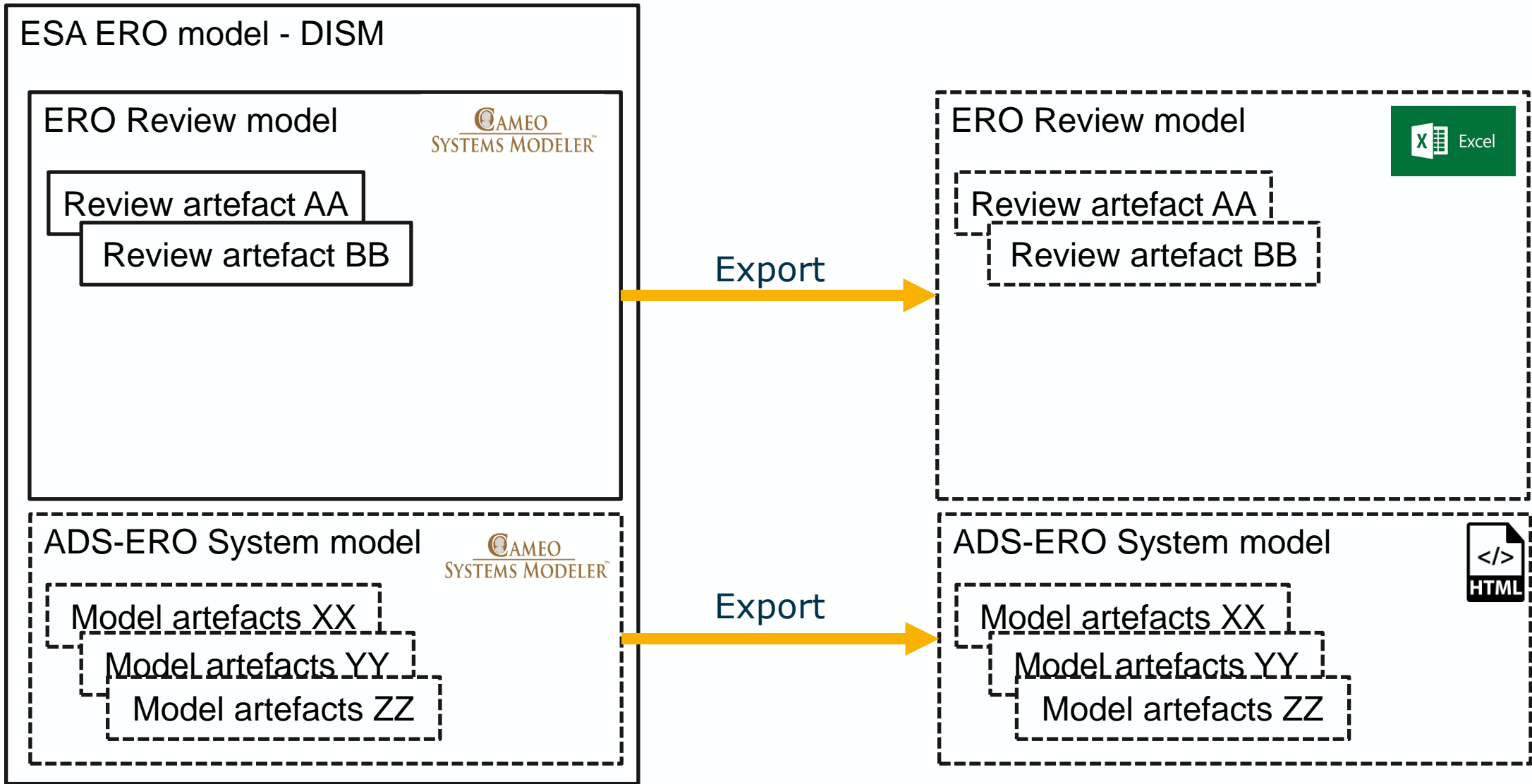
Raising Issues – Online Review



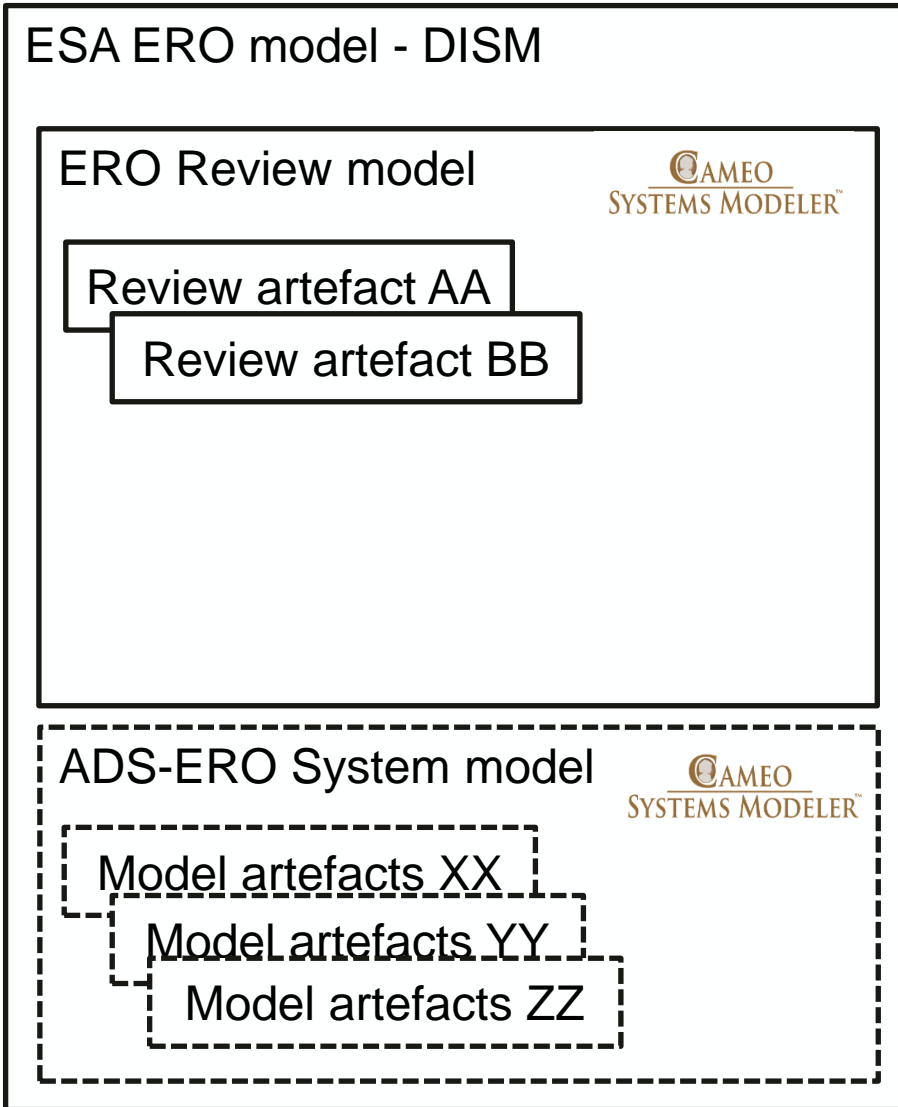
Raising Issues – Online Review



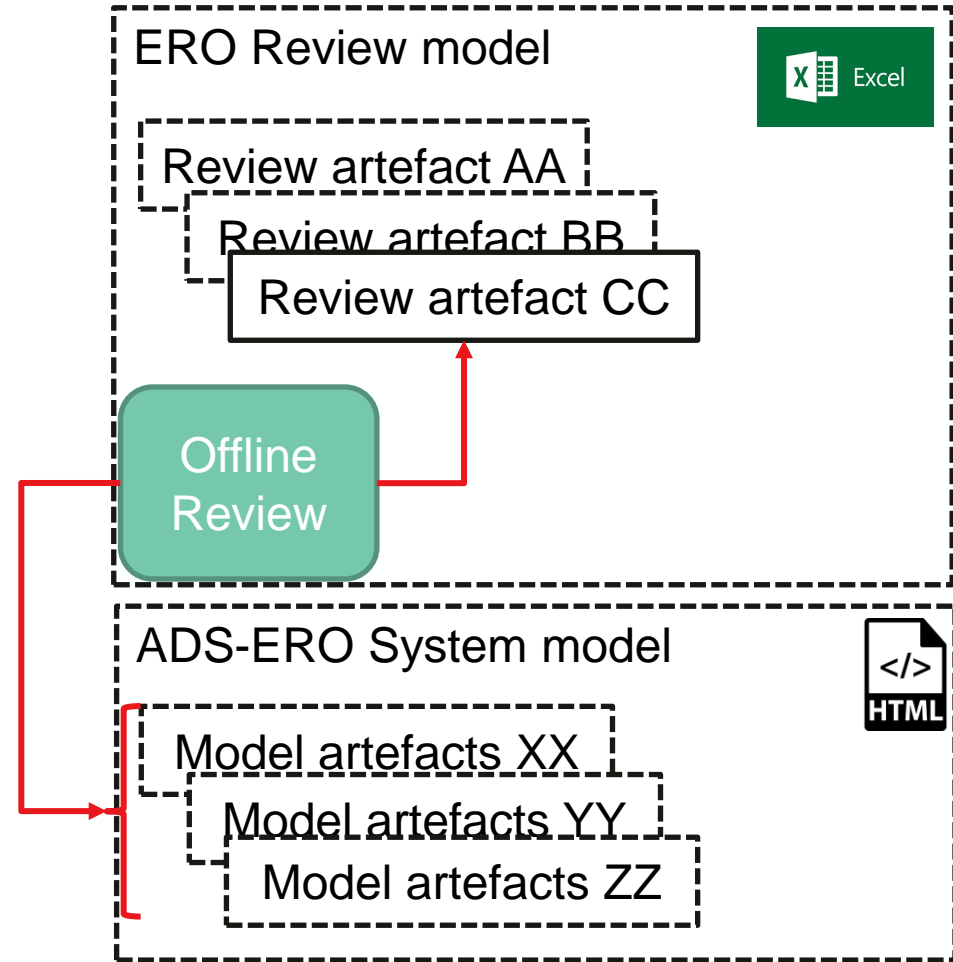
Raising Issues – Offline Review



Raising Issues – Offline Review

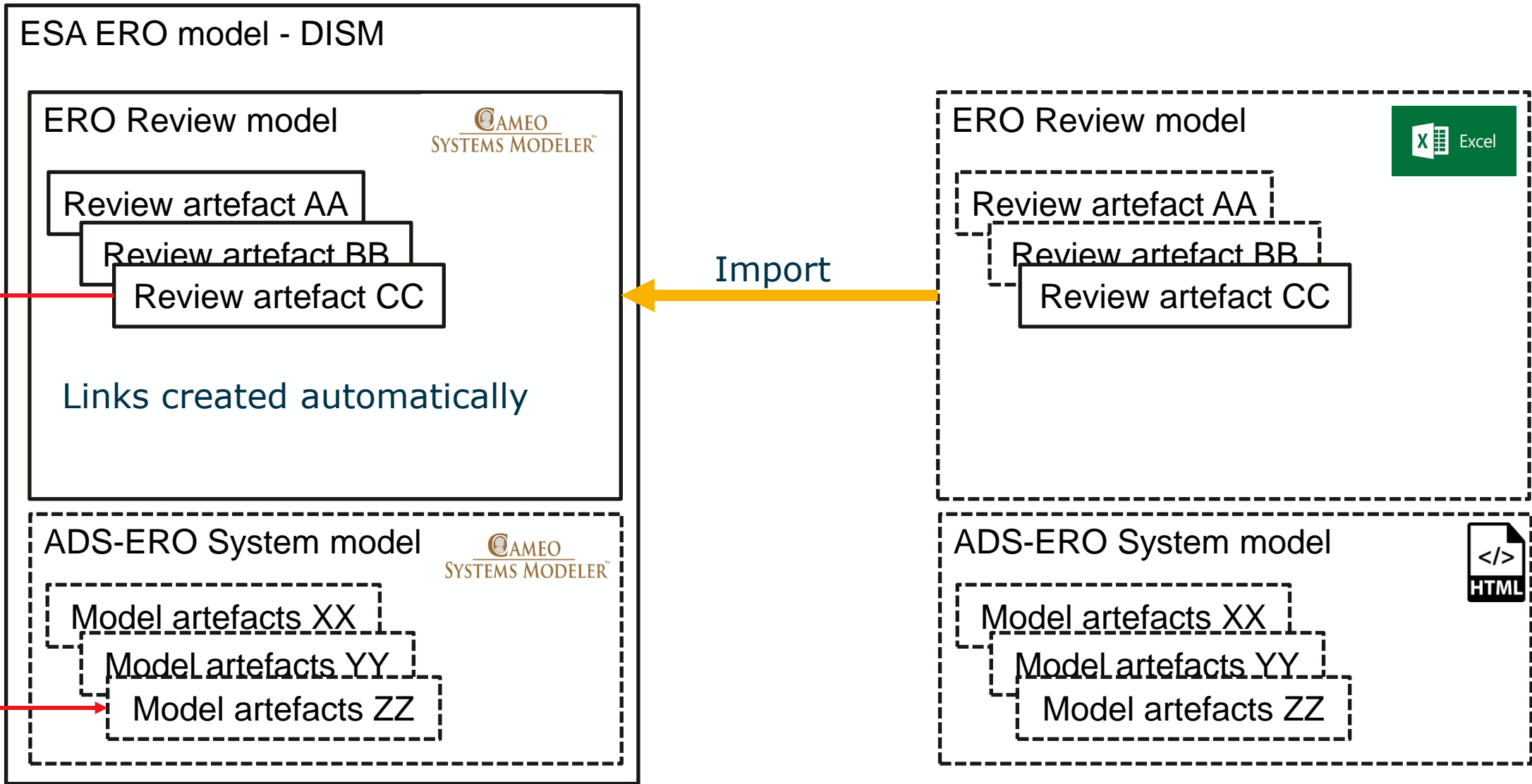


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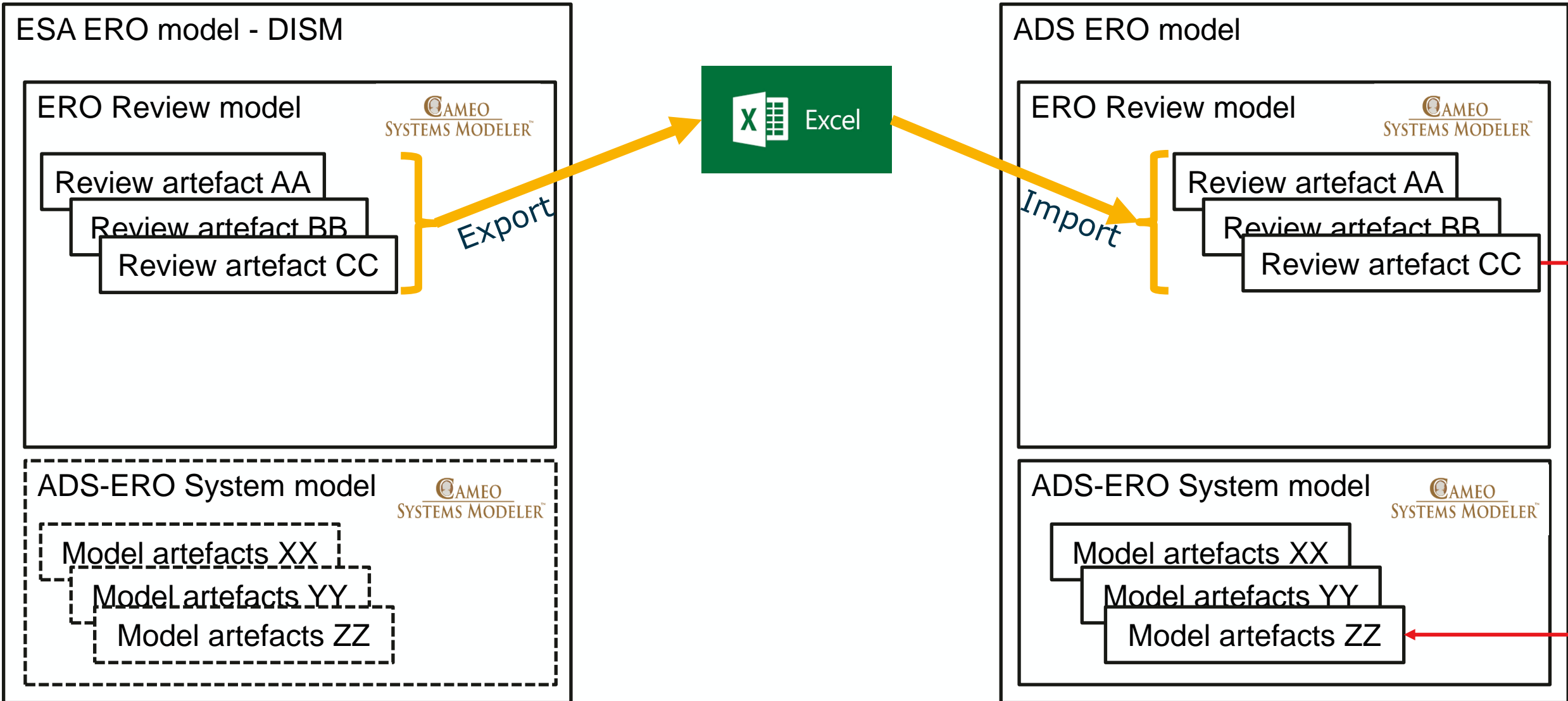


2. Raise an issue in the review model **with model artefact name**

Raising Issues – Offline Review



Raising Issues – Offline Review



Lesson Learned and feedback

- Better communication on model purpose:
 - “What is the model used for?”
 - Lack of focus on specific use cases
- Earlier and more consistent involvement of experts in the modelling effort
- More levels of granularity in model views
- Extra workload: Timing of review

Conclusion

- A first iteration of MBR was accomplished
- SysML extension allowed for a fluid creation of comments in different format with consistent tracking of its resolving within the review process
- Reviewers and experts were able to sit around the same table and review aspects from different systems and sub-systems
- Interest was positive overall

Thank you for your attention

Questions are welcomed

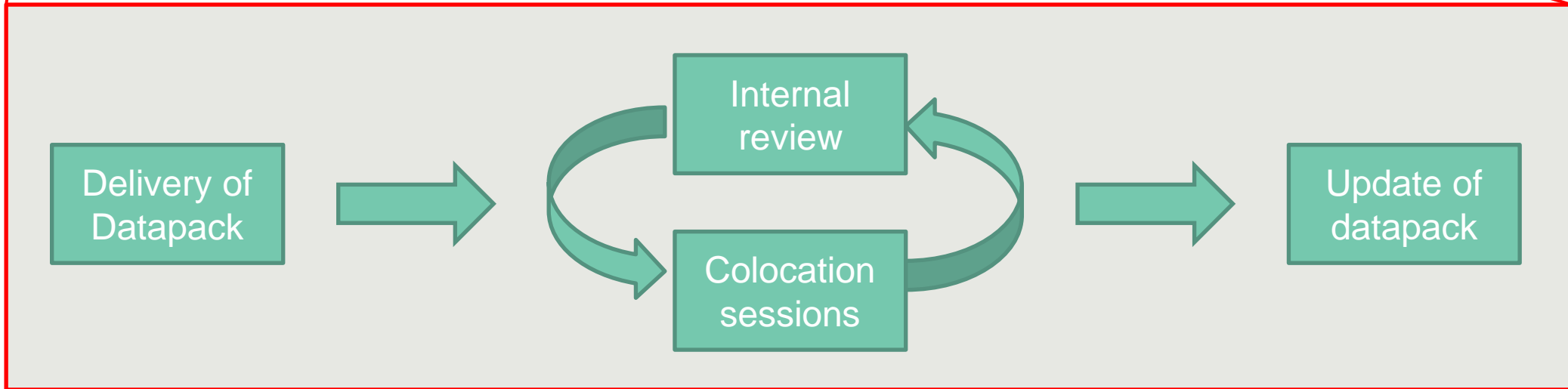
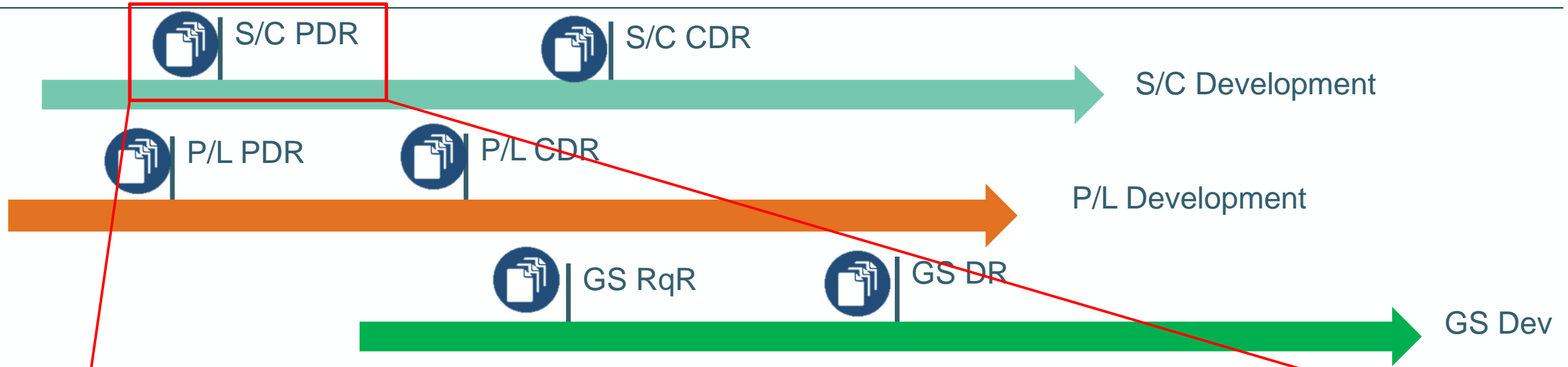
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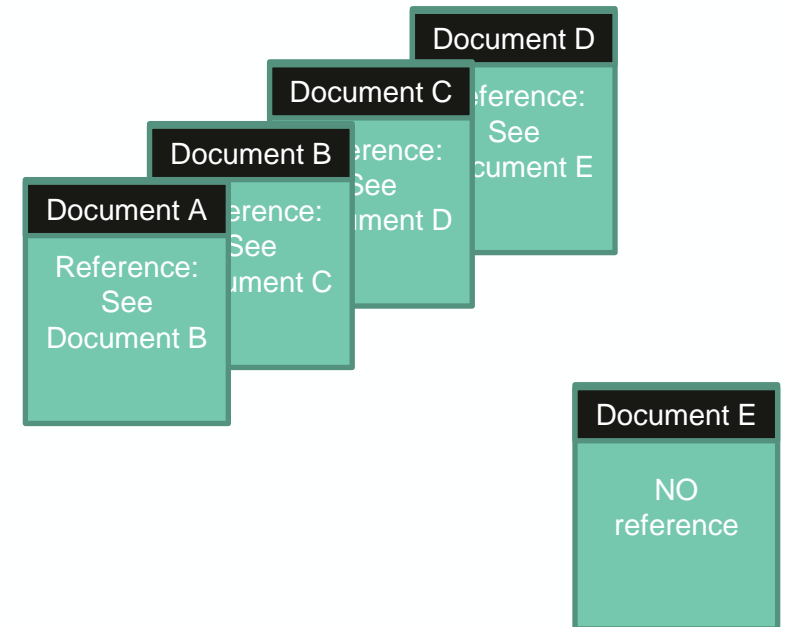
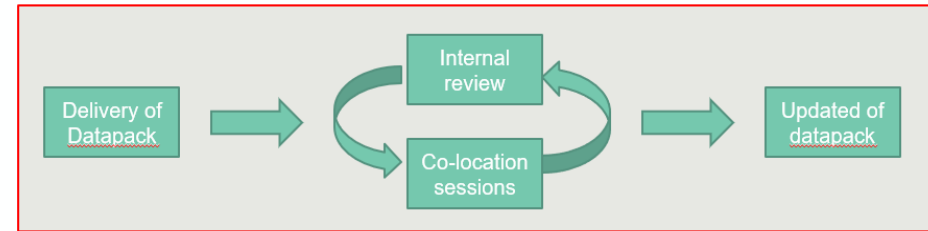


Paper Based Review Process



Paper Based Review Process

- Problems:
 - The production of these design documents are time consuming with a lot of room for consistency mistakes
 - Cross-disciplinary aspects are not necessarily captured in the level of details the reviewer would like to see (or not at all)
 - Nested document syndrome
 - Similar issues raised multiple times
 - At the end of the review design documents need to be updated



- Solution: Model Based Review