

# 5G FOR DEFENCE AND NETWORK DEFENSIBILITY INSIGHTS, CONSEQUENCES AND SHORT TERM MITIGATIONS

CASTOR SW Days

KTH, Stockholm, 220831

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# CONTENT

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- Introduction
- “Analysis”
- Programmable networks
- 5G COMPAD







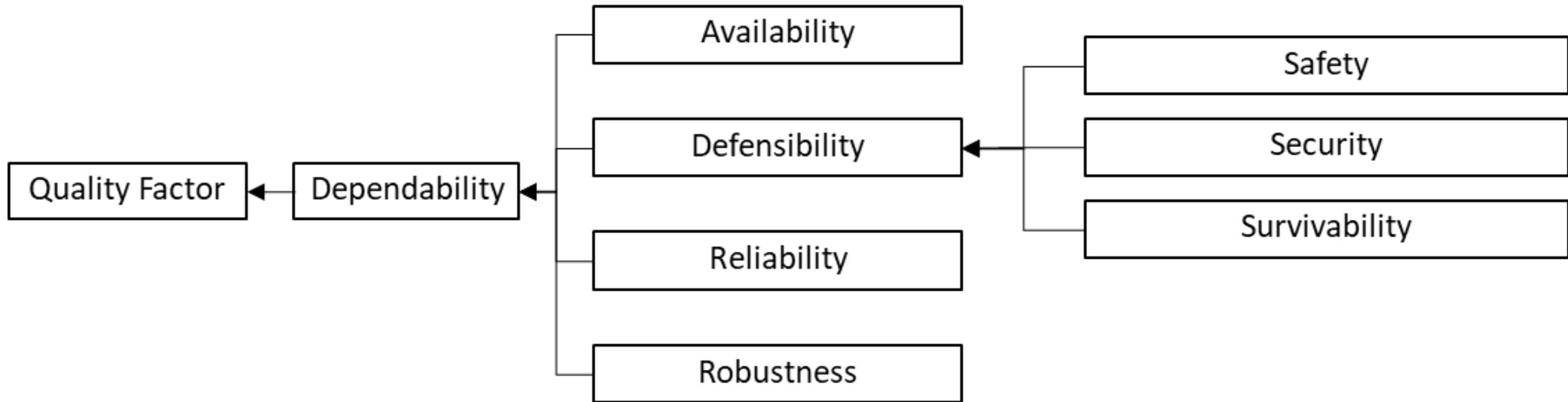
**"CAN YOU SEE ANYTHING?"**

**HOWARD CARTER REPLIED:  
"YES, WONDERFUL THINGS!"**



# DEFINITIONS

## DEFENSIBILITY IS A KIND OF DEPENDABILITY



Standard Decomposition of Defensibility into Quality Sub-factors

Common Concepts Underlying Safety, Security, and Survivability Engineering, Donald G.

Firesmith, December 2003





# ANALYSIS



# REWARDS



3GPP  
A GLOBAL INITIATIVE

Federated Mission Networking

5G subscriptions are forecast to reach 4.4 billion in 2027.

**4.4bn**

- 5G
- LTE (4G)
- WCDMA/HSPA (3G)
- GSM/EDGE-only (2G)
- TD-SCDMA (3G)
- CDMA-only (2G/3G)

Figure 1: Mobile subscriptions by technology (billion)

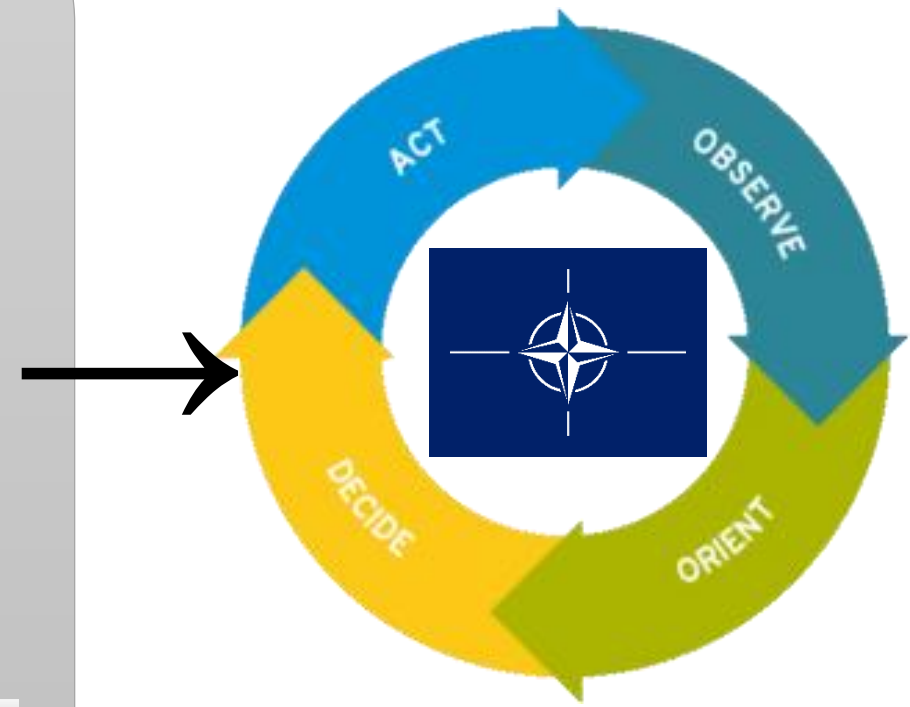
Year	5G	LTE (4G)	WCDMA/HSPA (3G)	GSM/EDGE-only (2G)	TD-SCDMA (3G)	CDMA-only (2G/3G)	Total
2016	0.0	1.8	2.2	3.0	0.0	0.0	7.0
2017	0.0	2.0	2.0	2.5	0.0	0.0	6.5
2018	0.0	2.2	1.8	2.0	0.0	0.0	6.0
2019	0.0	2.4	1.6	1.5	0.0	0.0	5.5
2020	0.0	2.6	1.4	1.0	0.0	0.0	5.0
2021	0.0	2.8	1.2	0.8	0.0	0.0	4.8
2022	0.2	2.6	1.0	0.6	0.0	0.0	4.4
2023	0.4	2.4	0.8	0.4	0.0	0.0	4.0
2024	0.6	2.2	0.6	0.3	0.0	0.0	3.7
2025	0.8	2.0	0.4	0.2	0.0	0.0	3.4
2026	1.0	1.8	0.3	0.1	0.0	0.0	3.2
2027	1.2	1.6	0.2	0.1	0.0	0.0	3.1

Ericsson's mobility Report June 2022

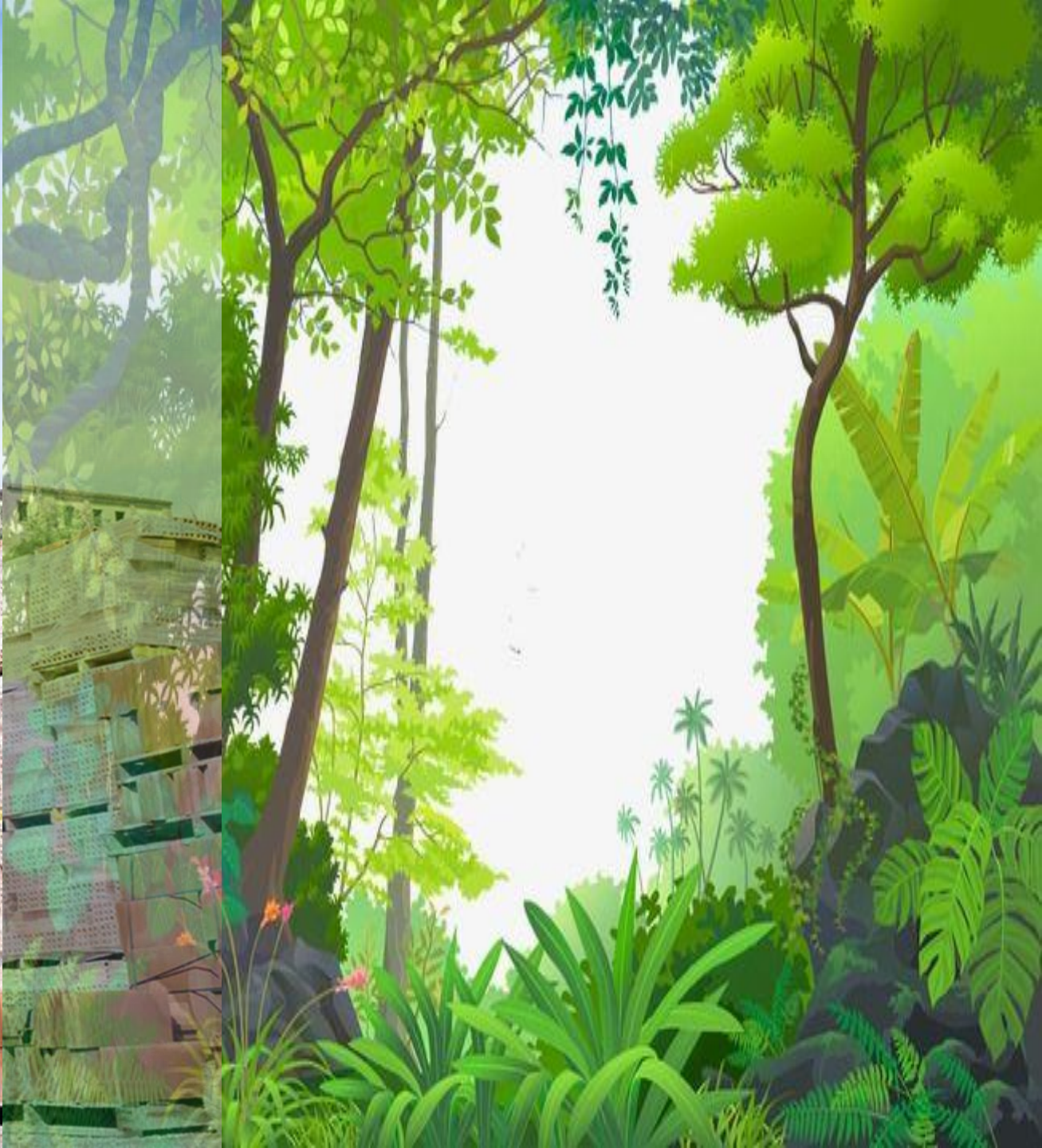
Interoperability

Economy of Scale

## Defense utility











# COMPLEXITY 1(3)

## CONSEQUENCE OF THAT SOFTWARE EATS THE WORLD

- The universal machine
  - Can be changed to any other machine
- Near-zero marginal cost
  - Cognitive complexity
- Degree of isolation
  - Operating Systems assumes that “they are alone on the hardware”. Virtualization create this illusion on shared hardware.

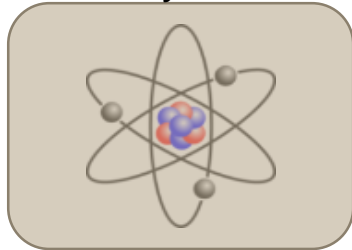




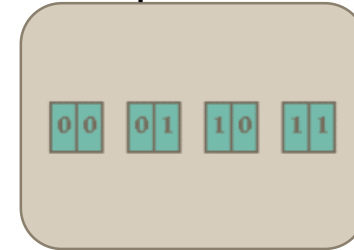
# Complexity 2(3)

threat landscape increases in **diversity**

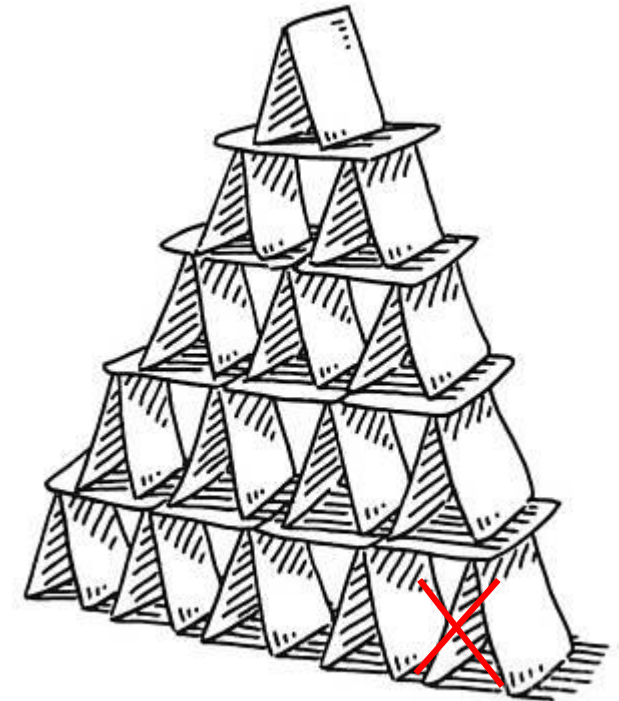
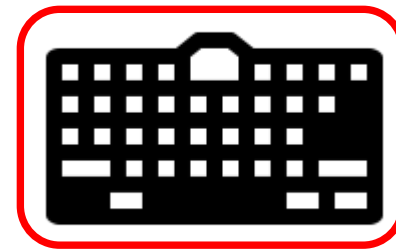
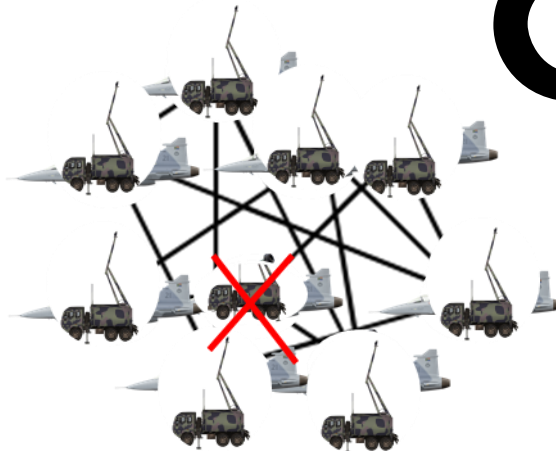
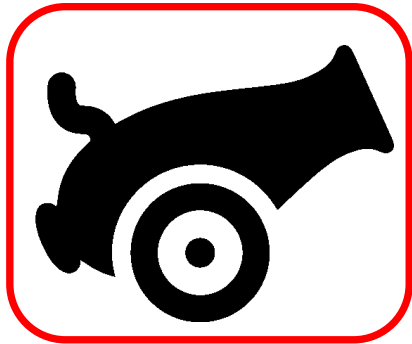
Physics



Computer Science



&

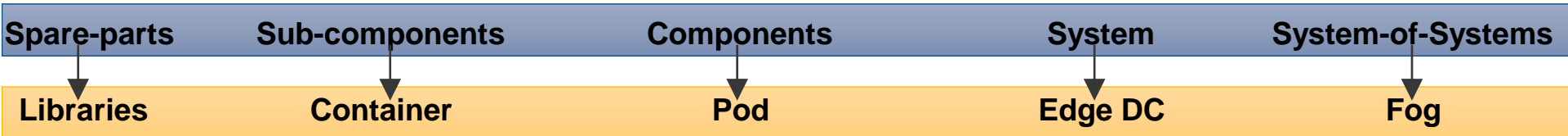
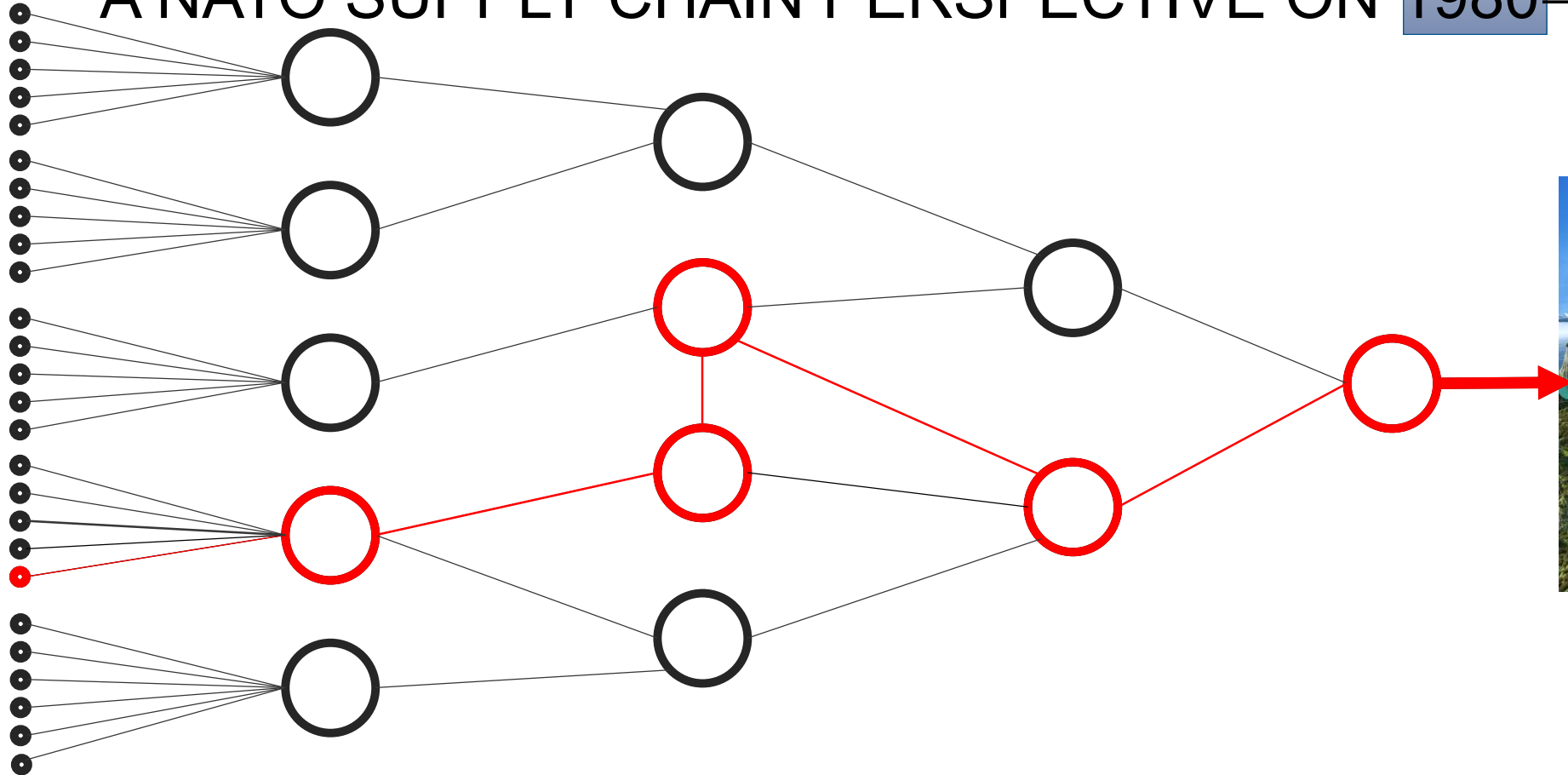






# COMPLEXITY 3(3)

A NATO SUPPLY CHAIN PERSPECTIVE ON 1980 → 2030

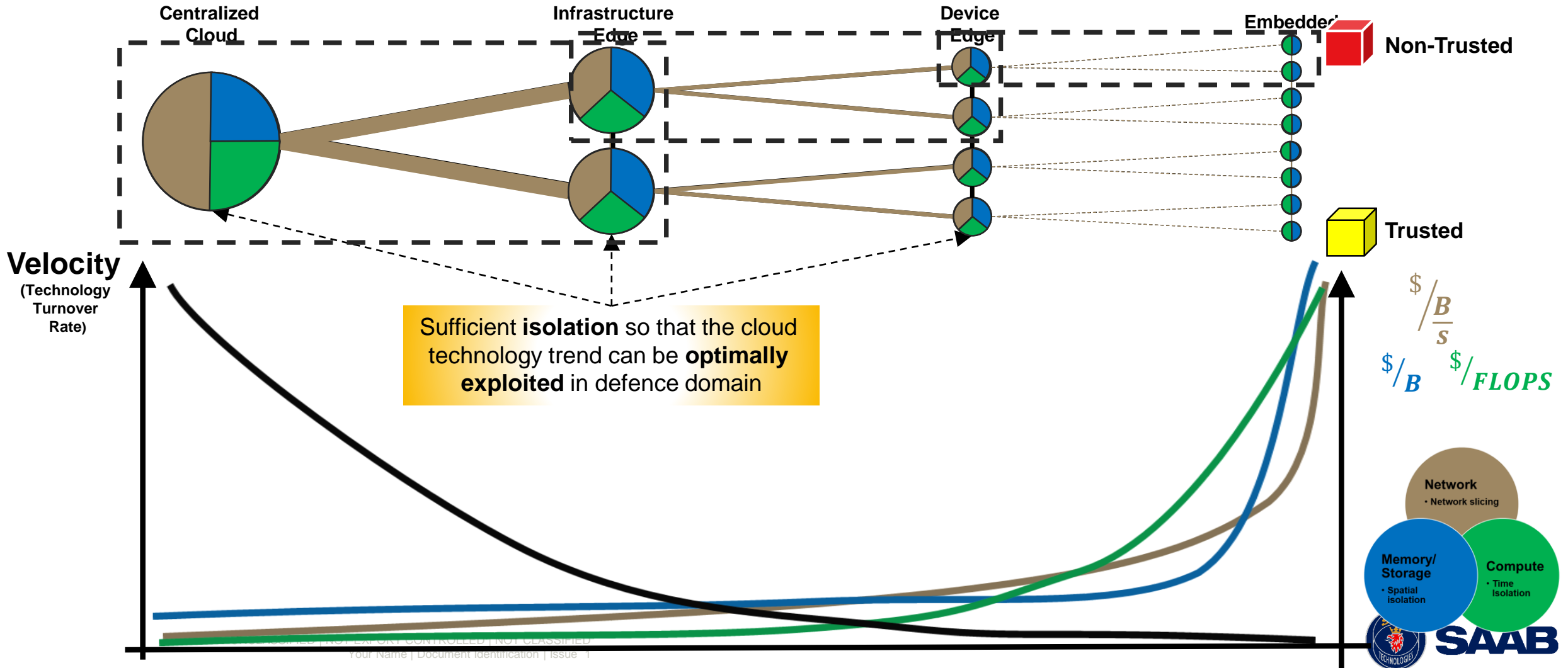


- ✓ Confidentiality
- ✓ Integrity
- ✗ Availability
- ✓ Traceability



# VELOCITY

## ECONOMY OF SCALE VS SOLATION

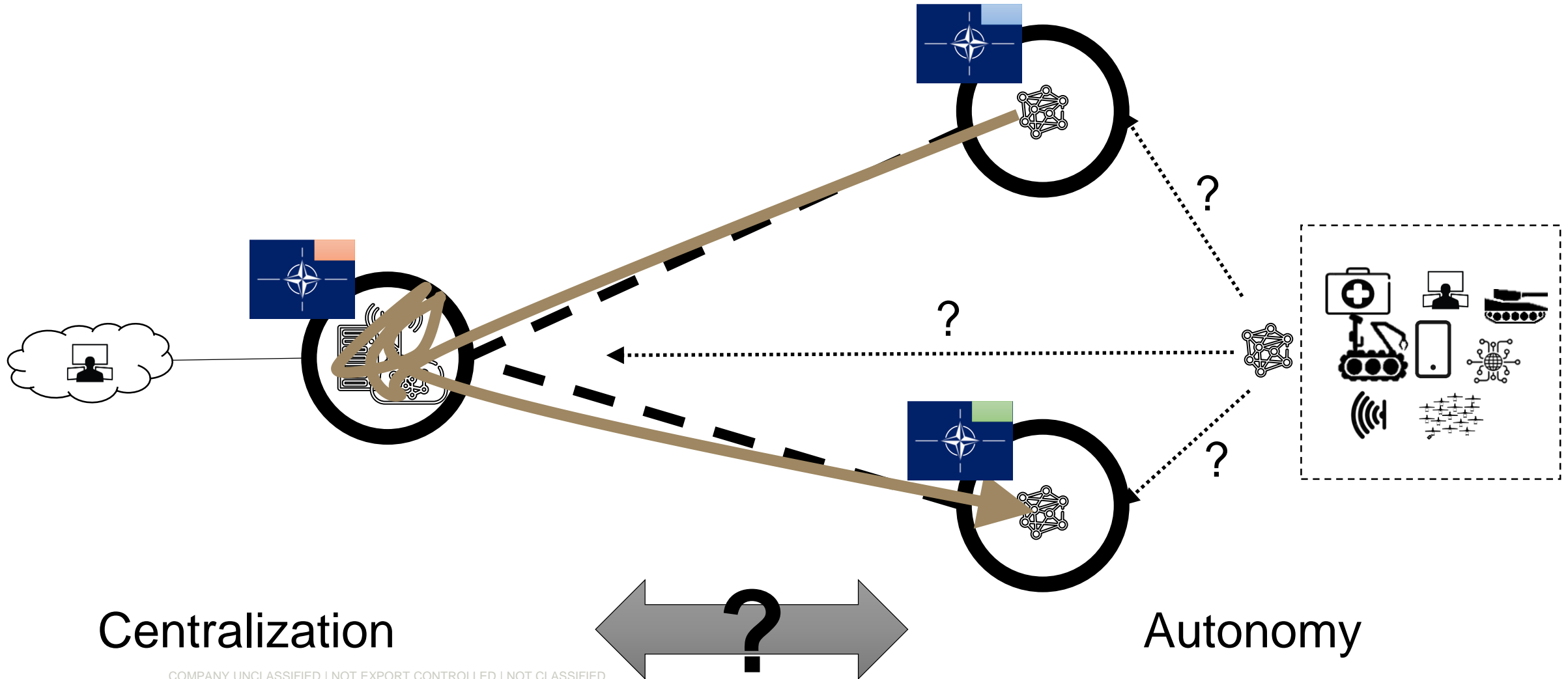






# SINGLE POINT OF FAILURE

## 5G AND WORKLOAD TOPOLOGY



Centralization

Autonomy



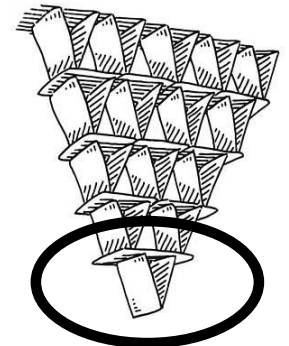
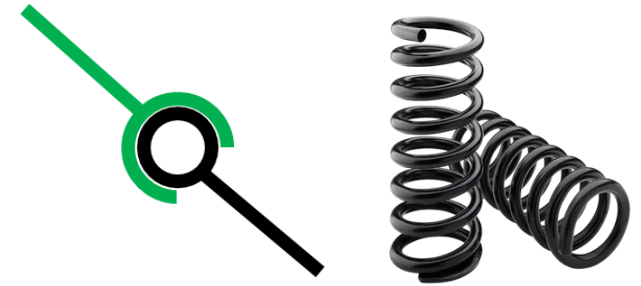


# MITIGATE **COMPLEXITY** | **VELOCITY** | **SINGLE POINT OF FAILURE**

## SHORT TERM SOLUTION CANDIDATE

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- **Loose coupling**
  - Small common reviewable verifiable code base that deliver trustworthy **isolation** between redundant systems → **resilience**
- **Lock down** functionality at build time to minimize configurability during deployment
- Work with the **software supply chain**.



**Root of Trust**

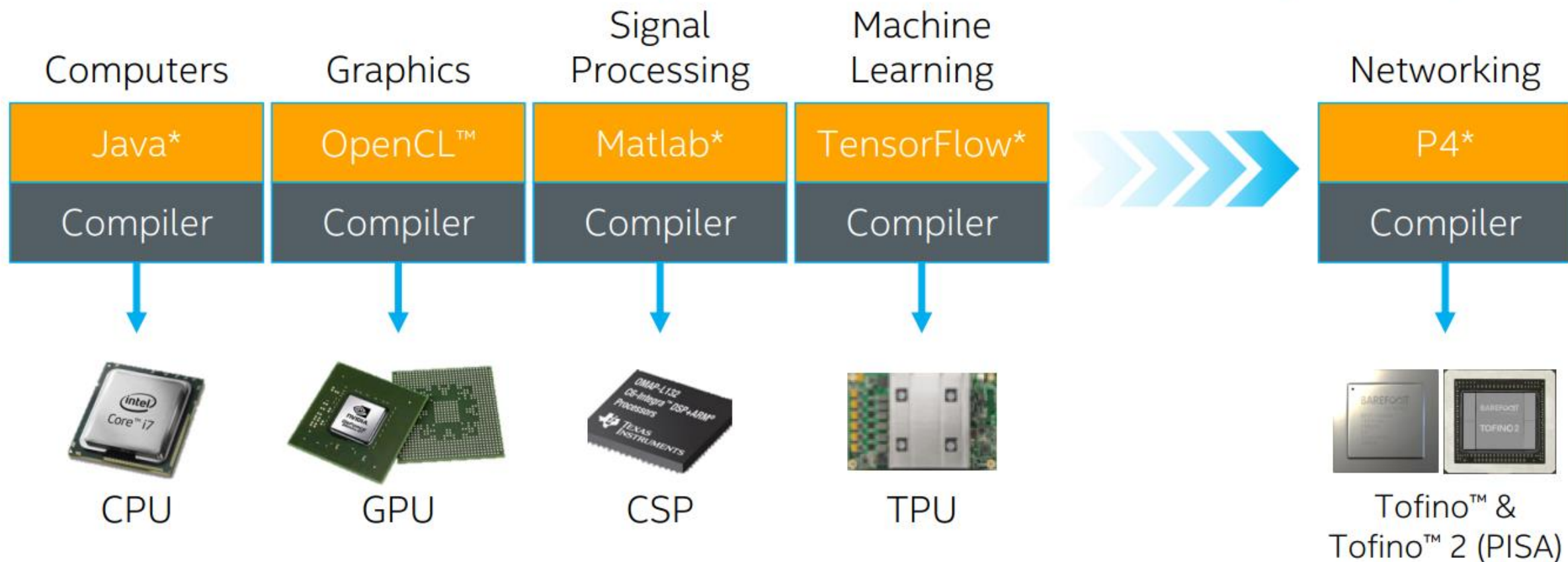
AN IMPORTANT INGREDIENT IN THE PAIN RELIEVER:

# PROGRAMMABLE NETWORKS



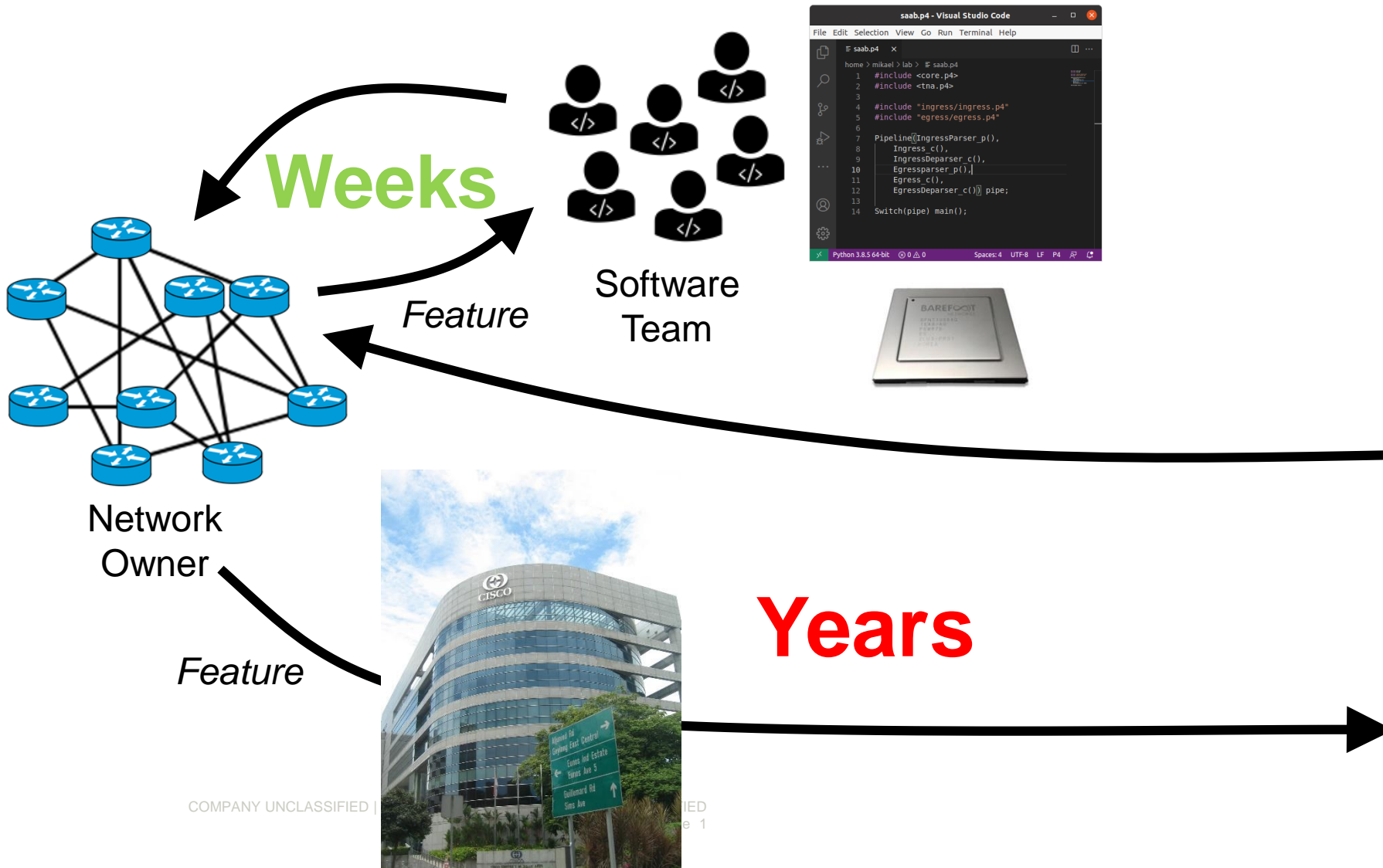


# General Industry Trend: Rise of the Domain-Specific Architectures (DSAs)

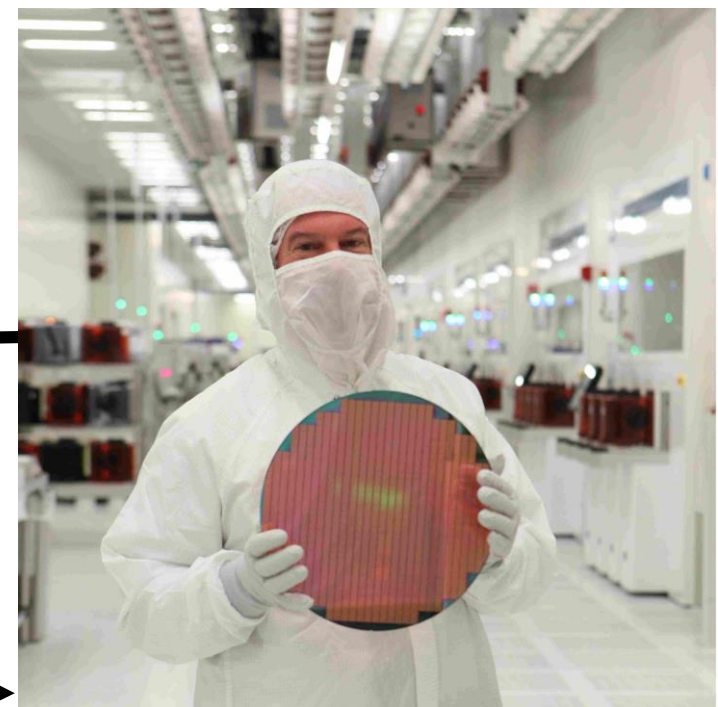


Other names and brands may be claimed as the property of others.

# SDN (P4) BRINGS CHANGE



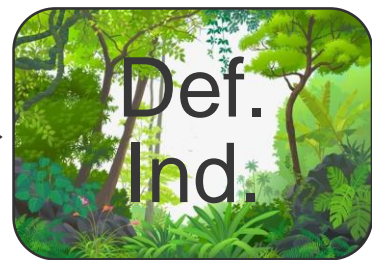
```
saab.p4 - Visual Studio Code
File Edit Selection View Go Run Terminal Help
F saab.p4 x
home > mikel > lab > F saab.p4
1 #include <core.p4>
2 #include <tna.p4>
3
4 #include "ingress/ingress.p4"
5 #include "egress/egress.p4"
6
7 Pipeline{
8   IngressParser p(),
9   IngressParser c(),
10  EgressParser p(),
11  EgressParser c(),
12  EgressParser c();
13 } pipe;
14 Switch(pipe) main();
```



# FIX THE BROKEN SUPPLY CHAIN



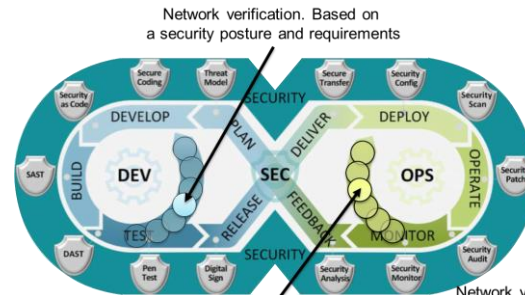
• Product Suppliers



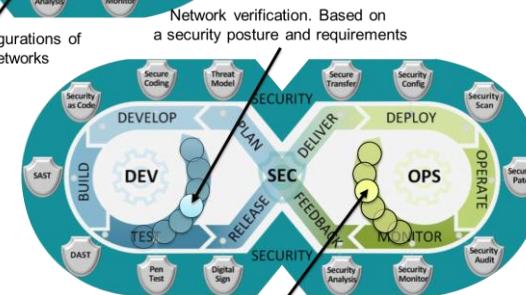
• Integrators



• Operators

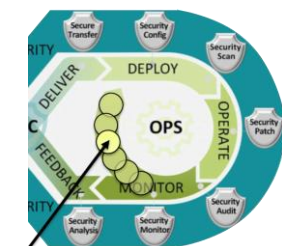


Secure reconfigurations of verified networks



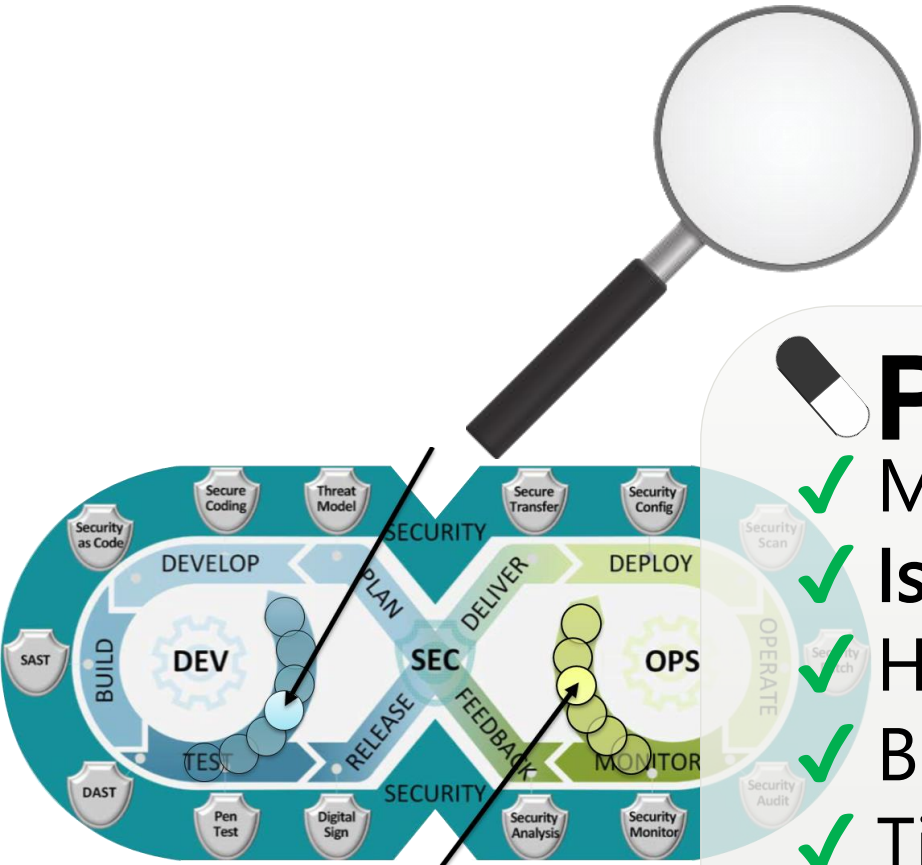
Secure reconfigurations of verified networks

ion. Based on and requirements



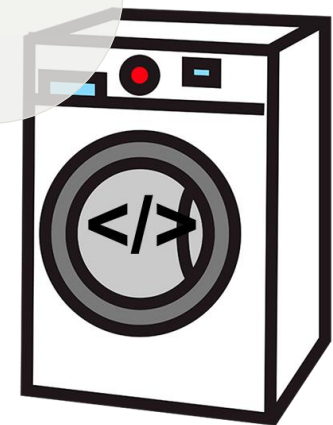
igurations of networks





# Pain Relievers

- ✓ Mitigate complexity
- ✓ Isolation safeguards
- ✓ High fidelity SW supply chains
- ✓ Back-up network clones
- ✓ Timely patching
- ✓ Transparency & observability
- ...



# OFFICIAL FLYER



## 5G COMPAD

5G Communications for Peacekeeping And Defense

### SELECTED PROJECTS EUROPEAN DEFENCE FUND (EDF) 2021

<b>CALL TITLE:</b>	ISR and advanced communications
<b>TOPIC TITLE:</b>	Robust defence multi-dimensional communications
<b>DURATION OF THE PROJECT:</b>	36 months
<b>TYPE(S) OF ACTIVITIES:</b>	Studies; Design; Prototyping; Testing
<b>ESTIMATED TOTAL COST:</b>	€ 37,090,303.98
<b>MAXIMUM EU CONTRIBUTION :</b>	€ 20,998,532.29

### SHORT DESCRIPTION OF THE PROJECT:

**5G COMPAD will demonstrate the relevance of 5G mobile communications technology in support of sustained information superiority.**

The project "5G Communications for Peacekeeping And Defense" (5G COMPAD) will design, prototype and test a reference architecture for a 5G based robust and resilient multi-dimensional communications system to demonstrate operational capabilities of 5G integrated in selected defence platforms and systems. It will develop new and improved functionalities and improve the lifecycle cost. As a result the project will enable enhanced operational capabilities.



@defis\_eu



#StrongerEurope  
#EUDefenceIndustry

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### SELECTED PROJECTS EUROPEAN DEFENCE FUND (EDF) 2021

#### MEMBERS OF THE CONSORTIUM AND COUNTRY OF ESTABLISHMENT:

NAME OF THE ENTITY	COUNTRY
SAAB AB (Coordinator)	Sweden
APR TECHNOLOGIES AB	Sweden
AUSTRIAN INSTITUTE OF TECHNOLOGY GMBH	Austria
BHE BONN HUNGARY ELECTRONICS LTD	Hungary
BITTIUM WIRELESS OY	Finland
CAFA TECH OU	Estonia
EIGHT BELLS HELLAS	Greece
ERICSSON AB	Sweden
FORSVARETS FORSKNINGINSTITUTT	Norway
INSTER TECNOLOGIA Y COMUNICACIONES SAU	Spain
INTRACOM DEFENSE SINGLE MEMBER S.A.	Greece
LATVIJAS MOBILAIS TELEFONS SIA	Latvia
LEONARDO - SOCIETA PER AZIONI	Italy
NOKIA SOLUTIONS AND NETWORKS OY	Finland
RHEINMETALL ELECTRONICS GMBH	Germany



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NAME OF THE ENTITY	COUNTRY
SINTEF AS	Norway
SYNKZONE	Sweden
TELENOR ASA	Norway
THALES SIX GTS France SAS	France

# 5G COMPAD DEVELOPS OPERATIONAL EFFECT

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- **Reinforced Interoperability**
  - Enabling enhanced operational capabilities of the armed forces with 5G
  - Providing resilience together with today's military communication networks
- **Sustained information superiority** in the defence domains at scale
  - Fast and recurrent exploitation of 5G and beyond from Telco to Defence capabilities, with feedback from Defence to Telco
  - Enables interoperable and robust Military Multi-Domain Clouds
  - Enabling e.g. Superior Logistics Management in the support zone
- **Security of Supply**
  - Develop and exploit **European Sovereign Critical technology** for Peace Keeping and Defence Communication
  - bringing the world's leading European 5G vendors and defence system integrators together
  - secure supply of key technology
  - Strengthen strategic autonomy by trusted vendors within Europe



The background features a large, dark, metallic-looking Saab logo on the left, which is an oval containing a crown and a griffin. To the right of the logo, the word "SAAB" is written in large, bold, outlined letters. The entire scene is dimly lit, suggesting a night or dusk setting.

# CASTOR SW Days

KTH, Stockholm, 220831

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