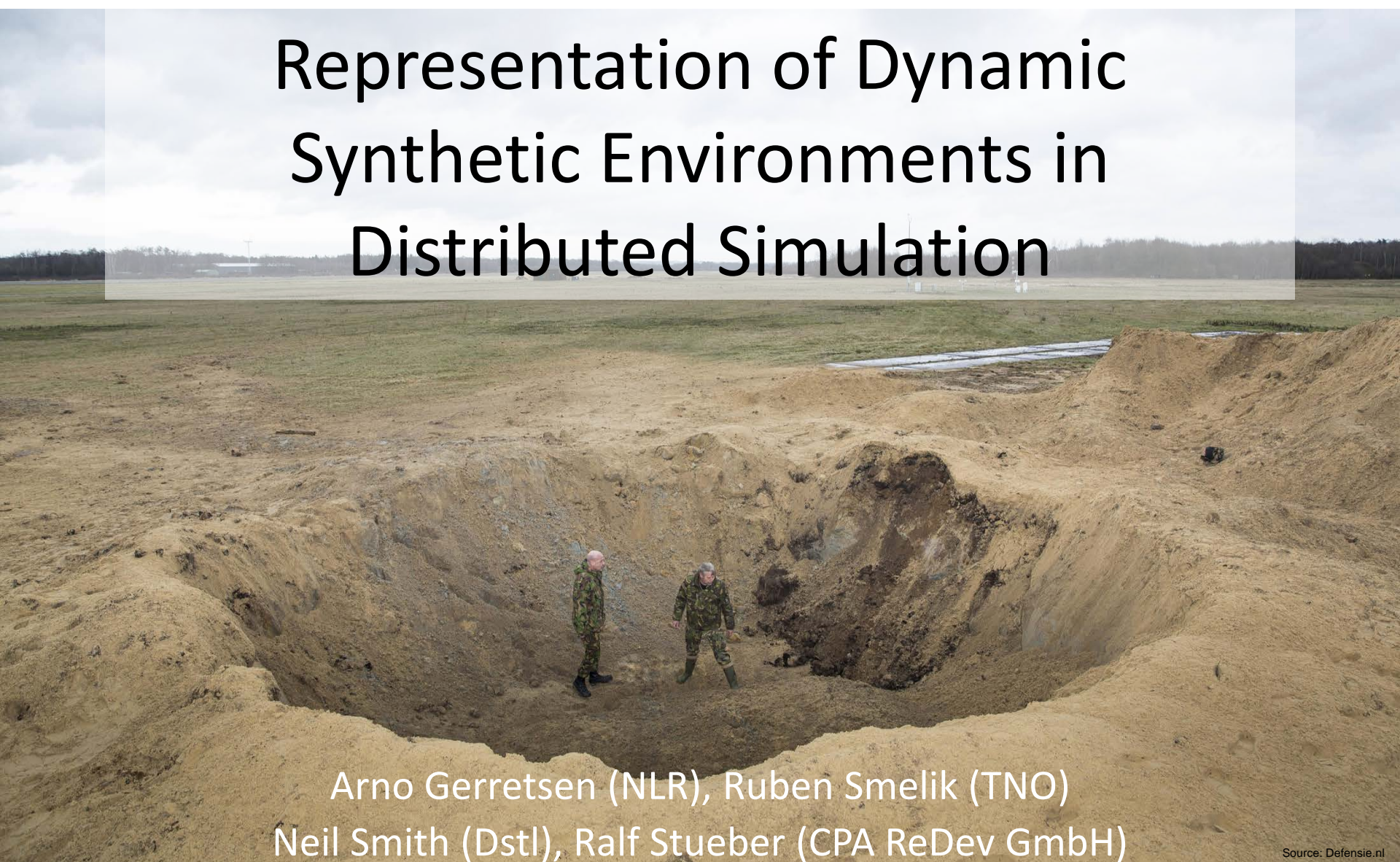


# Representation of Dynamic Synthetic Environments in Distributed Simulation



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# Content

- Relevance and background
- MSG-156 research question
- Approach
  - Use cases
  - Conceptual models
  - Initial solution architecture
  - Experimentation
- Future work

# Military operations and the environment



Take place in a complex  
natural environment



... modified by operations



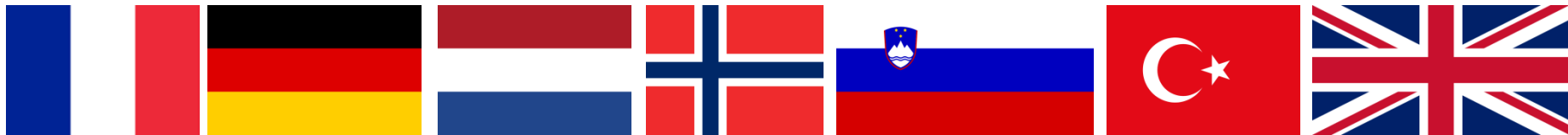
... affected by weather

# Current (distributed) simulation capabilities



# MSG-156 objectives

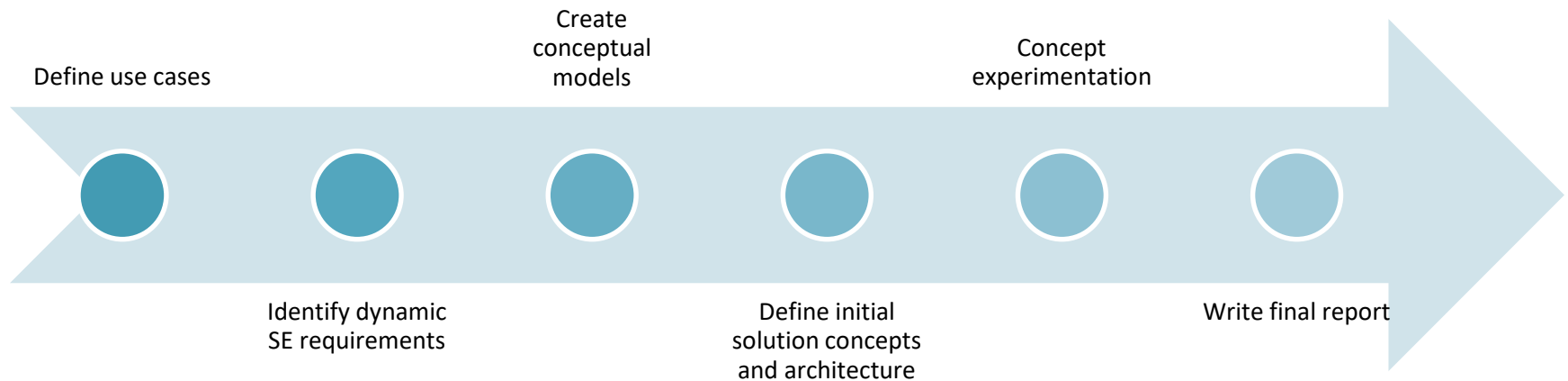
- Define **best practices**, required **methodologies**, **technologies** and inform requirements for **standards** needed to achieve a correlated dynamic SE in future distributed simulation exercises
- Evaluate methodologies and technologies through concept experimentation where needed.



# MSG-156 focus areas

- Dynamic terrain
  - Shared between exercise participants
  - Affected by natural, human geophysical and force engagement effects
  - Methods and technologies to deform the SE in a common and consistent manner
- Variable weather
  - Shared between exercise participants
  - Relevant aspects to represent
  - Available data sources
  - Methods and technologies to integrate weather in a common and consistent manner

# Task group approach



# Use cases



Close Air Support



Air engagement in realistic weather



Trafficability influenced by weather



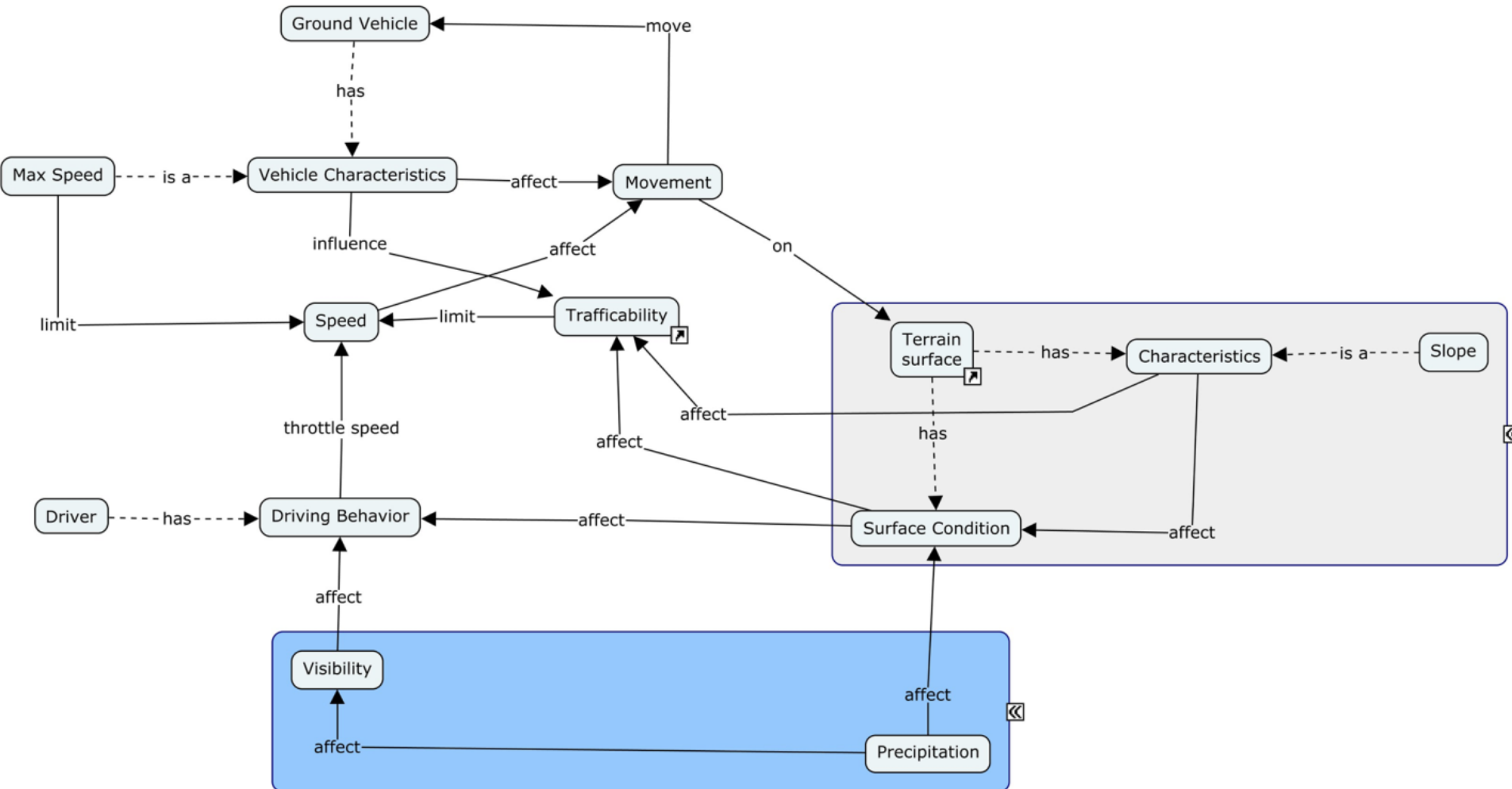
Terrain modifications



# Conceptual model

- Conceptual modelling diagrams have been created to understand ...
  - ... the concepts involved in dynamic SE
  - ... how these concepts are related to each other
- Conceptual modelling diagrams used to ...
  - ... assign responsibilities to different simulation components
  - ... Create initial solution architecture for dynamic SE

# Conceptual model



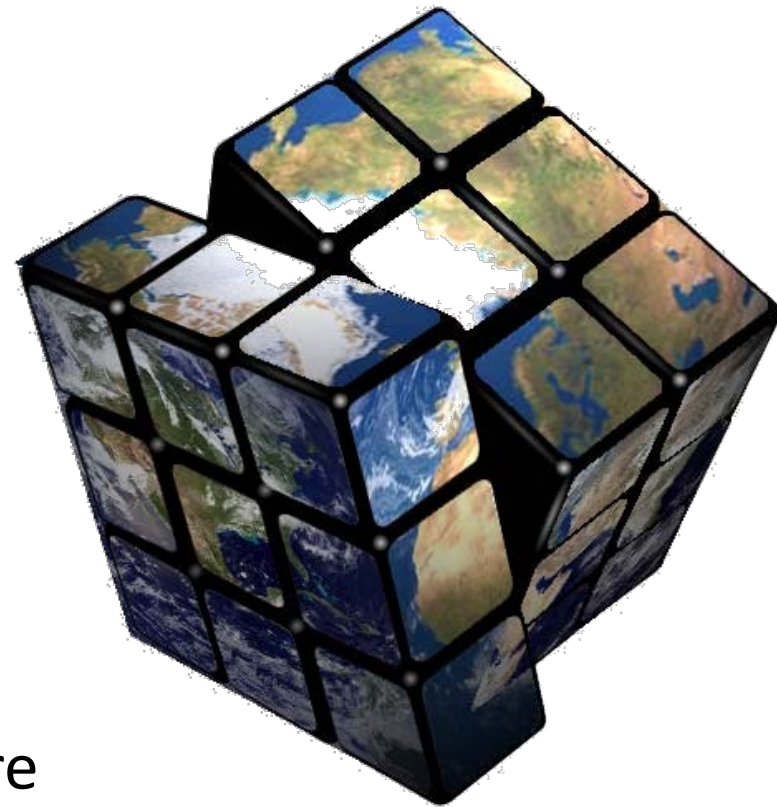
# Solution architecture

- Traditionally each simulation is responsible for its own SE
  
- Achieving a correlated dynamic SE is hard
  - Modifications need to be made by each system
  - Common models and techniques for these modifications are needed



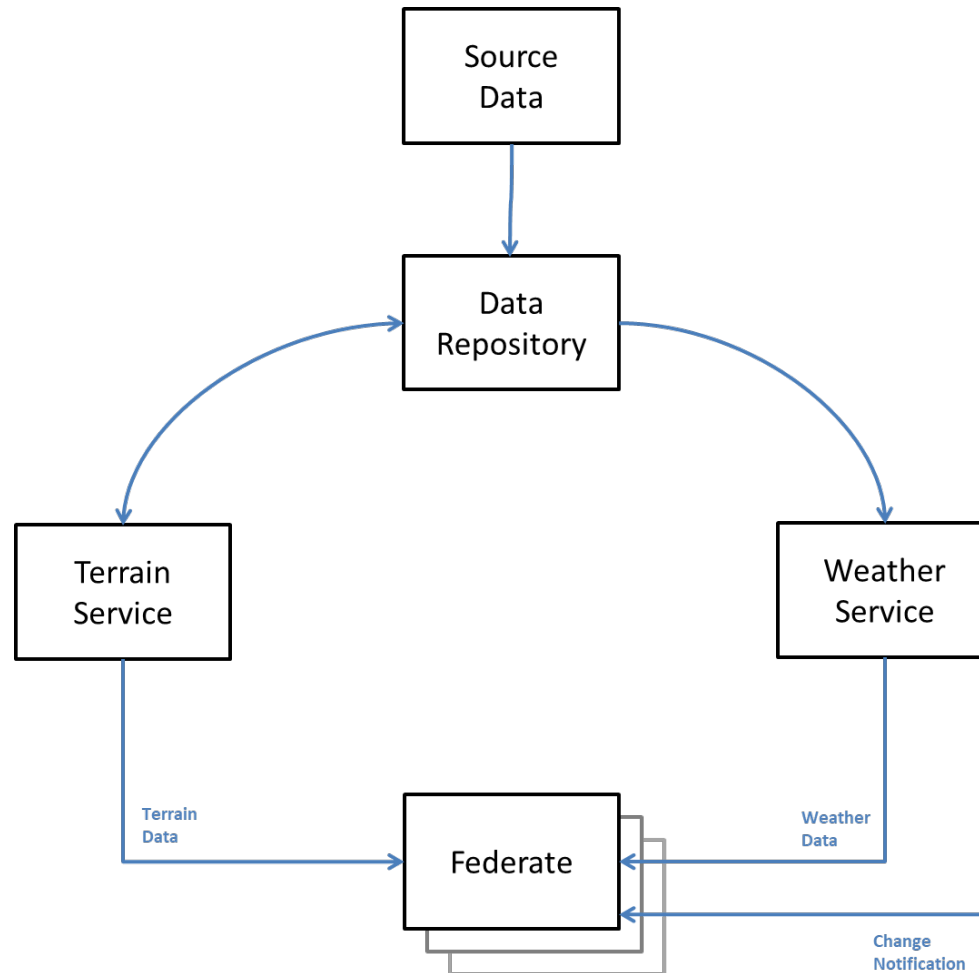
# Solution architecture

- Using MSaaS technologies one central SE representation could be used by all participants
- Modifications to the SE only have to be made once!
- Paradigm shift compared to most existing simulation systems
- MSG-156 decided to go for a MSaaS based solution architecture

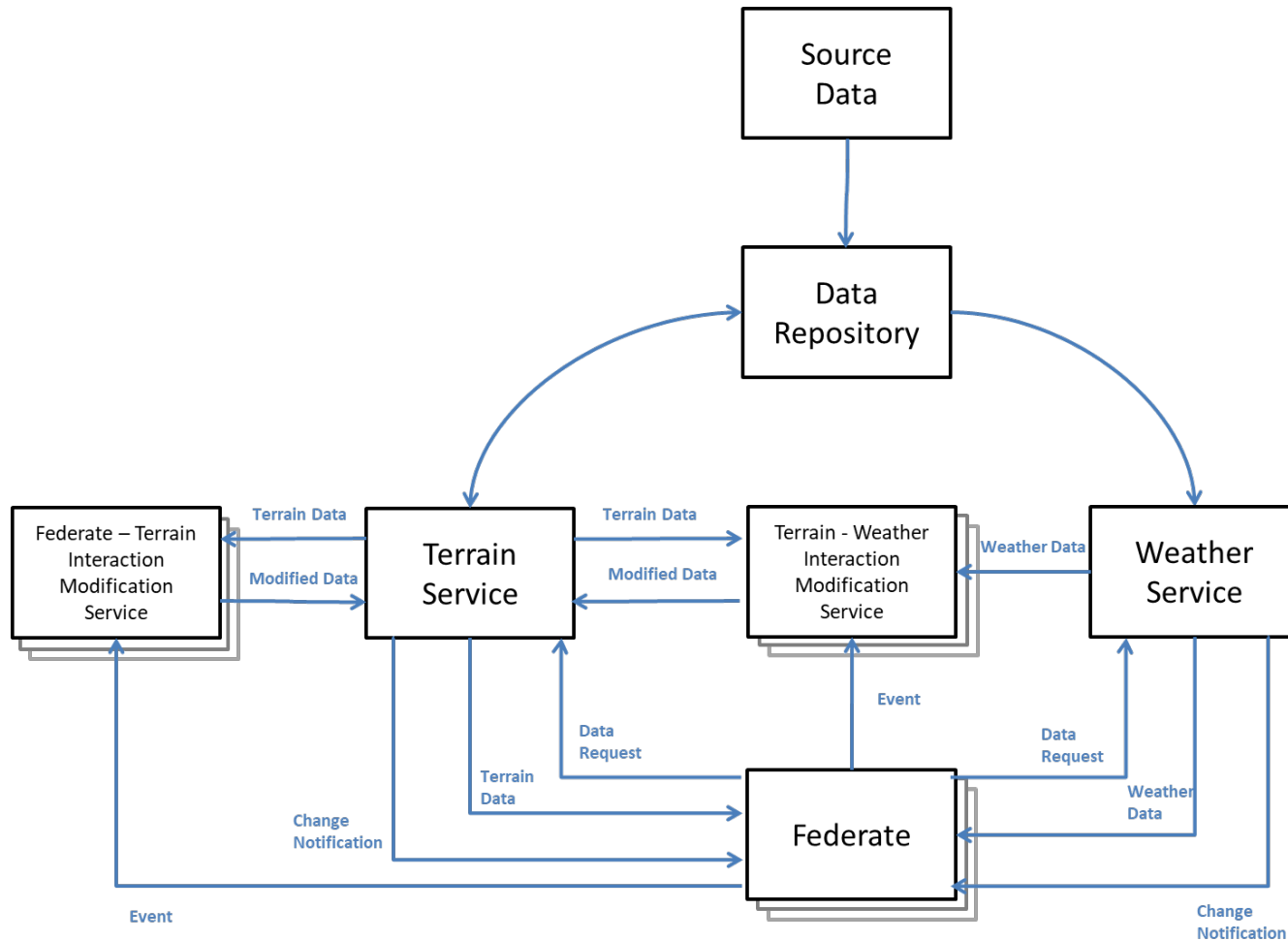


Source: Frank Adamo

# Service based architecture for static SE

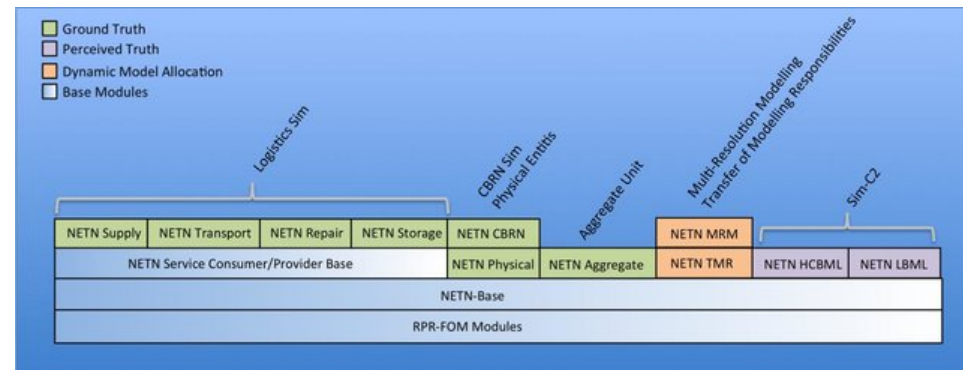
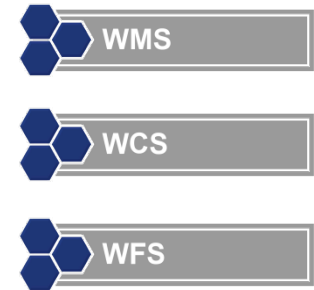


# Service based architecture for dynamic SE



# Interfaces

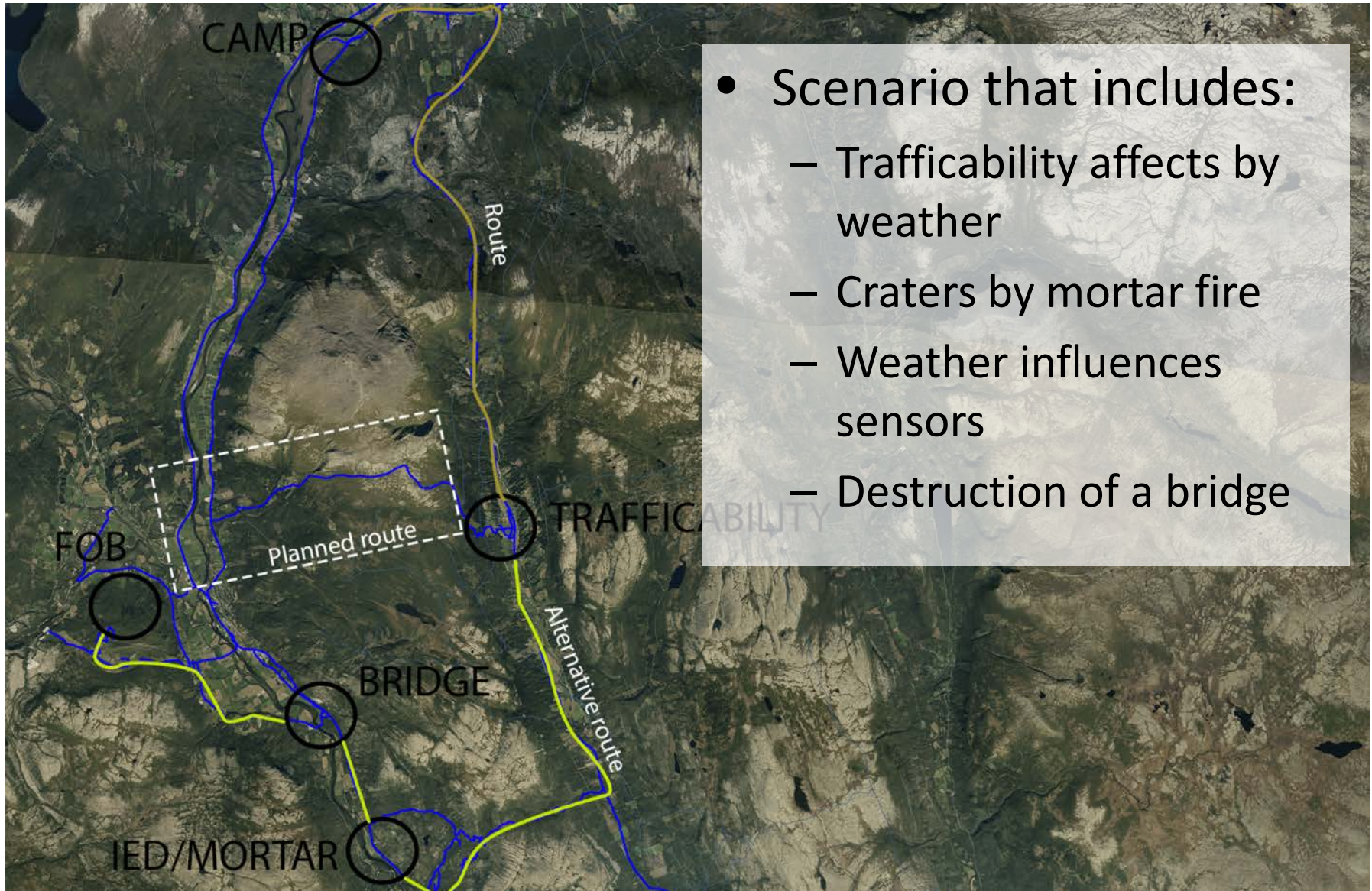
- Raster data: OGC WMS/WCS
- Vector data: OGC WFS
- HLA weather FOM



# Experimentation

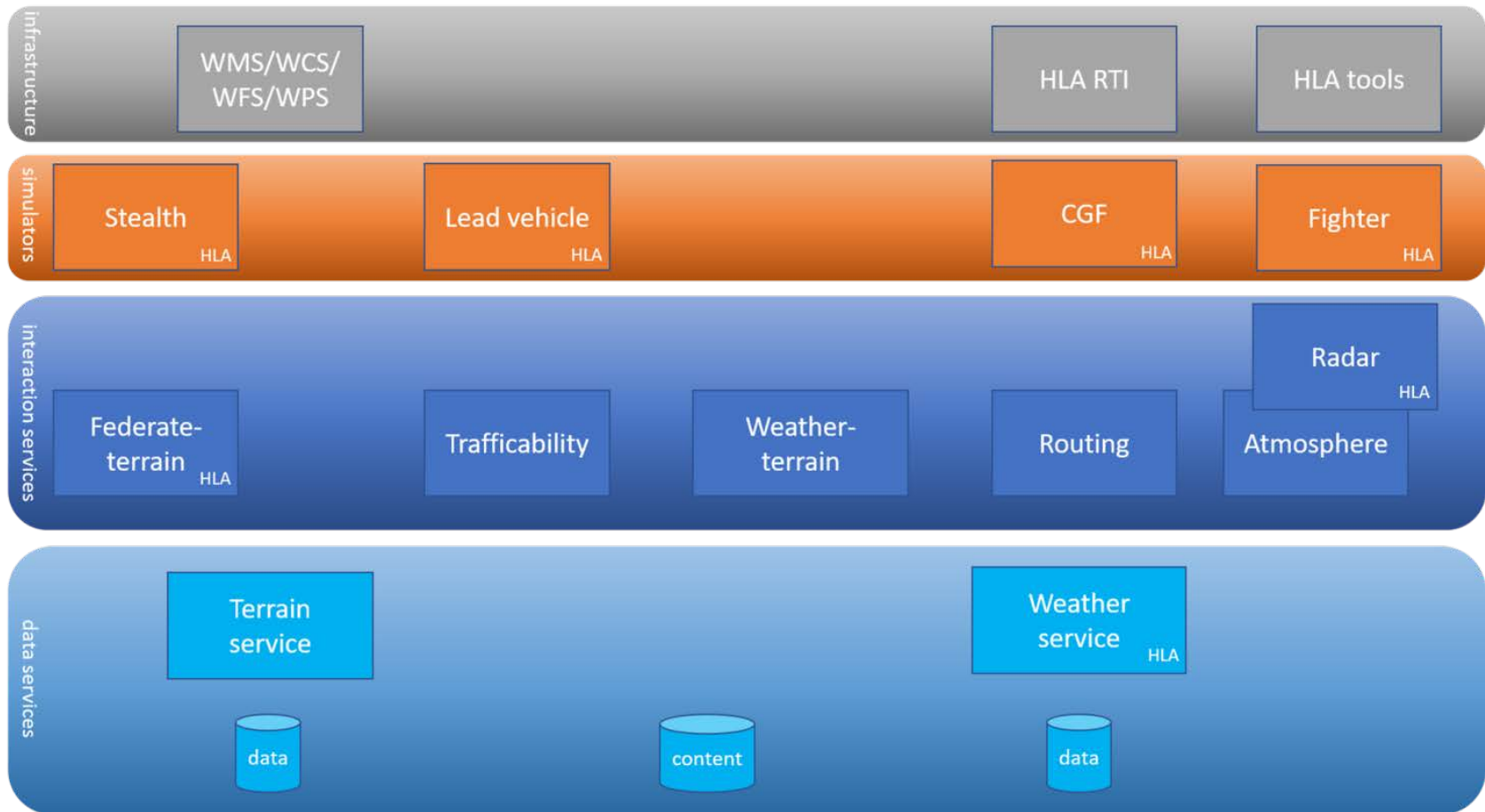
- Try the proposed solution architecture in a practical experiment
- Get hands-on experience with:
  - Impact of using dynamic SE services in MTDS
  - Requirements on needed interfaces and standards
- Use lessons learned for the recommendations in the final report





- Scenario that includes:
  - Trafficability affects by weather
  - Craters by mortar fire
  - Weather influences sensors
  - Destruction of a bridge

# Experiment assets



# Future work

- Experiment / demonstration by mid 2020
- Final report end of 2020, with recommendations about ...
  - ... needed M&S technologies and services to achieve a correlated representation of a dynamic SE
  - ... the best architecture for insertion of a dynamic SE into MTDS
  - ... needed standards and (potentially) development of future standards

# Questions



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