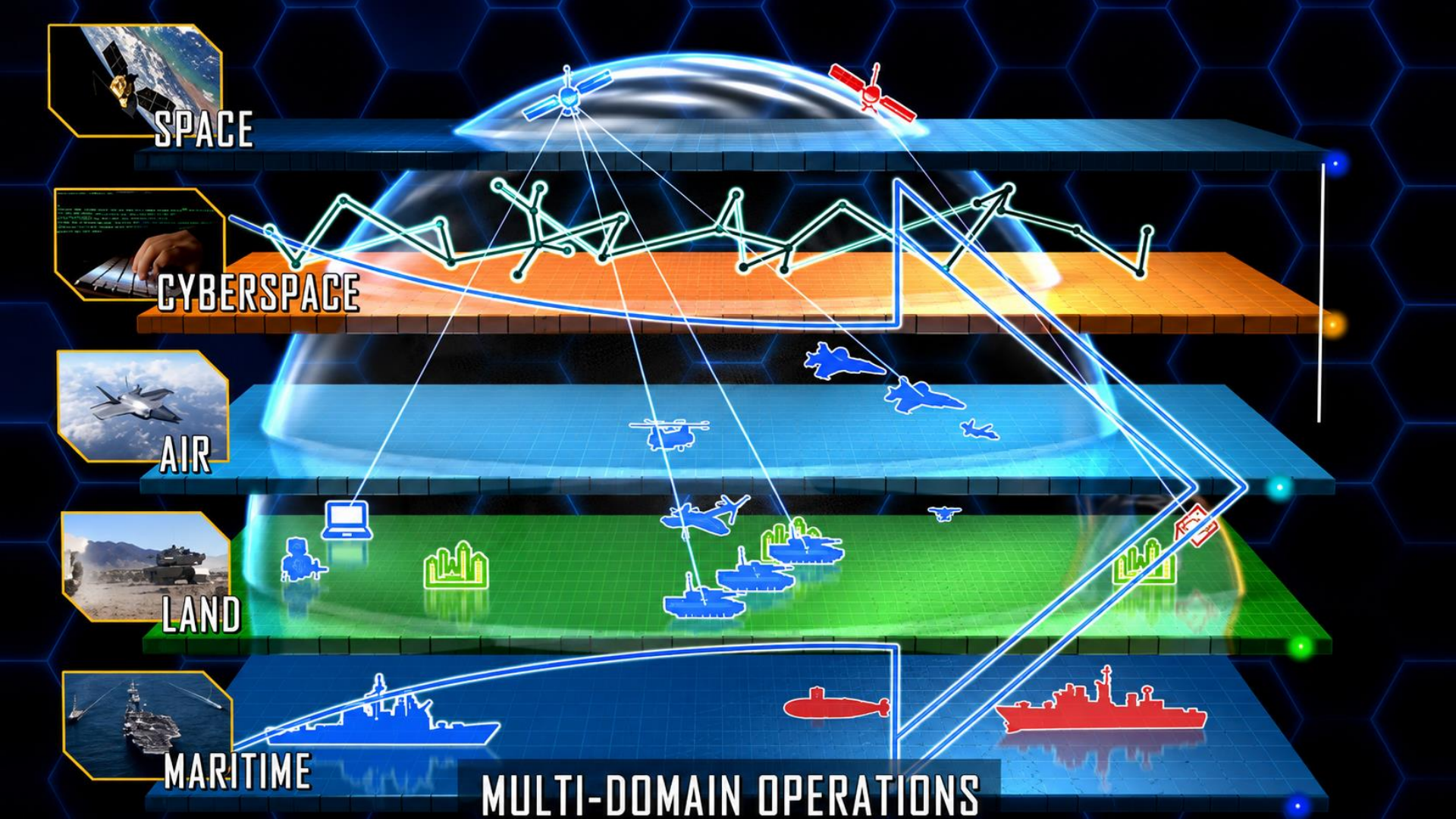
Accelerating the future of aerospace

PYRAMID

Enabling Interoperable Multi-Domain Operations Simulations for Wargaming

Hajo Erwich


SPACE
CYBERSPACE
AIR
LAND
MARITIME
MULTI-DOMAIN OPERATIONS

Outline

- Background
- System design
- PYRAMID Workflow
- Technical Overview
- Case study: Scenario
- Case study: Setup
- Conclusion

FFI Norwegian Defence Research Establishment

25/036

FFI-RAPPORT

Simulation of multi-domain operations for experimentation and analysis

– requirements and available tools

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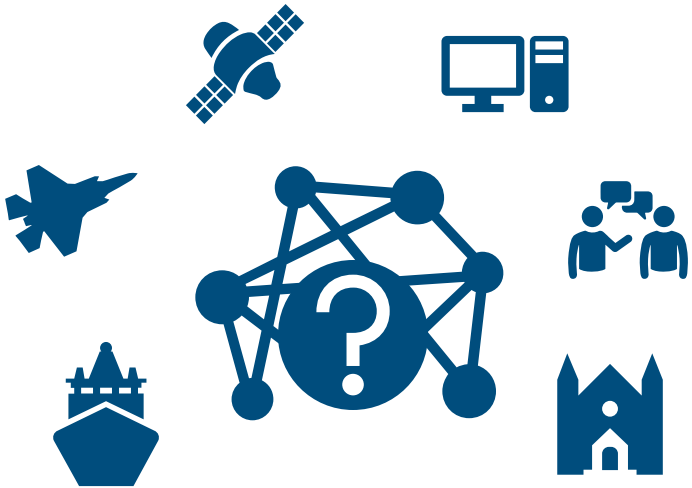
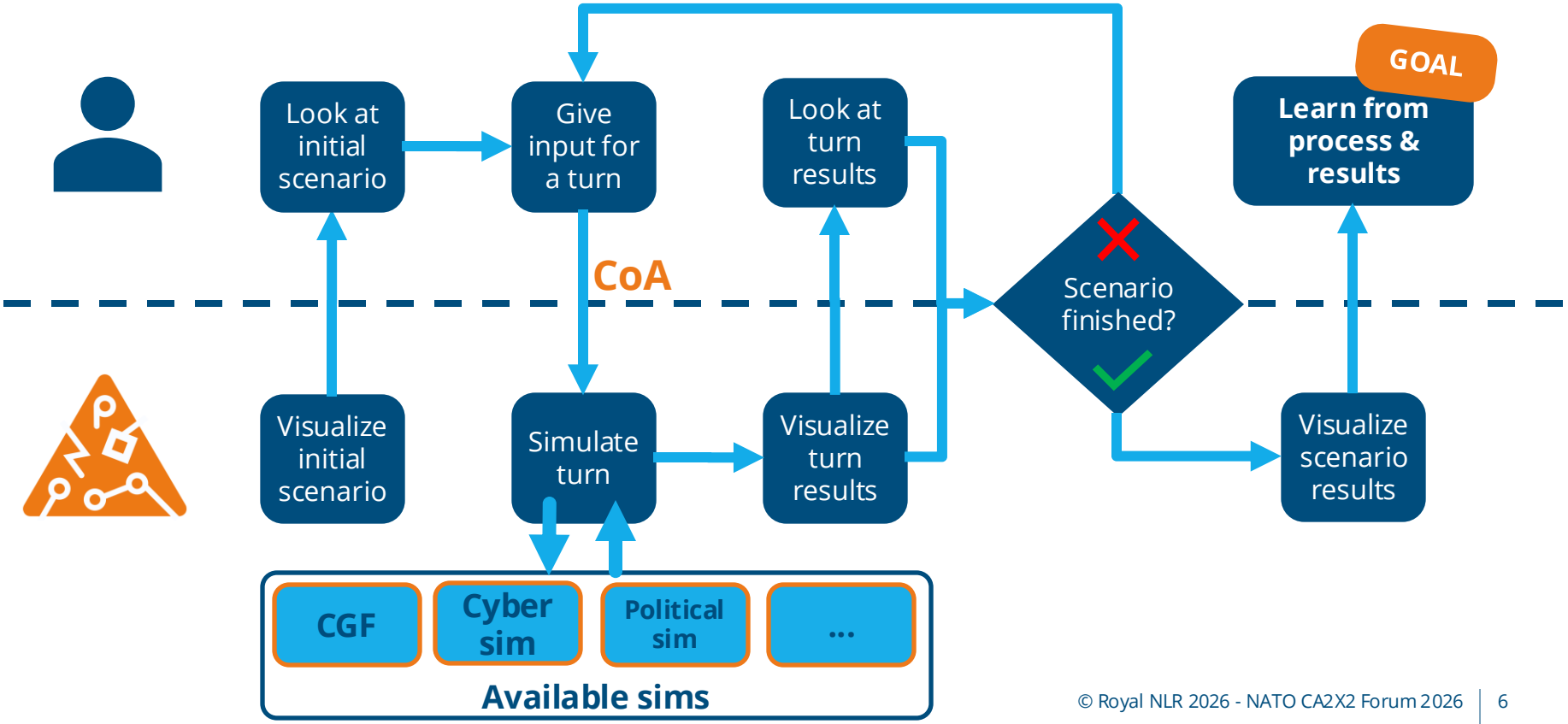
In the past...

one single simulation

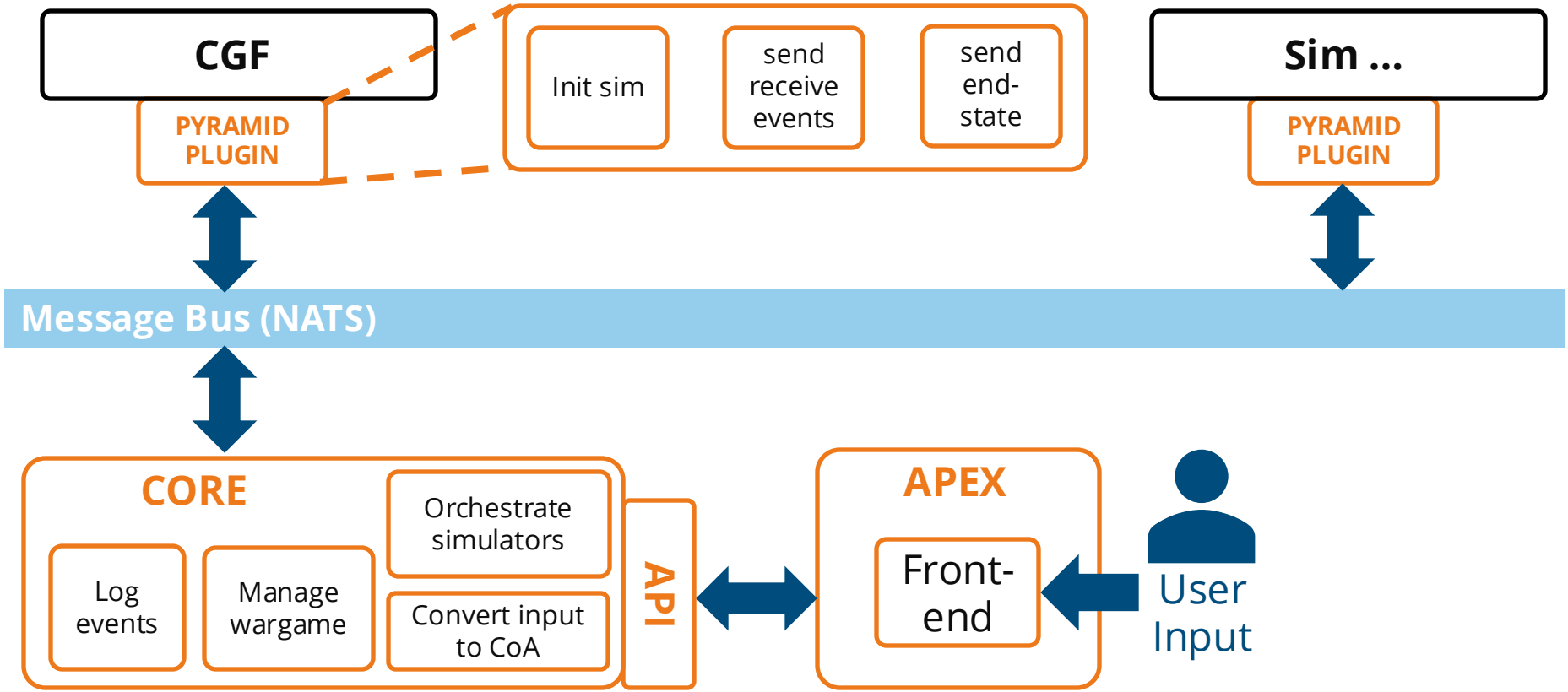
The future



PYRAMID Workflow



Technical Overview



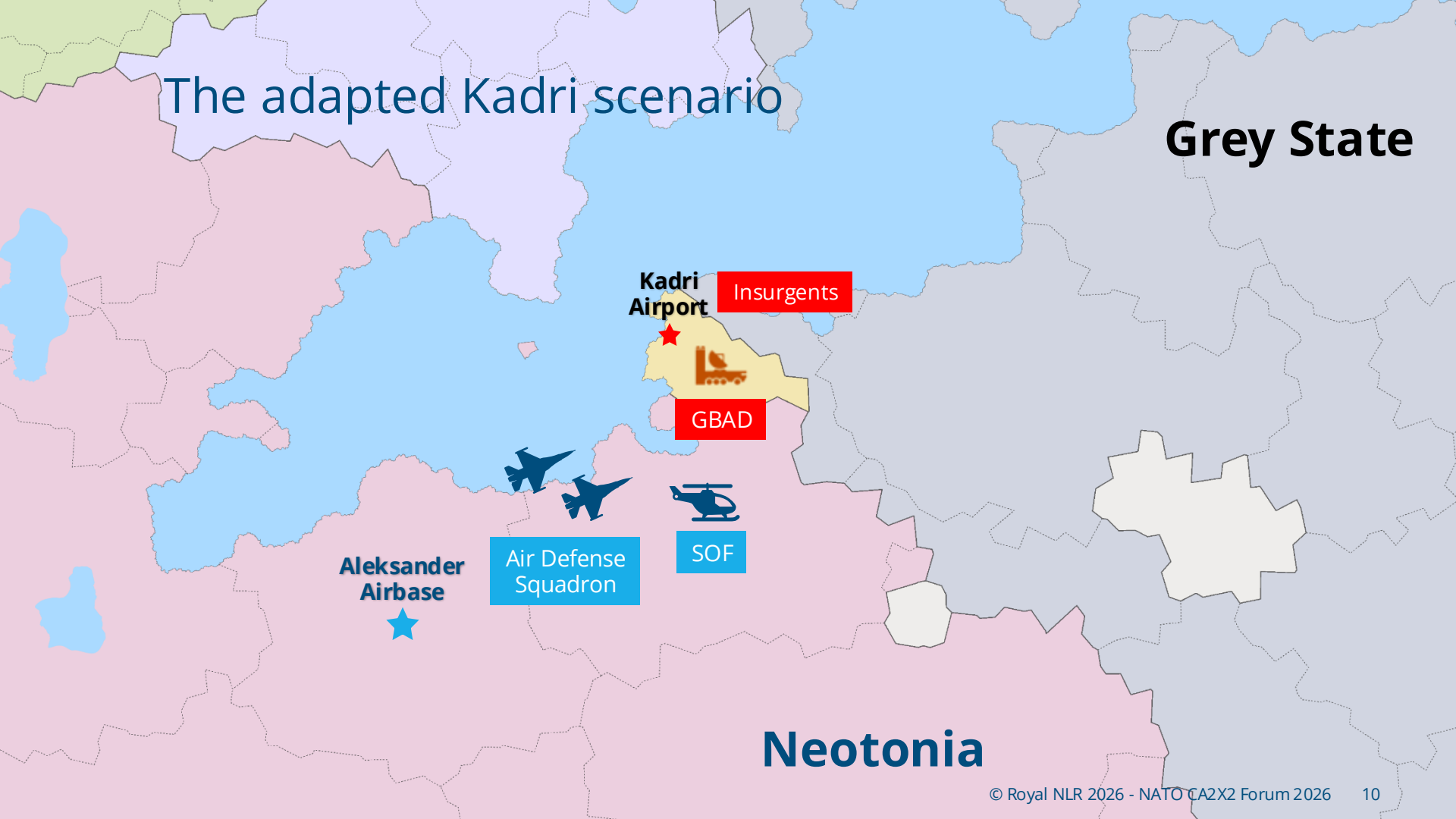
Command Parser Example

"Task hacker group to disable the Neotonian power grid via a DDoS attack."

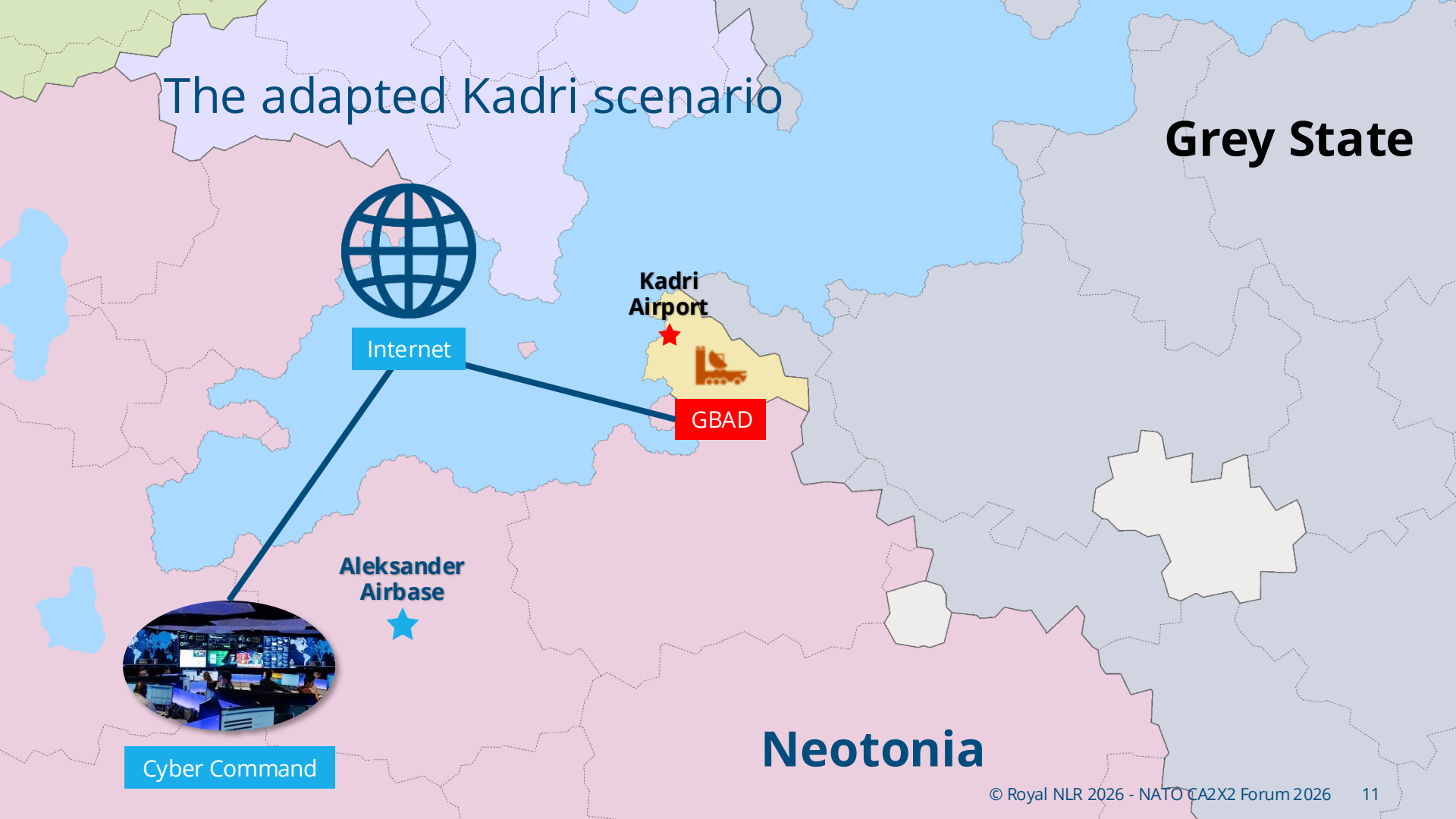
```
[    // CyberOffenseCommand
    {
        metadata: {
            guid: "da708985-51fd-4e6e-9418-97f16b5a3fa0"   // Unique identifier
            wallClockTime: "2026-07-24Z07:35:27"           // Current wall-clock time
            simulationTime: "2026-03-14Z12:05:21"          // Current simulation time
            timeElapsed: 321                               // Seconds from start of scenario
            source: "Pyramid.Core"
        }
        actor: {
            marking: "hacker group"                        // Name of acting entity
        }
        target: {
            marking: "Neotonian power grid"                // Name of targeted entity
        }
        attack_type: DENIAL_OF_SERVICE                     // Type of cyber offense
        attack_vector: INET                                // Attack vector
        effect: DISABLED                                   // Desired outcome
    }
]
```

Case study

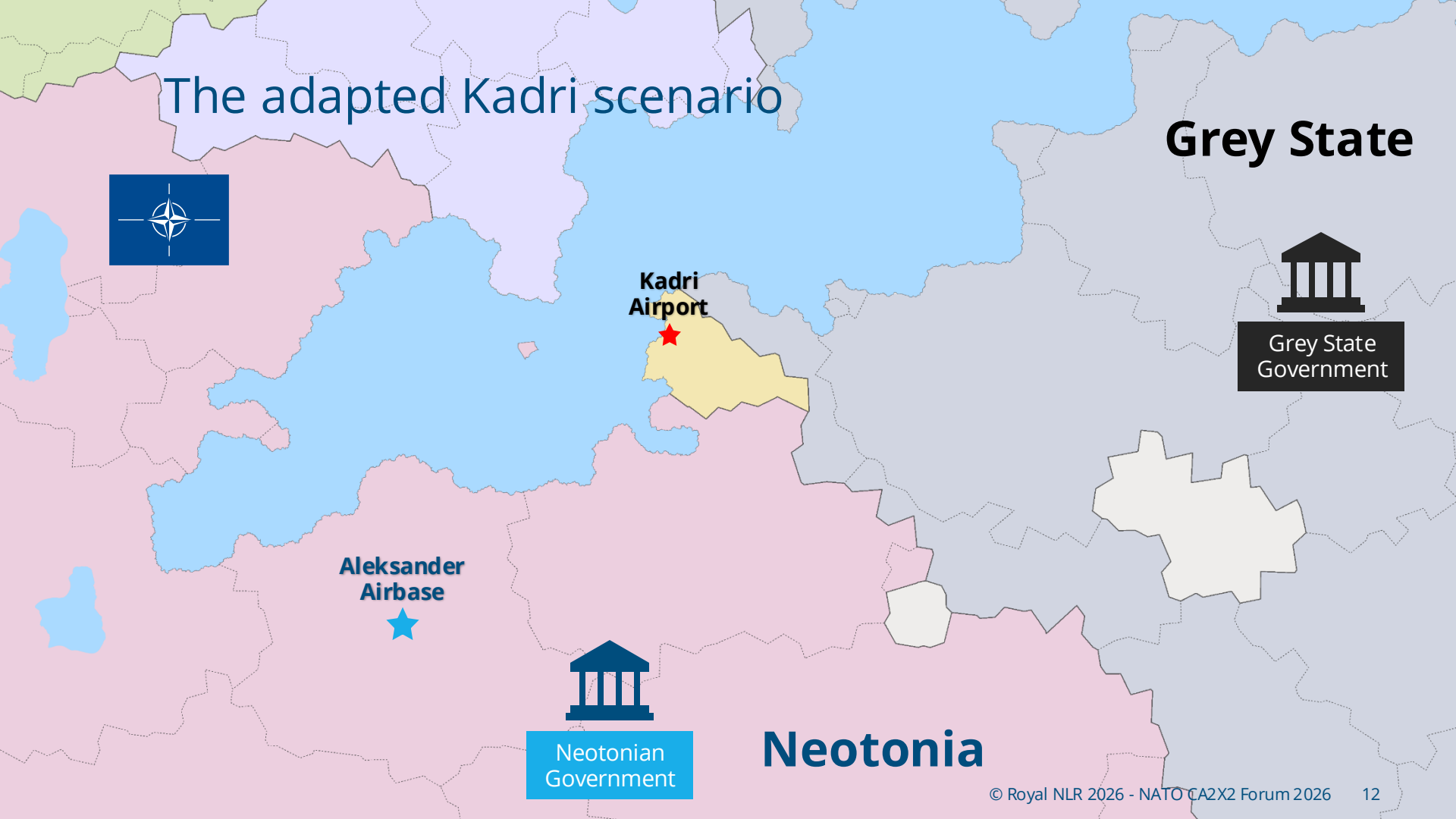
The adapted Kadri scenario



The adapted Kadri scenario

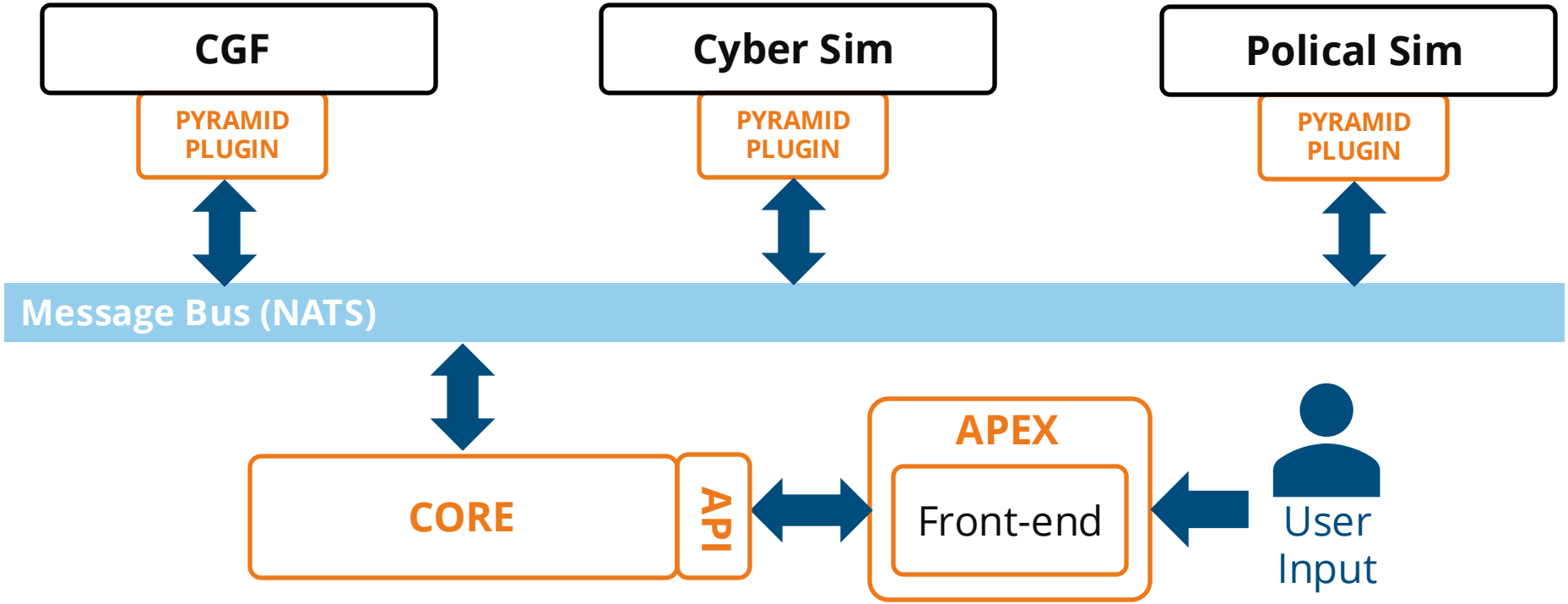


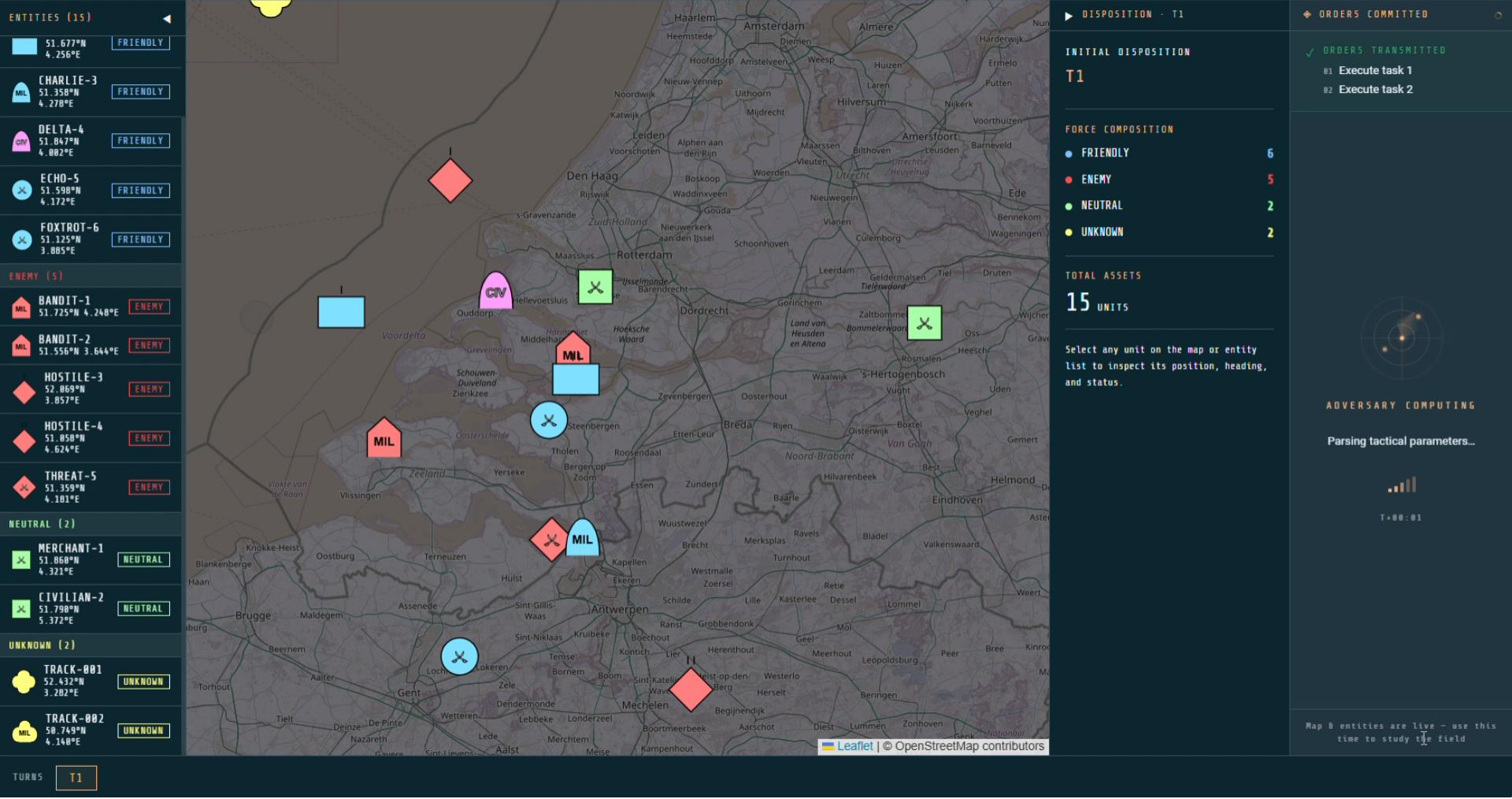
The adapted Kadri scenario



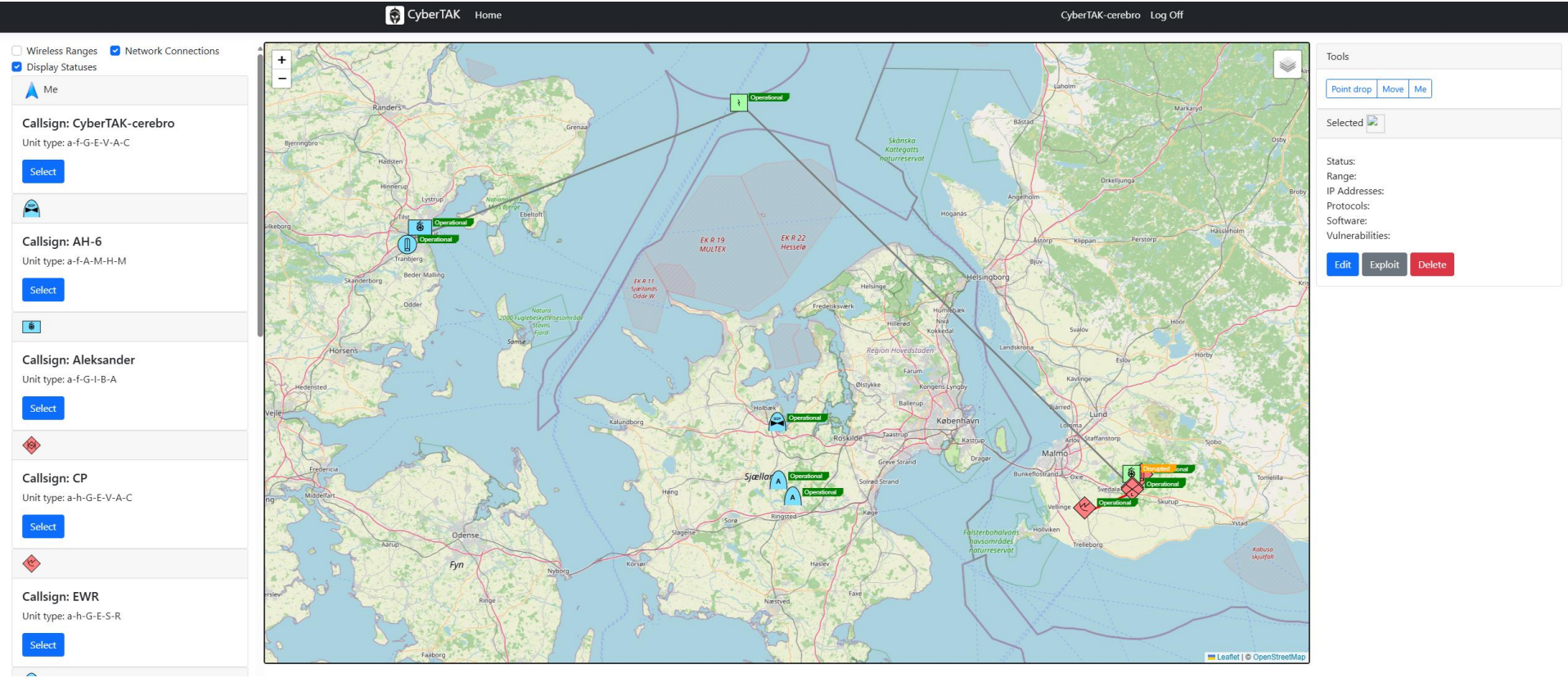
The adapted Kadri scenario

Case study implementation




ENTITIES (15)
51.677°N 4.256°E FRIENDLY
CHARLIE-3 51.358°N 4.278°E FRIENDLY
DELTA-4 51.847°N 4.002°E FRIENDLY
ECHO-5 51.598°N 4.172°E FRIENDLY
FOXTROT-6 51.125°N 3.885°E FRIENDLY
ENEMY (5)
BANDIT-1 51.725°N 4.248°E ENEMY
BANDIT-2 51.556°N 3.644°E ENEMY
HOSTILE-3 52.069°N 3.857°E ENEMY
HOSTILE-4 51.858°N 4.624°E ENEMY
THREAT-5 51.359°N 4.181°E ENEMY
NEUTRAL (2)
MERCHANT-1 51.860°N 4.321°E NEUTRAL
CIVILIAN-2 51.790°N 5.372°E NEUTRAL
UNKNOWN (2)
TRACK-001 52.432°N 3.282°E UNKNOWN
TRACK-002 50.749°N 4.148°E UNKNOWN
CIV
MIL
Leaflet | © OpenStreetMap contributors
DISPOSITION · T1
INITIAL DISPOSITION
T1
FORCE COMPOSITION
FRIENDLY 6
ENEMY 5
NEUTRAL 2
UNKNOWN 2
TOTAL ASSETS
15 UNITS
Select any unit on the map or entity list to inspect its position, heading, and status.
ORDERS COMMITTED
ORDERS TRANSMITTED
01 Execute task 1
02 Execute task 2
ADVERSARY COMPUTING
Parsing tactical parameters...
T+00:01
Map & entities are live — use this time to study the field
TURNS
T1

Cyber Simulation Visualized



Diplomacy: political simulator

Ava Martinez – President (Neotonia)

Televised statement – State TV channel: *We are aware of a recent cyber intrusion targeting our electronic warfare systems. Our cyber security units are actively responding and restoring full operational status. Neotonia remains committed to safeguarding its defenses and protecting the safety of its citizens.*

Nina Khristova – Interior Minister (Grey State)

Televised statement – State TV channel: *We are fully aware of CyberTAK-cerebro's sabotage of the EWR. The state has already activated counter-measures and will ensure those responsible are swiftly brought to justice. Grey State will not tolerate any attempt to destabilize our sovereign institutions.*

Sebastian Jensen – Secretary General (NATO)

Televised statement – NATO State TV channel: *The recent cyber assault on the European Warning Radar is a stark reminder of the evolving threats we face. NATO has mobilised our cyber defence assets to restore full functionality and is working closely with partner nations to strengthen resilience. We remain steadfast in our commitment to collective defence and will keep all allies fully informed of subsequent developments.*

PYRAMID

- Accessible way to connect simulation tools
- Front-end to facilitate wargaming
- Combine with real/fast-time simulation

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Thank you for your attention!

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