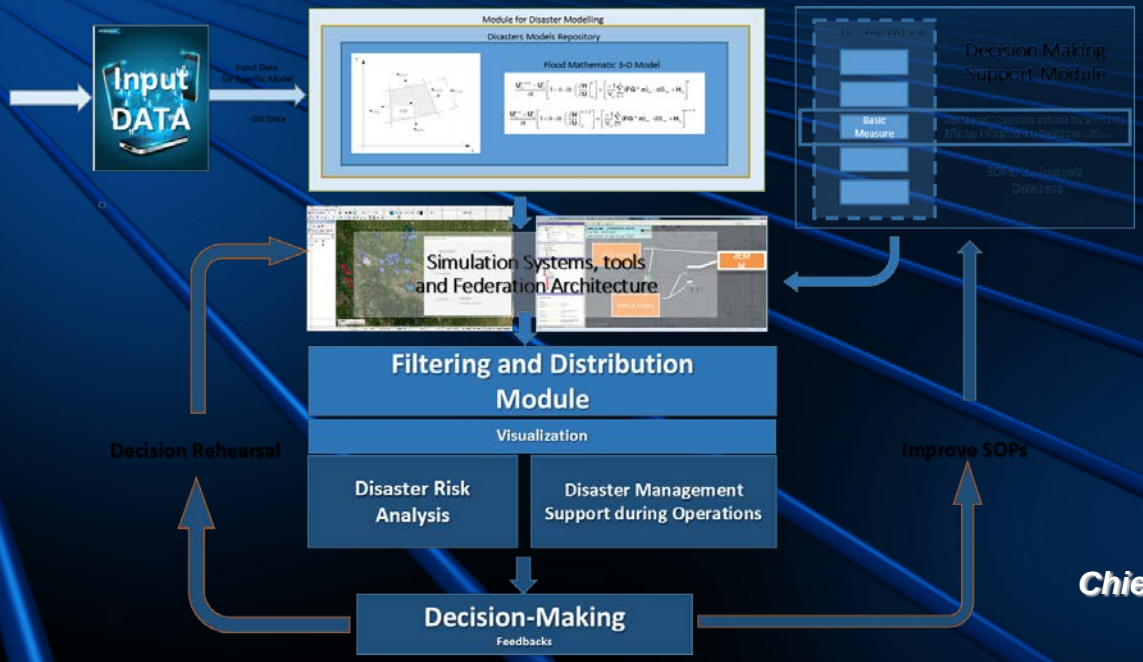
M&S SUPPORT FOR CRISIS AND DISASTER MANAGEMNT PROCESSES AND BUILDING SOCIETAL RESILIENCE



Orlin NIKOLOV

COL BGR – AF

Chief of Capabilities Branch CMDR COE

Agenda

- Introduction
- Integrated (Distributed) CDMP &CCI Simulation Platform
- Simulation environment for risk assessment
- M&S Support for CMDR Processes and CCI

OPERATIONAL REQUIREMENTS

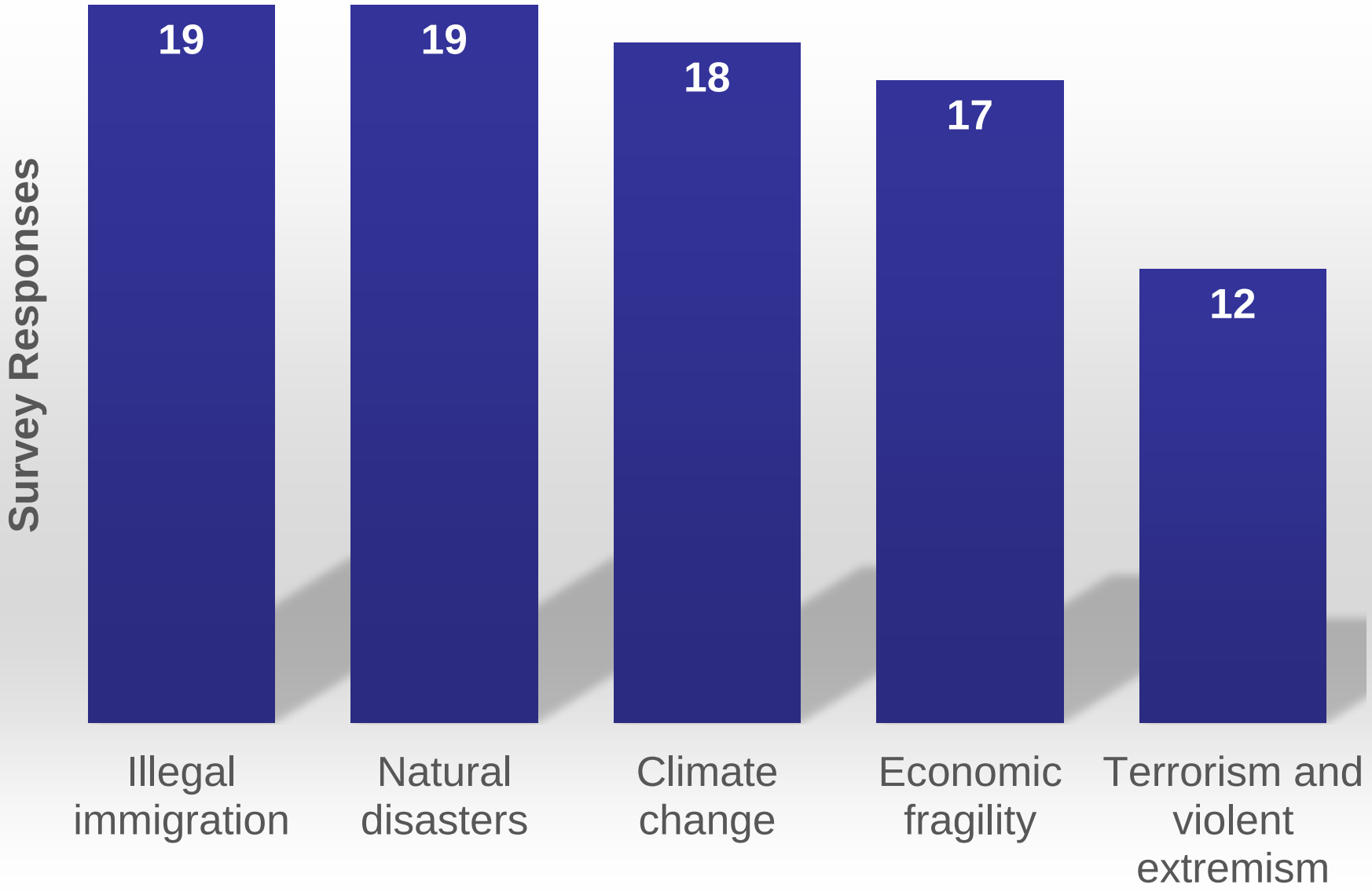
NATO STRATEGIC CONCEPT:

"to prevent crises, to manage conflicts and stabilize post-conflict situation …working more closely with …. the United Nations and the European Union"

UTILIZING GEOPOLITICAL REALITIES: cross point for SE Europe, Balkans, Caucasus, Black Sea region, Middle East

BULGARIA: secure and safe, a bridge between NATO and EU, focal point for the neighbors

Top 5 Security Challenges for the Next 5 Years



Compiling the NATO Exercise Management Environment *

Training Objectives

TOMM

MEL/MIL

JEMM

Simulation

Joint Theater Level Simulation

JCATS

ITC Integrated Training Capability

VBS2

Setting

JEST

Evaluation

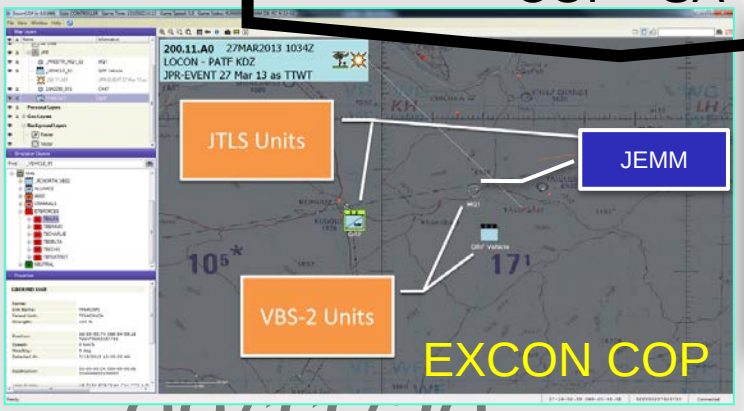
EPROM

EXercise Information Service (EXIS)
Units – Holdings – Story Lines – Events – Shared Layers - Plans
Web-Service: SOAP - REST

EXIS Mgmt Service

EXCON Business Applications
COP - SA

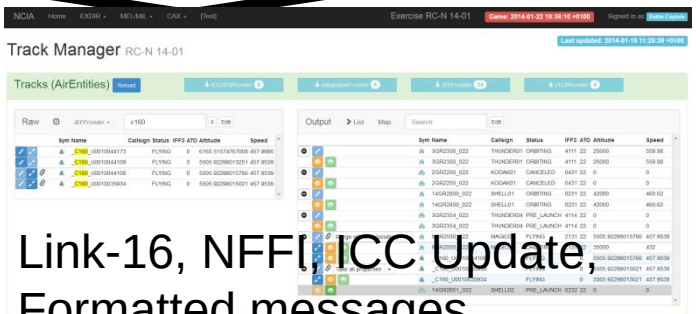
C2 – ISR Interoperability



Injections	
Total	760
Draft	56
Proposed	39
To_be_Modified	40
Approved	20
Validated	5
Scheduled	48
Injected	241
Confirmed	301
On_Hold	1
Cancelled	9

Injected Daily:	
26-Mar	21
27-Mar	34
28-Mar	70
29-Mar	17
30-Mar	174
1-Apr	140
2-Apr	85

Dashboard



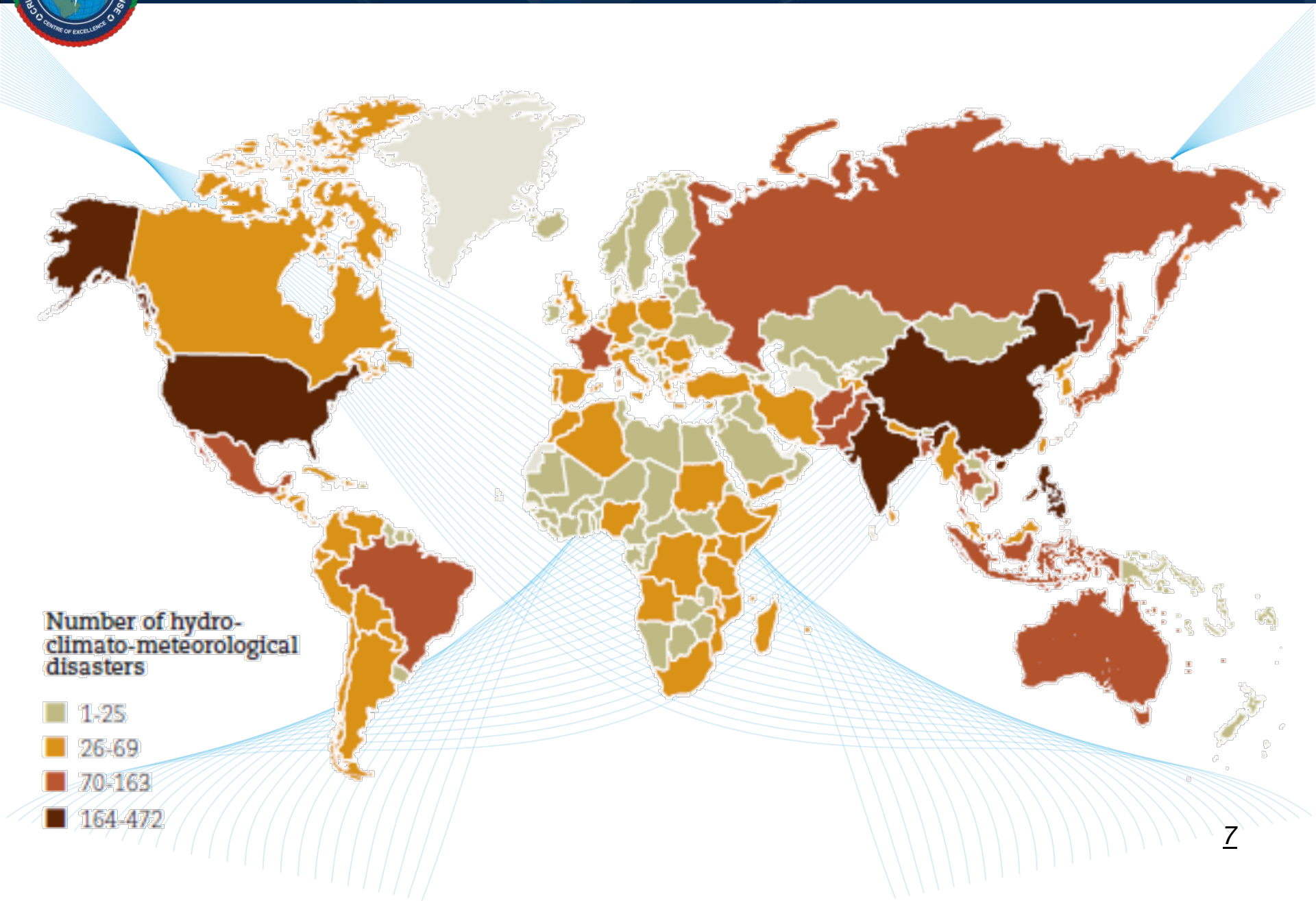
Link-16, NFFI, ICC Update, Formatted messages

09/11/20 5

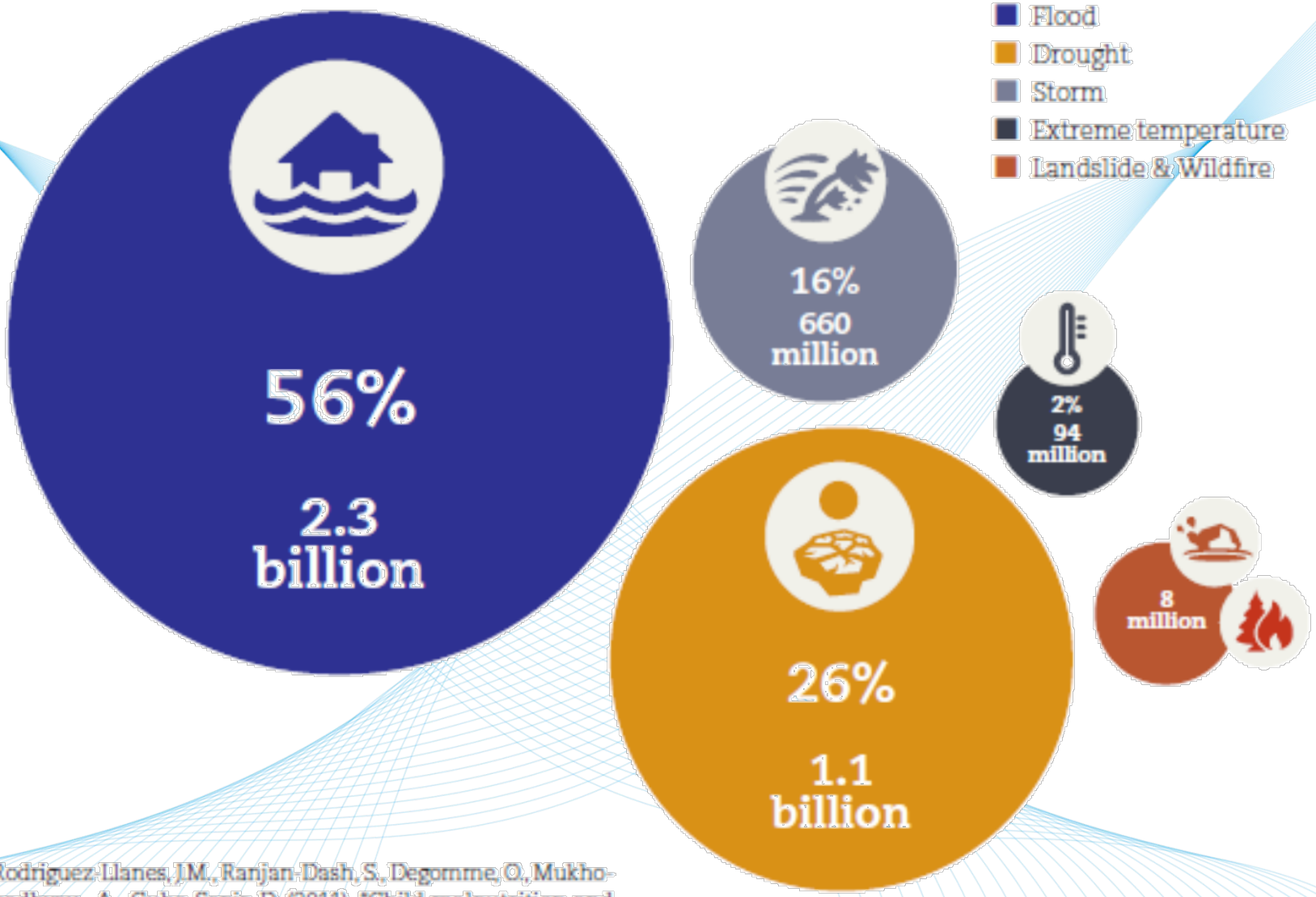
Disasters & Climate Change Implications

*The human cost of weather related disasters – Centre of research of epidemiology of disasters (CRED)

Number of weather related disasters

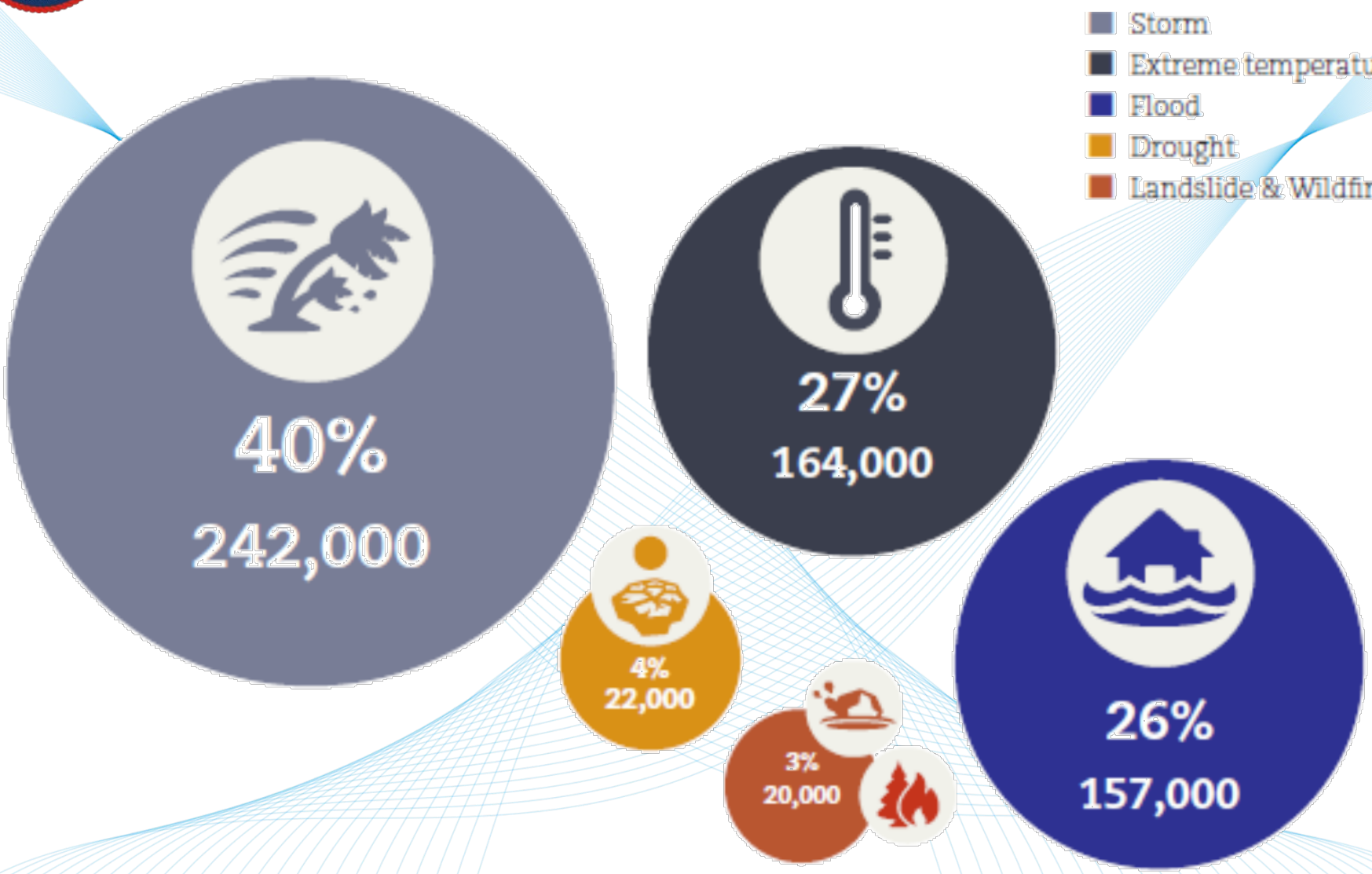


Number of people affected by disasters



Rodriguez-Llanes, J.M., Ranjan-Dash, S., Degomme, O., Mukhopadhyay, A., Guha-Sapir, D. (2011). "Child malnutrition and recurrent flooding in rural eastern India: a community-based survey". BMJ Open 2001;1: e000109.

Number of people killed in disasters type



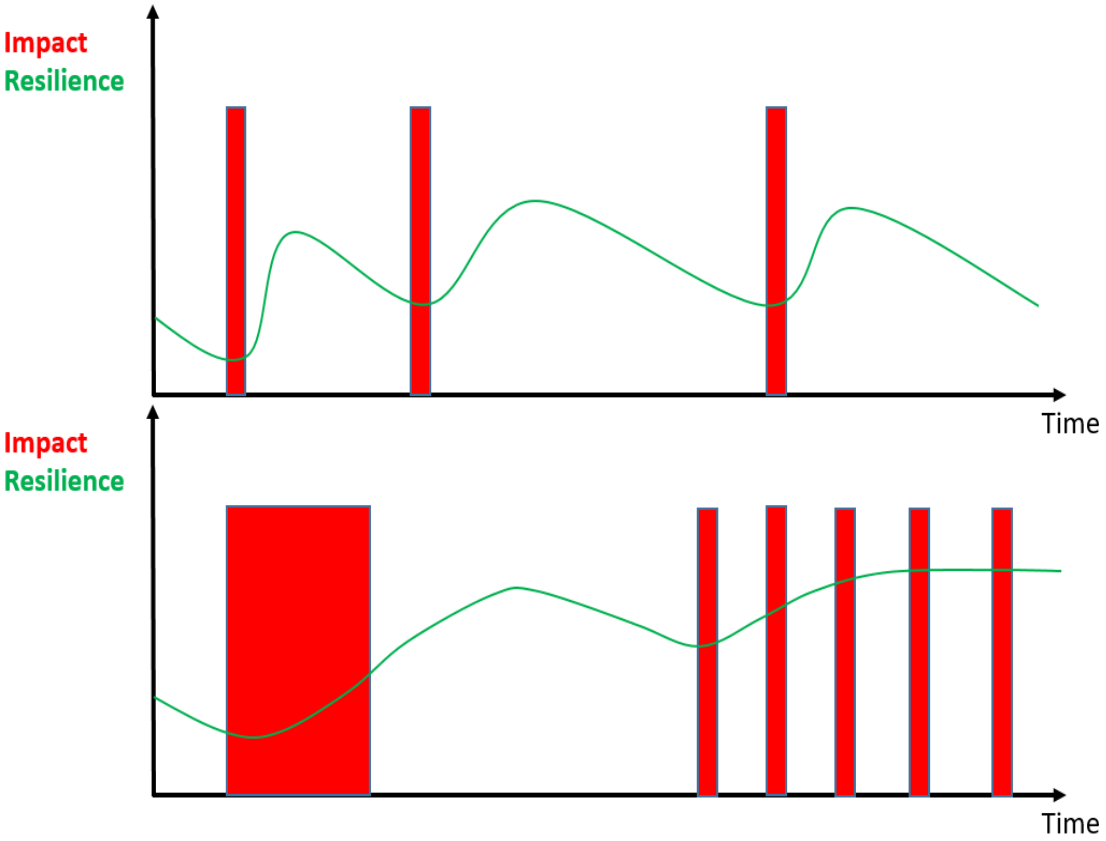
Building resilience in society

- Reaffirm commitments under the North Atlantic Treaty;
- Commit to improve resilience through working in five critical areas;
- Reaffirm the primary responsibility of nations to achieve resilience whilst stressing the need for coherent NATO support to assess and facilitate national progress;
- Note that actions and commitments by Allies in other international bodies will also contribute to enhance resilience and stress that appropriate engagement is needed.

Building resilience in society

1. assured continuity of government and critical government services;
2. resilient energy supplies;
3. ability to deal effectively with the uncontrolled movement of people;
4. resilient food and water resources;
5. ability to deal with mass casualties;
6. resilient communications systems;
7. resilient transportation systems.

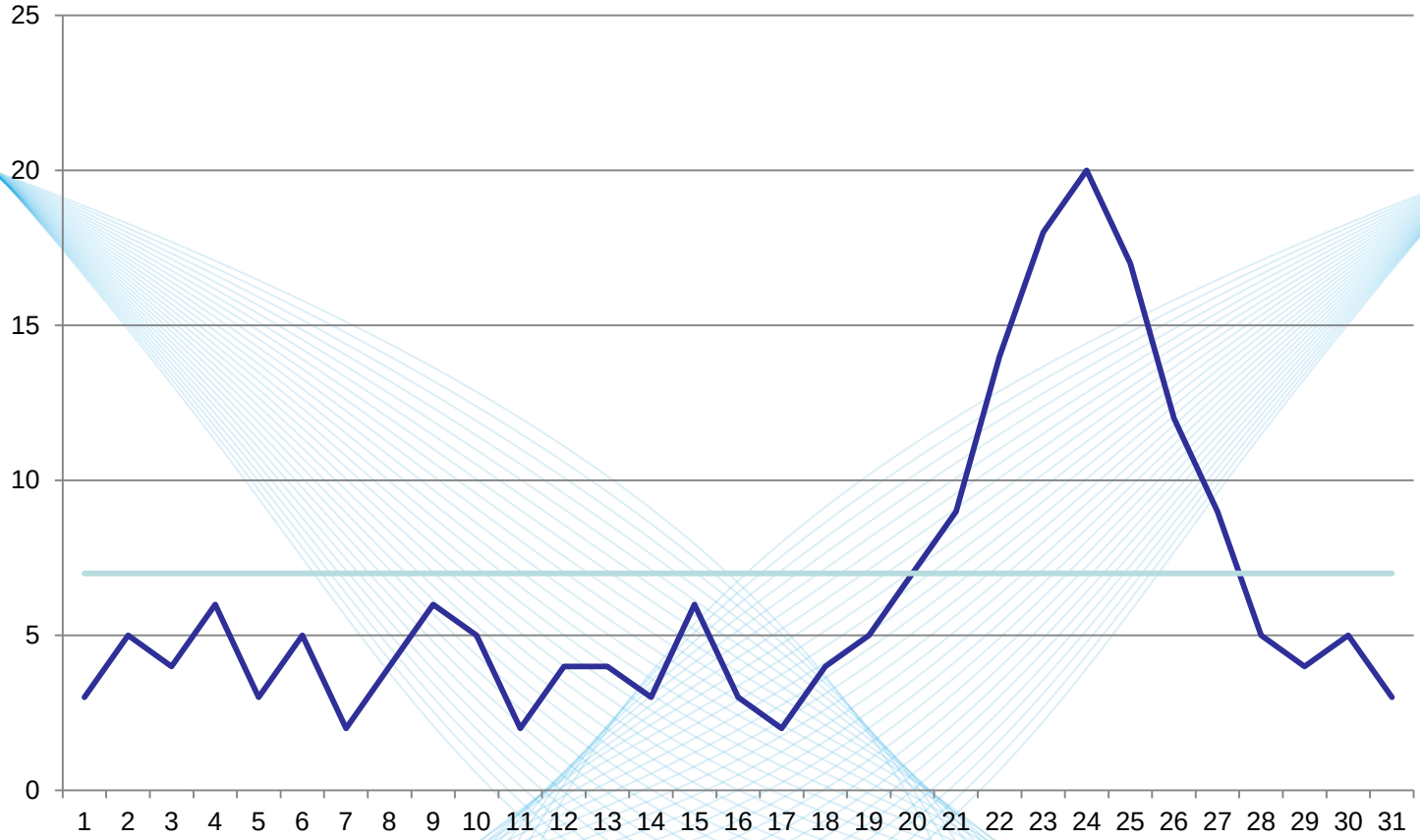
Building resilience in society



- Hostility of the environment;
- History and precedents;
- Culture;
- Education and training;
- Ethic values;
- Financial status.

$$R=k1*Env+k2*Hist+k3*Cult+k4*Edu+k5*Ethic+k6Fin$$

Building resilience in society

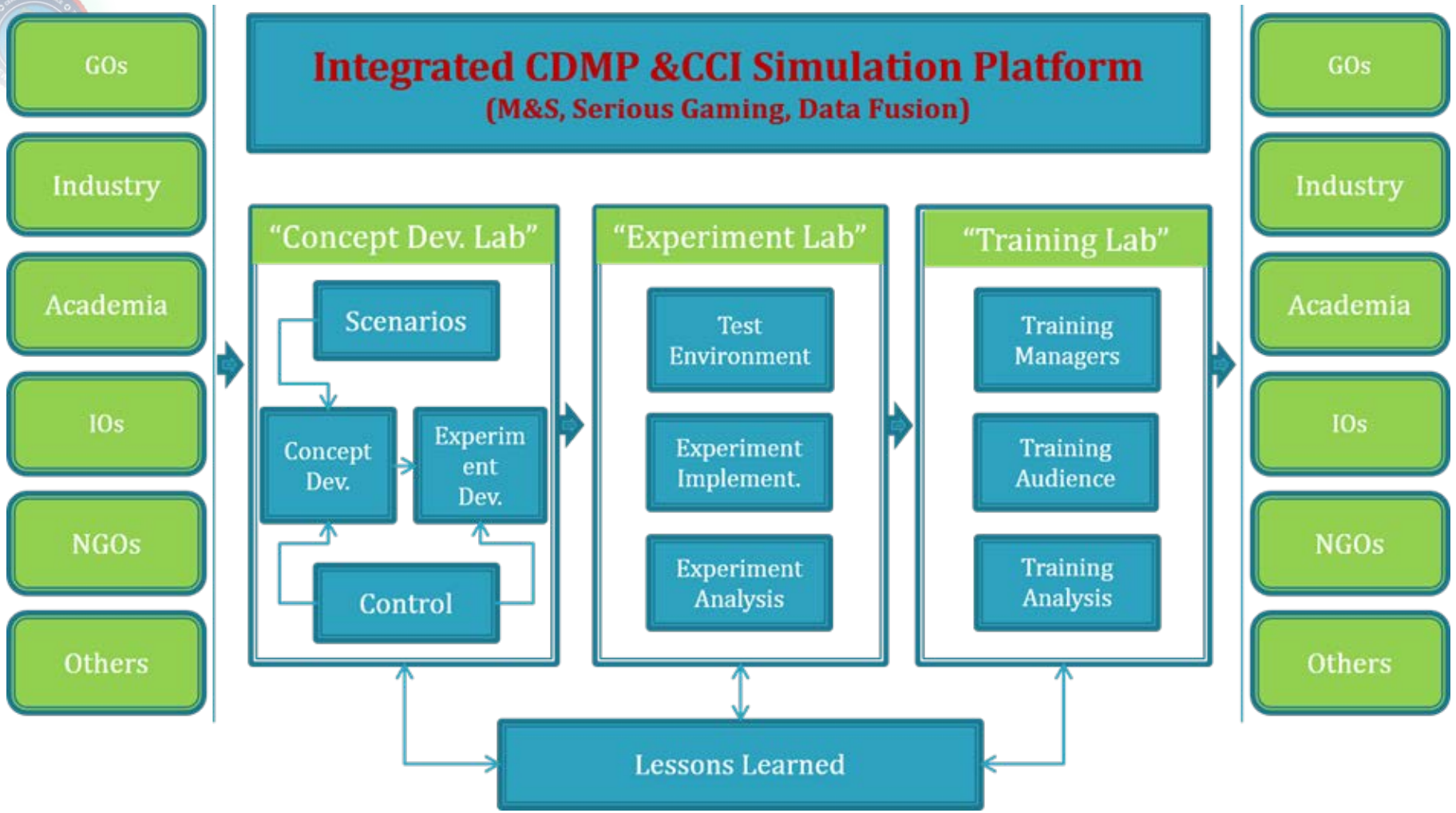


Moral and Ethical Values → Legislation → Analysis → Thresholds

Integrated (Distributed) CDMP &CCI Simulation Platform

- **Management Framework –** Management Framework includes the Integrated Management Cycle. Considering the training specific features and the best practices, the framework has been developed on the conceptual basis of the project management.
- **Simulation Framework** – application of a federated approach based on High Level Architecture (HLA), but could include also Distributed Interactive Simulation (DIS) and Test and Training Enabling Architecture (TENA);
- **Modelling and Simulation Tools** - tools including modelling and simulation of CBRN, flooding and earthquake effects during crises, crowd movement models and modelling of civil emergency services, etc.;
- **Environment Representation** - including terrain, weather conditions and infrastructure;
- **Training Audience** with their C4I real tools including decision and situational assessment tools, also visualization, simulation control and analysis tools;
- **ICT Infrastructure –** including hardware, basic software and connectivity for supporting the functioning of the Training Environment.

Integrated (Distributed) CDMP &CCI Simulation Platform



Decision Making Support and Data Analysis platform for CMDR and Climate Change
(M&S Support for CMDR Processes and CCI)

The aim of the project is to develop a technical architecture capable of supporting and conducting CDM exercises and analysis.
It should be established with several crisis management and disaster response tools and simulations that are supported by NATO and enable non-military type operations.

The software environment should enable to provide:

- distributed environment including HLA and DIS
- automated data collection,
- engine for modeling with defined triggers,
- C2 logic and SOPs implementation;
- a dynamically generated plan for Crisis/Disaster Response,
- prognosticate and Climate Change analyses

Decision Making Support and Data Analysis platform for CMDR and Climate Change

The timeline would be linked to the operational support for key events in the crisis management and disaster response community (NATO CMX, EADRCC exercises, SEESIM, VIKING, other) as the major initial operational capability (IOC) milestone.

Phase 1 – *twelve (12) months in length and result in the development and approval of the Master Plan to guide and direct this project.*
Phase 2 – *twelve (12) months is length and result in the initial operational capability (IOC). Planning experimentation, testing and training for CMXs would be conducted as well during this phase.*
Phase 3 – *twelve (12) months is length and result successful support and execution of CM exercises and analysis efforts as part of the operational support of the crisis management and disaster response technical platform.*

Decision Making Support and Data Analysis platform for CMDR and Climate Change

TOPICS TO BE COVERED:

- Database for storage and management of the information and data related with crisis and disasters.
- Capability for determination of players, objects, infrastructures, systems. Should be defined: location, form, vulnerability, relations with other objects/systems. Capability for data import from different sources like GEO information.
- Capability for implementation of control logic (command and control system, decision making and supporting system)
- Capabilities for modeling and simulation of crisis and disaster events
  - ✓ Module for modeling environment parameters under defined initial conditions
  - ✓ Engine for model generation based on statistical data
  - ✓ Replay the events using the stored information into the database.
- Capability for education and training
- Artificial intellect for simulating actions of individual or collective players
- Report generating module for the environmental parameters
- Integration with other used in NATO software tools.

Input Data
for Specific Model

GIS Data

Module for Disaster Modelling

Disasters Models Repository

Flood Mathematic 3-D Model

Dissintegrated SOP

Decision Making
Support Module

Basic
Measure

Additional Metadata added: Relevant to;
Effects; Influence on; Relations with…

SOPs, LL, Analysis
Database

Simulation Systems, tools
and Federation Architecture

Filtering and Distribution
Module

Visualization

Disaster Risk
Analysis

Disaster Management
Support during Operations

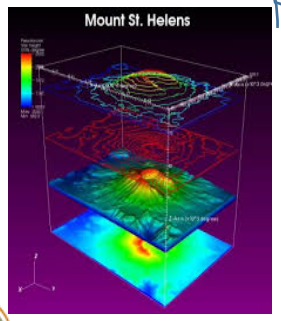
Decision-Making

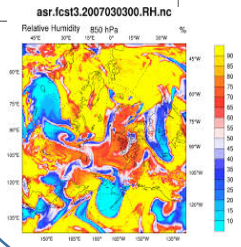
Feedbacks

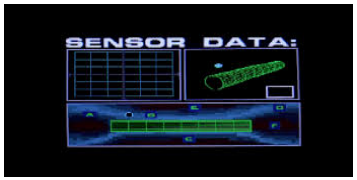
Decision Rehearsal

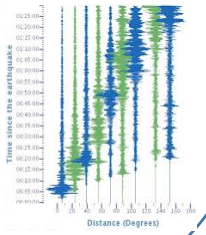
Improve SOPs

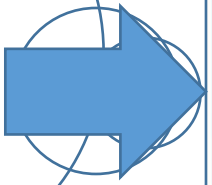
Collecting information

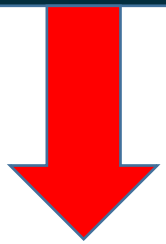












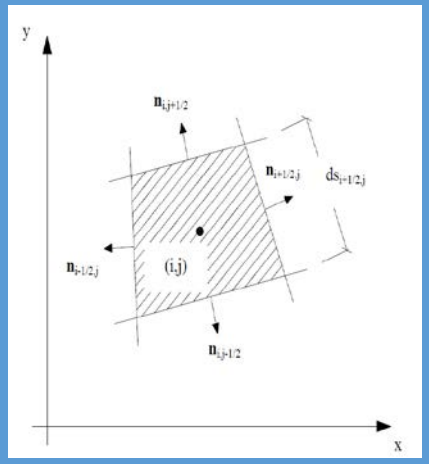
Module for Disaster Modelling

Input Data
for Specific Model

GIS Data

Module for Disaster Modelling

Disasters Models Repository



Flood Mathematic 3-D Model

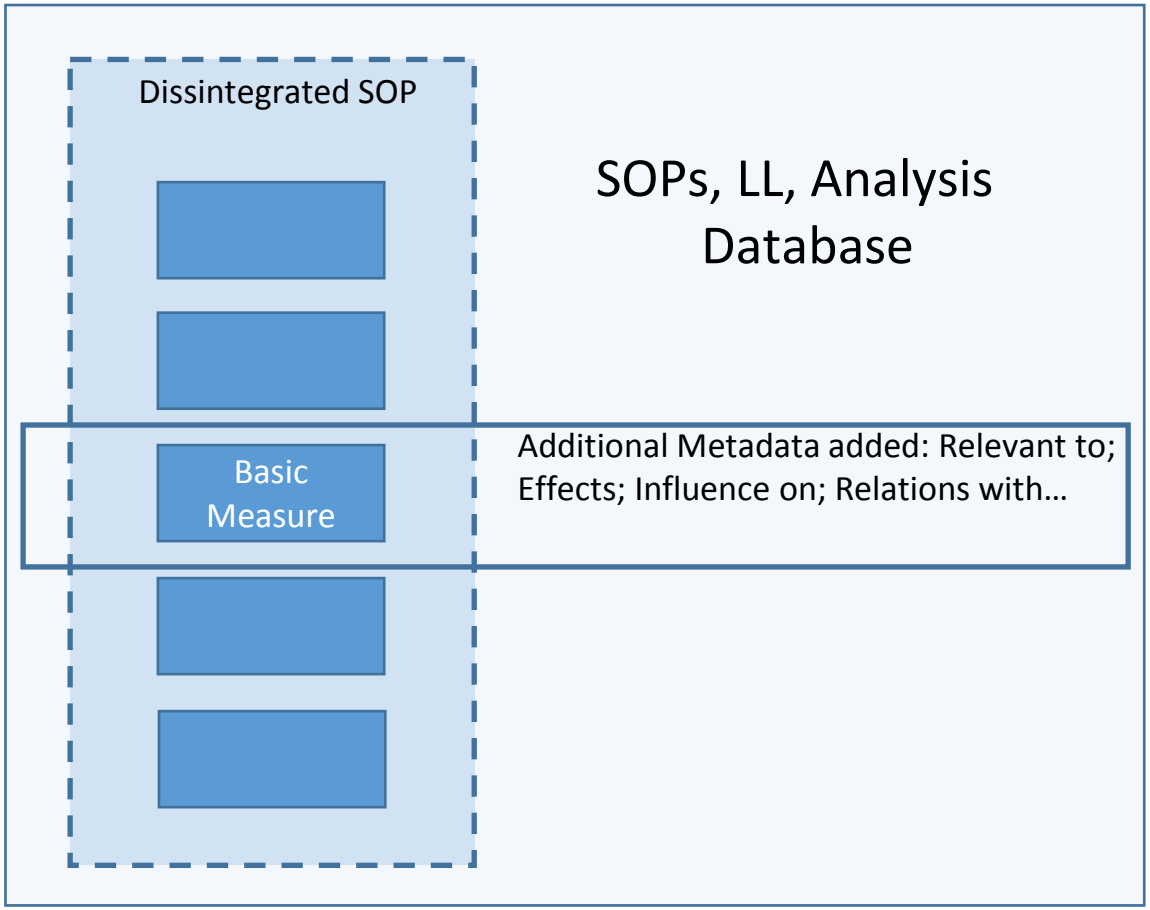
$$\frac{U_{i,j}^{n+1/2}-U_{i,j}^{n}}{\delta t}\left[1-\theta\cdot\delta t\cdot\left(\frac{\partial H}{\partial U}\right)_{i,j}^{n}\right]=\left[\frac{-1}{V_{i,j}}\sum_{k=1}^{4}(FG^{*}\cdot n)_{wk}\cdot dS_{wk}+H_{i,j}\right]^{n}$$

$$\frac{U_{i,j}^{n+1}-U_{i,j}^{n}}{\delta t}\left[1-\theta\cdot\delta t\cdot\left(\frac{\partial H}{\partial U}\right)_{i,j}^{n+1/2}\right]=\left[\frac{-1}{V_{i,j}}\sum_{k=1}^{4}(FG^{*}\cdot n)_{wk}\cdot dS_{wk}+H_{i,j}\right]^{n+1/2}$$

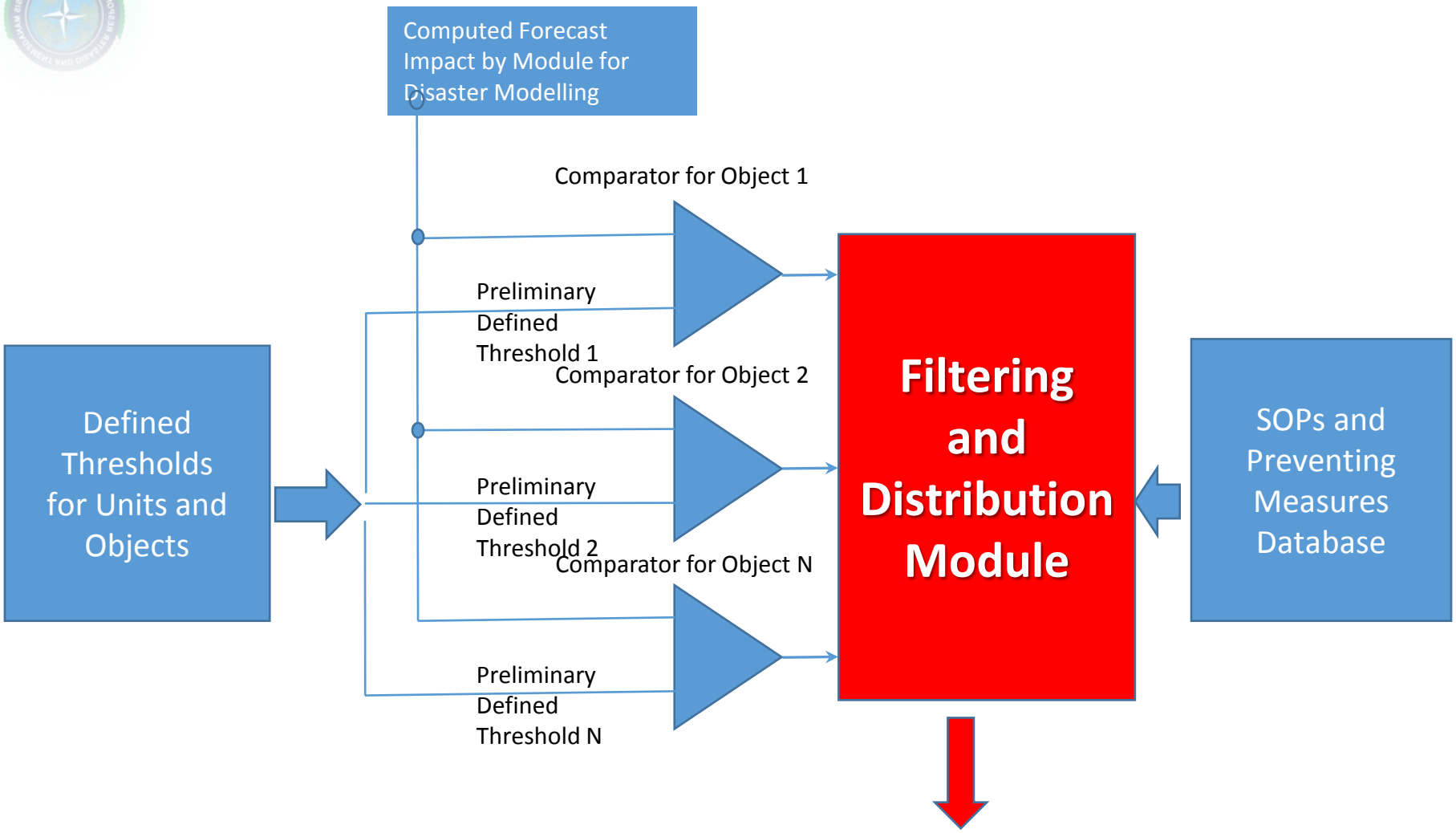
HLA Object published in Federation,
Text Reports

Decision Making Support Module

Defined Thresholds for certain objects



Filtering and Distribution Module



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and Federation Architecture

Filtering and Distribution
Module

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Disaster Risk
Analysis

Disaster Management
Support during Operations

Decision-Making

Feedbacks

Decision Rehearsal

Improve SOPs

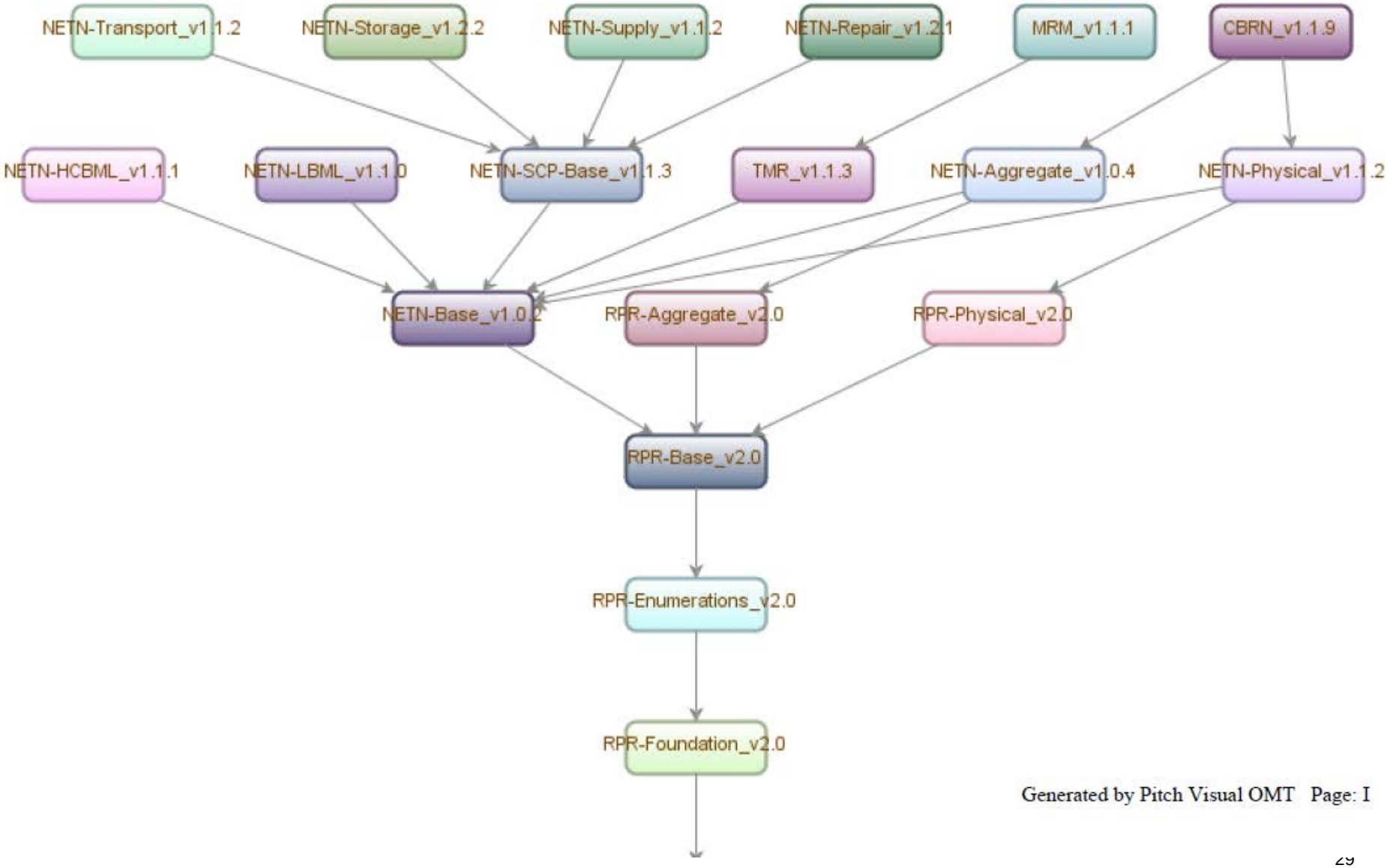
What is FOM

"In the context of distributed simulation, a **Federation** is a union of essentially independent applications (**Federate**) interoperating using common infrastructure services accessed through well-defined standard interfaces and governed by common agreements on modelling responsibilities and information exchange. A **High-Level Architecture (HLA) Evolved Federation** is a federation using the HLA standard (IEEE 1516-2010) to specify available infrastructure services and APIs for accessing them. The HLA standard also specifies how to document information exchange using a **Federation Object Model (FOM)**."

AMSP-04 NATO Education and Training Network Federation Architecture and FOM Design

NETN-FOM STRUCTURE NOW

NETN-Disasters



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Decision Making Support and Data Analysis platform for CMDR and Climate Change

DELIVERABLE AND/OR END PRODUCT:

- *Concept/SOP for automatic data collection and analysis in complex environment.*
- *Standardized Database for forces and resources data storage.*
- *Models of human society environments.*
- *Models of crisis/disasters evolution.*
- *Computer formalization of Command and Control logic for Crisis/Disaster Response.*
- *Technical platform for information/data collection, update and analysis, reports generation and dynamic response plan.*
- *To provide distributed environment for all deliverables mentioned above.*

Decision Making Support and Data Analysis platform for CMDR and Climate Change

TECHNICAL TEAM LEADER AND LEAD NATION:

Lead Nations: BGR; CMDR COE
Nations Willing/Invited to Participate:

- **NATO Nations and Bodies**: all NATO Nations and Bodies invited
- **PfP Nations**: all PfP nations invited
- **Global Partners**: all GP nations invited
- **Contact / Other Nations**: NCIA, ACT, JWC, JFTC, all NATO organizations related to M&S, industry are invited
- **Confirmed participation**: AUT, BGR, GER; SLO; USA; MS CoE, CMDR COE; JCBRN COE; JFTC; NCIA; ACT
- **TBC**: ITA; POL, GRE, NLD; GBR; IBM: IABG; Bohemia interactive

M&S SUPPORT FOR CRISIS AND DISASTER MANAGEMNT PROCESSES AND BUILDING SOCIETAL RESILIENCE

Thank You!

ORLIN NIKOLOV |COL (OF-5), BGR-AF

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orlin.nikolov@cmdrcoe.org