SoSECIE Webinar

Welcome to the
2021 System of Systems Engineering Collaborators Information Exchange (SoSECIE)

We will start at 11AM Eastern Time

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NDIA System of Systems SE Committee

- **Mission**
  - To provide a forum where government, industry, and academia can share lessons learned, promote best practices, address issues, and advocate systems engineering for Systems of Systems (SoS)
  - To identify successful strategies for applying systems engineering principles to systems engineering of SoS
- **Operating Practices**
  - Face to face and virtual SoS Committee meetings are held in conjunction with NDIA SE Division meetings that occur in February, April, June, and August

NDIA SE Division SoS Committee Industry Chairs:
Mr. Rick Poel, Boeing
Ms. Jennie Horne, Raytheon
OSD Liaison:
Dr. Judith Dahmann, MITRE

Simple Rules of Engagement

- I have muted all participant lines for this introduction and the briefing.
- If you need to contact me during the briefing, send me an e-mail at sosecie@mitre.org.
- Download the presentation so you can follow along on your own
- We will hold all questions until the end:
  - I will start with questions submitted online via the CHAT window in Teams.
  - I will then take questions via telephone; State your name, organization, and question clearly.
- If a question requires more discussion, the speaker(s) contact info is in the brief.

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2021-2022 System of Systems Engineering Collaborators Information Exchange Webinars

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April 20, 2021
Leveraging Set-Based Practices to Enable Efficient Concurrency in Large Systems and Systems-of-Systems Engineering
Brian Kennedy

May 4, 2021
OUSD R&E: USD(R&E) Mission Engineering (ME) State of Practice
Elmer L. Roman

May 18, 2021
Application of Probabilistic Graph Models to Kill Chain and Multi-Domain Kill Web Analysis Problems
Jason Baker and Valerie Sitterle

June 1, 2021
Applying an MBSE Approach for Evaluating Shipyard Operations
David Jurkiewicz

https://www.mitre.org/capabilities/systems-engineering/collaborations/system-of-systems-engineering-collaborators

2021-2022 System of Systems Engineering Collaborators Information Exchange Webinars

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June 15, 2021
Implementing a Digital Engineering Environment for Mission Engineering
Jason Anderson and Jeffrey Boulware

June 29, 2021
Digital Engineering: From Toolchain to Platform
Dr. Aleksandra Markina-Khusid

July 13, 2021
Developing Meta Systems Architectures for Leading Innovation with Complex Societal and Technical Challenges
Dr. Cihan Dagli

July 27, 2021
Advancements Towards a Digital Approach for Mission Engineering
Todd Shayler and Daniel Browne

https://www.mitre.org/capabilities/systems-engineering/collaborations/system-of-systems-engineering-collaborators

Holistic architecture description for a future Global Health Assurance Systems of Systems

System of Systems Engineering Collaborators Information Exchange (SoSECIE)

April 6th, 2021
11:00 a.m. to Noon Eastern Time

Speaker: Adrián Unger
adrianunger@gmail.com
www.linkedin.com/in/adrian-unger-systemsengineer

Georgia Institute of Technology

Professional Master's in Applied Systems Engineering (2019)

AGENDA

- **Introduction**
- **Problems, Opportunities, Purpose**
- **Disciplines & Partitioning**
- **Constituent Systems & Stakeholders**
- **Heuristics**
- **Architecture Considerations & Models**
- **COVID**
- **Recommendations & Conclusions**

PROBLEMS, OPPORTUNITIES AND SOS PURPOSE

- Capacity (health systems).
- Doctors fatigue.
- Medical errors.
- Months for a medical consultation.
- Spreading disease emergency management is not standardized.
- Not enough doctors for a 1st diagnosis (world level)
- Some patients need to travel several miles to get to a hospital.
- Different laws in different countries (Health systems).
- Distributed Clinical medical records (ownership).
- Paper document retention laws (i.e.. 2-year retention).
- Hypothesis and rationales of medical cases not being registered (post-processing).
- Waste (paper, bio-pathological).
- Not standardized emergency management.

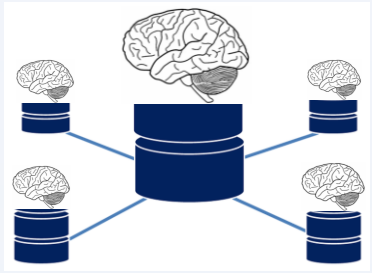
SoS purpose

*"Ensure a constant global annual improvement in health access regardless of the condition of the patient"**

***Should be replaced in the future by a known target (e.g. "ensure an increment of 10% in annual target").**

DISCIPLINES & PARTITIONS

Mobile clinics

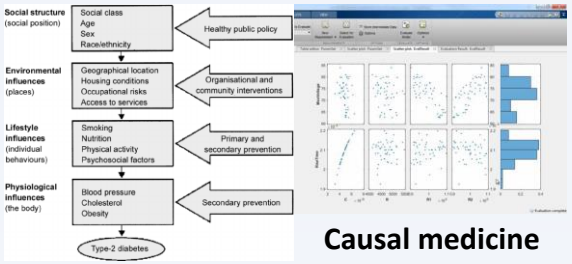


Collaborative medical knowledge databases

Individual electronic medical records

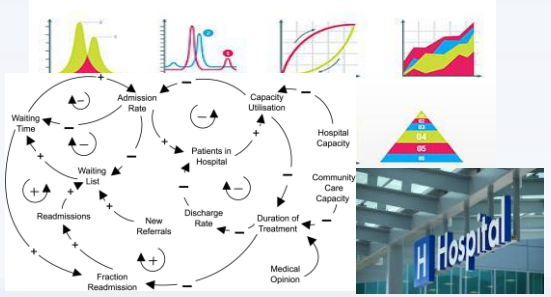
All-scenario medical ruggedized HMI

Tele-medicine



Causal medicine

Universal medical record retrieving



Health Institutions Dynamics & Performance

Reliable telecomm & networking

Global Health Emergency Management

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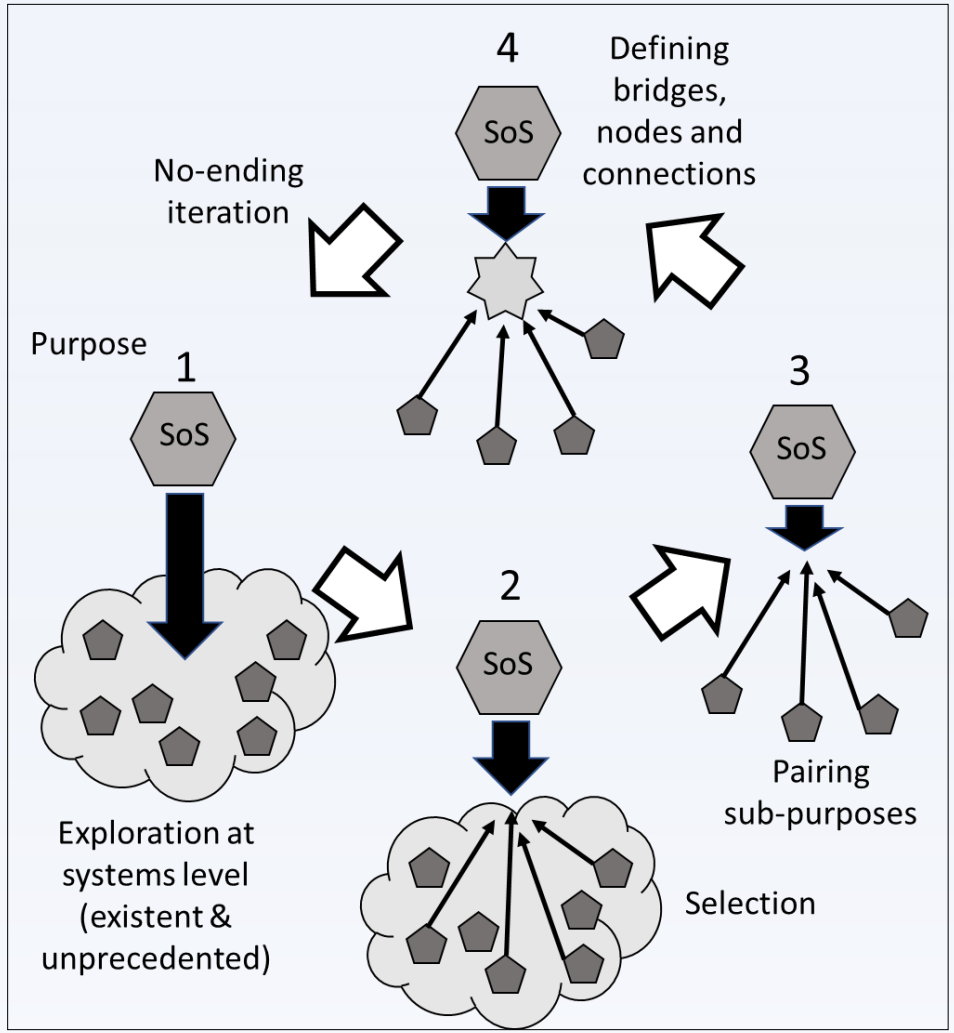
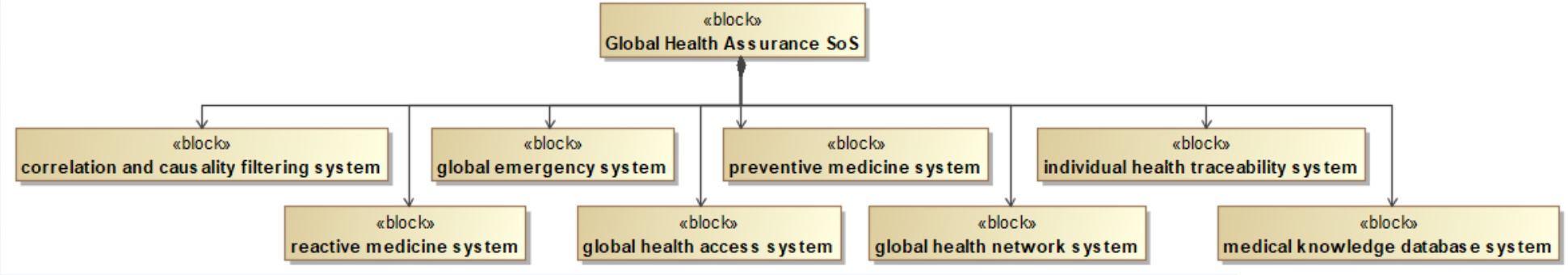
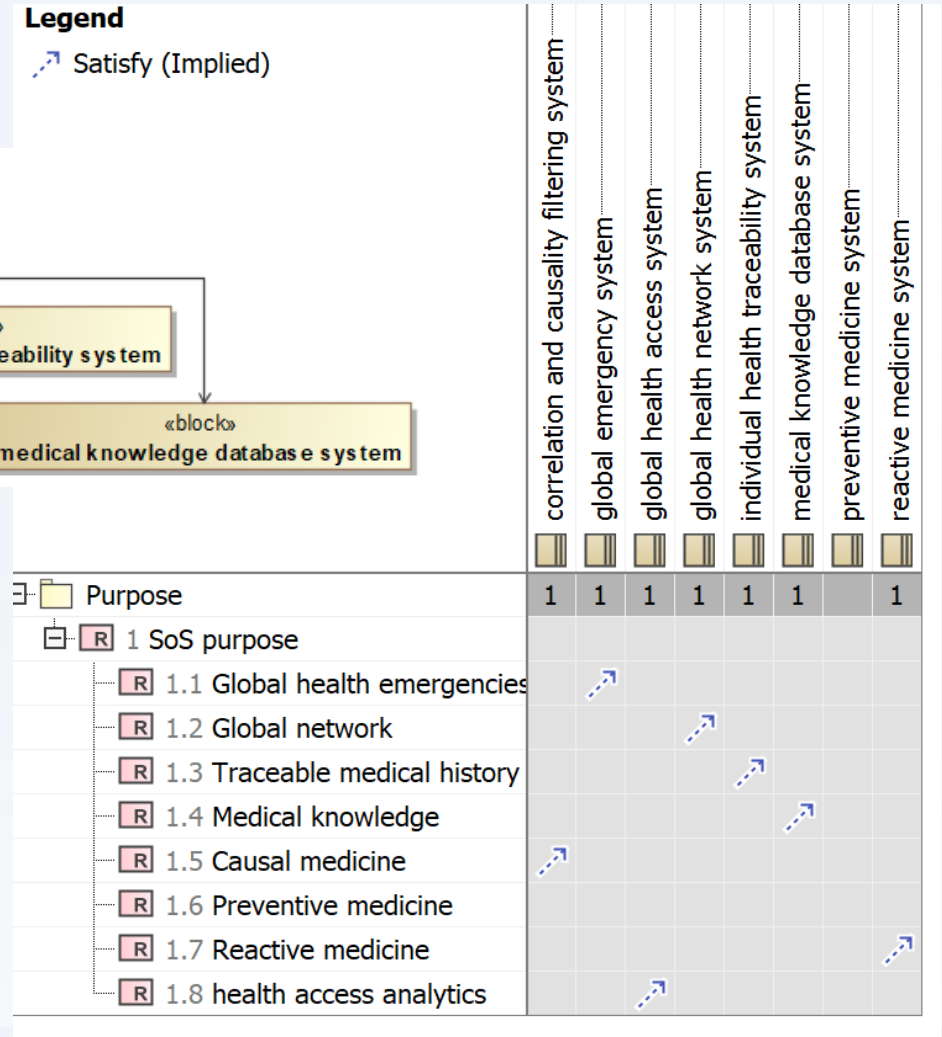
Dhanush telemedicine
Doctors without borders
Teguar medical tablet
Oxycare
Mathworks
Google maps
Systems dynamics.org

PROCESS


4
Defining bridges, nodes and connections
SoS
No-ending iteration
Purpose
1
SoS
3
SoS
2
SoS
Exploration at systems level (existent & unprecedented)
Pairing sub-purposes
Selection

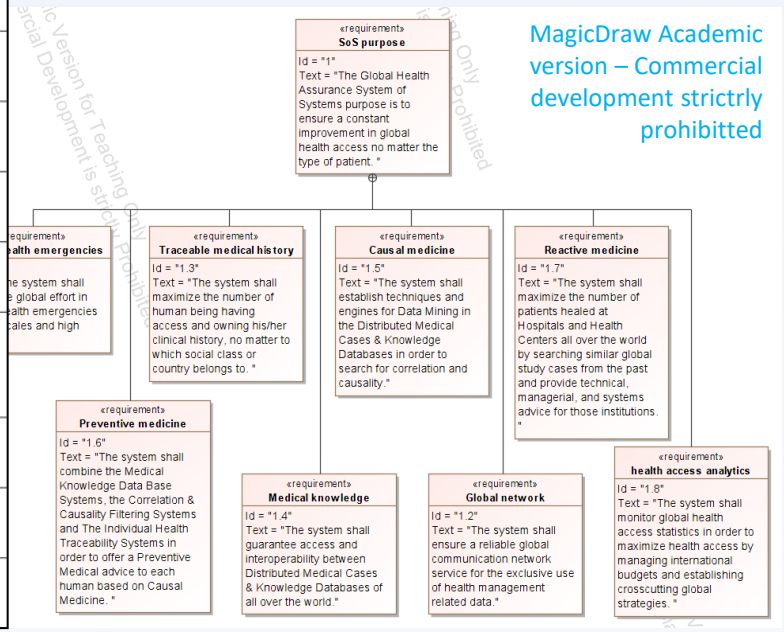
For further work





CONSTITUENT SYSTEMS & PURPOSES

	overloaded capacity of health institutions	clinical doctors fatigue	medical errors	waste	disjointed medical history	patients don't have ownership of medical history	spreading disease management not standarized	communications are still critical when managing health related emergency situations	collaborative work in medical industry is not efficient	world health statistics aren't enough	long delays for medical consultation	bottlenecks for 1st diagnosis	medical cases and rationales of treatment poorly registered	disjointed medical knowledge for causal analysis
Global Emergency System							x	x						
Global Health Network System			x					x	x				x	x
Individual Health Traceability System	x			x	x	x				x		x		
Medical Knowledge Data Base System		x	x	x	x	x			x	x			x	x
Correlation & Causality Filtering System			x							x			x	x
Global Preventive Medicine System	x	x									x	x		x
Reactive Medicine System	x						x				x	x		
World Health Access System	x	x					x	x	x	x	x			



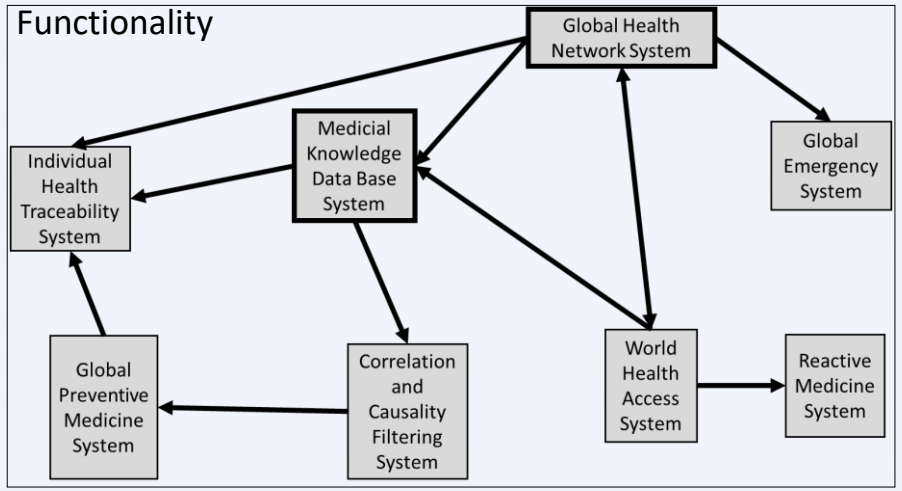
STAKEHOLDERS

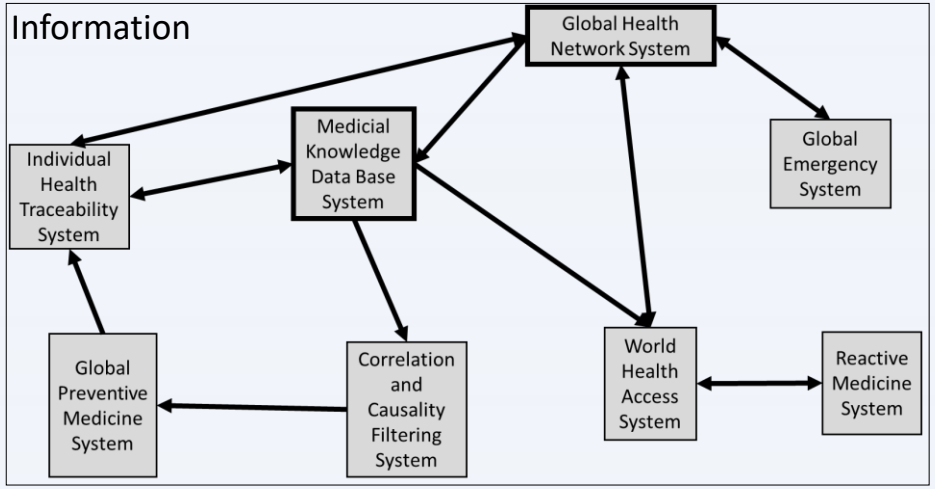
- Sick patients
- Healthy people
- Doctors
- Governments
- NGOs
- Companies
- Enterprises

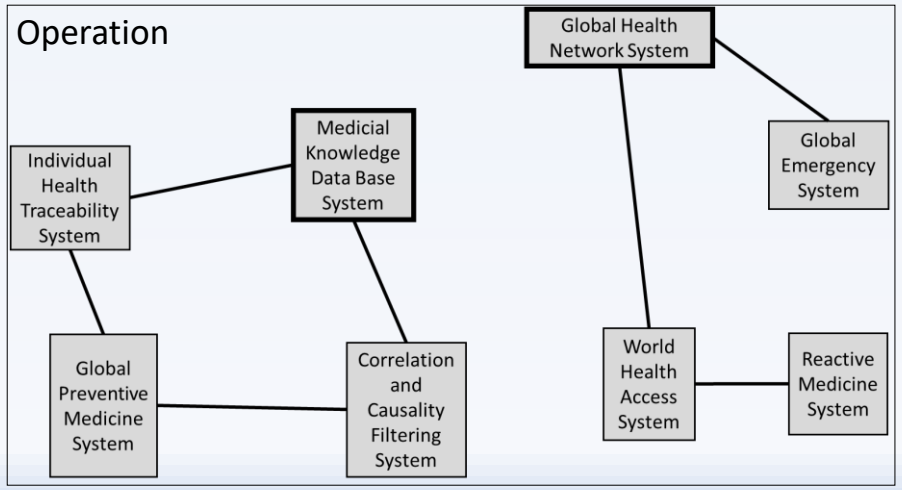
HEURISTICS

- *Address organizational as well as technical issues when making trades and decisions*
- *Acknowledge the different roles of systems engineering and systems engineers at the system vs. SoS levels*
- *Balance technical management of the SoS*
- *Use an architecture based on "open systems" and "loose" coupling*
- *Focuses on the design strategy and trades when the formal SoS is the first established, and throughout the SoS evolution*
- *If politics don't fly, hardware never will*

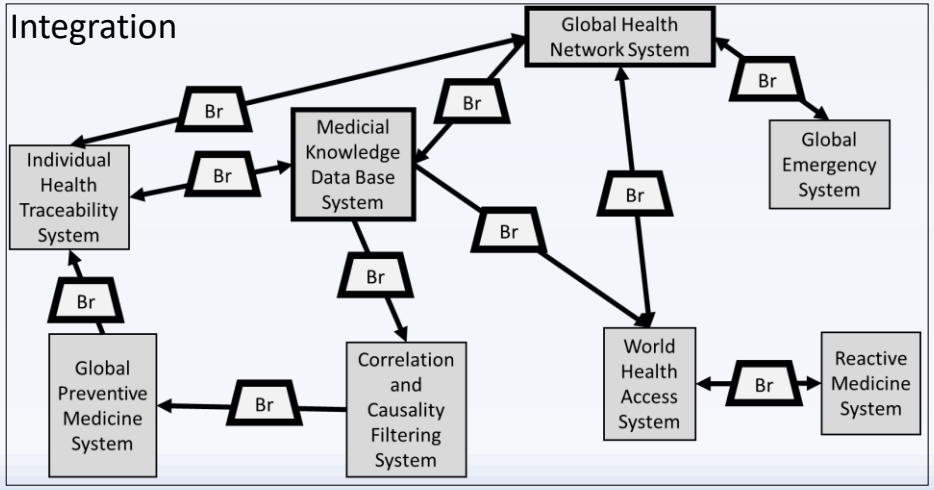
ARCHITECTURE CONSIDERATIONS



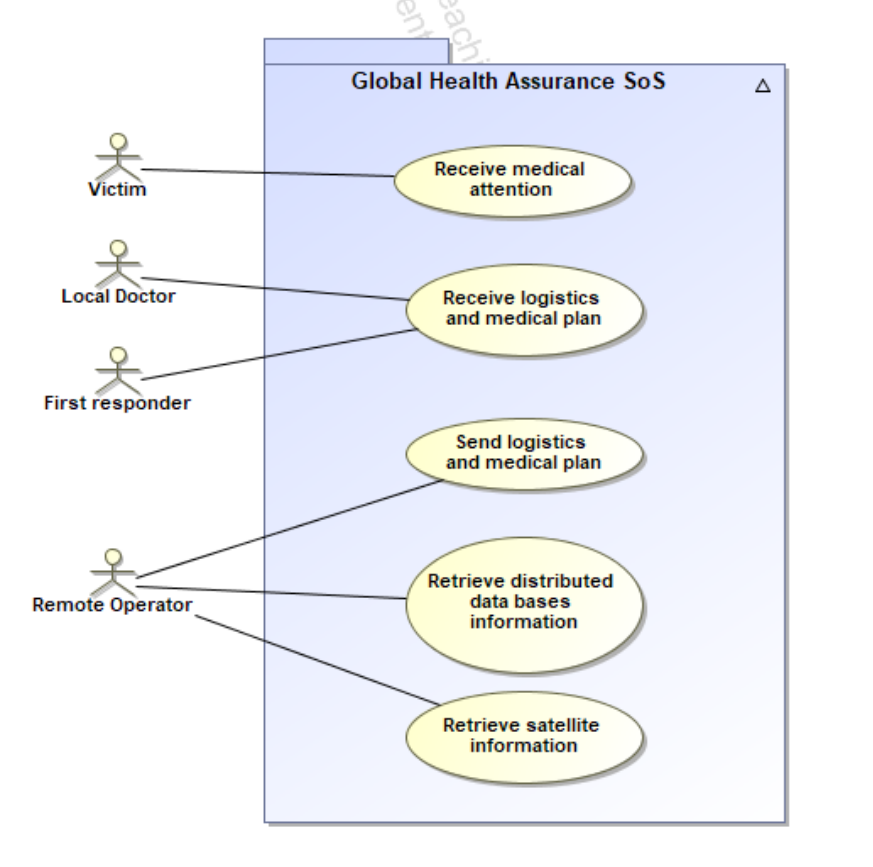


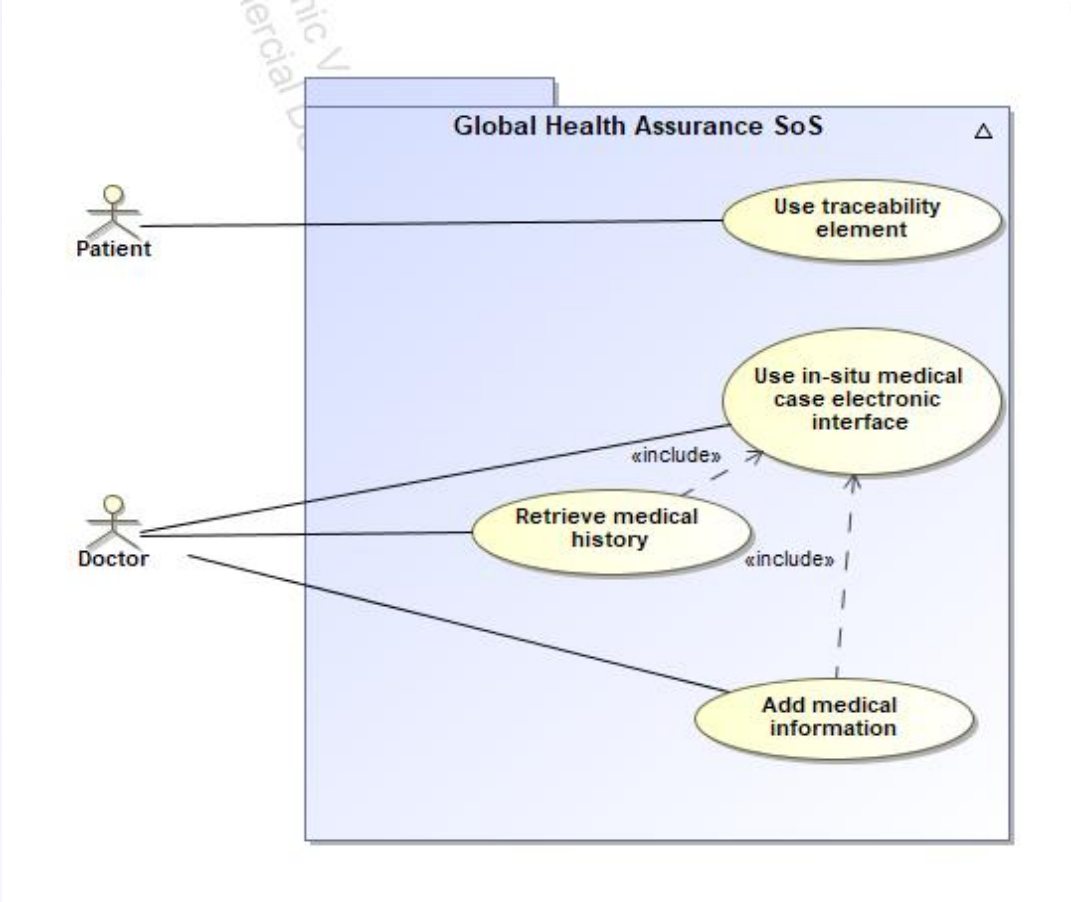


Autonomy
Complexity
Diversity
Integration strategy
Data architecture
Critical elements
Redundancy (Type)
Success factors

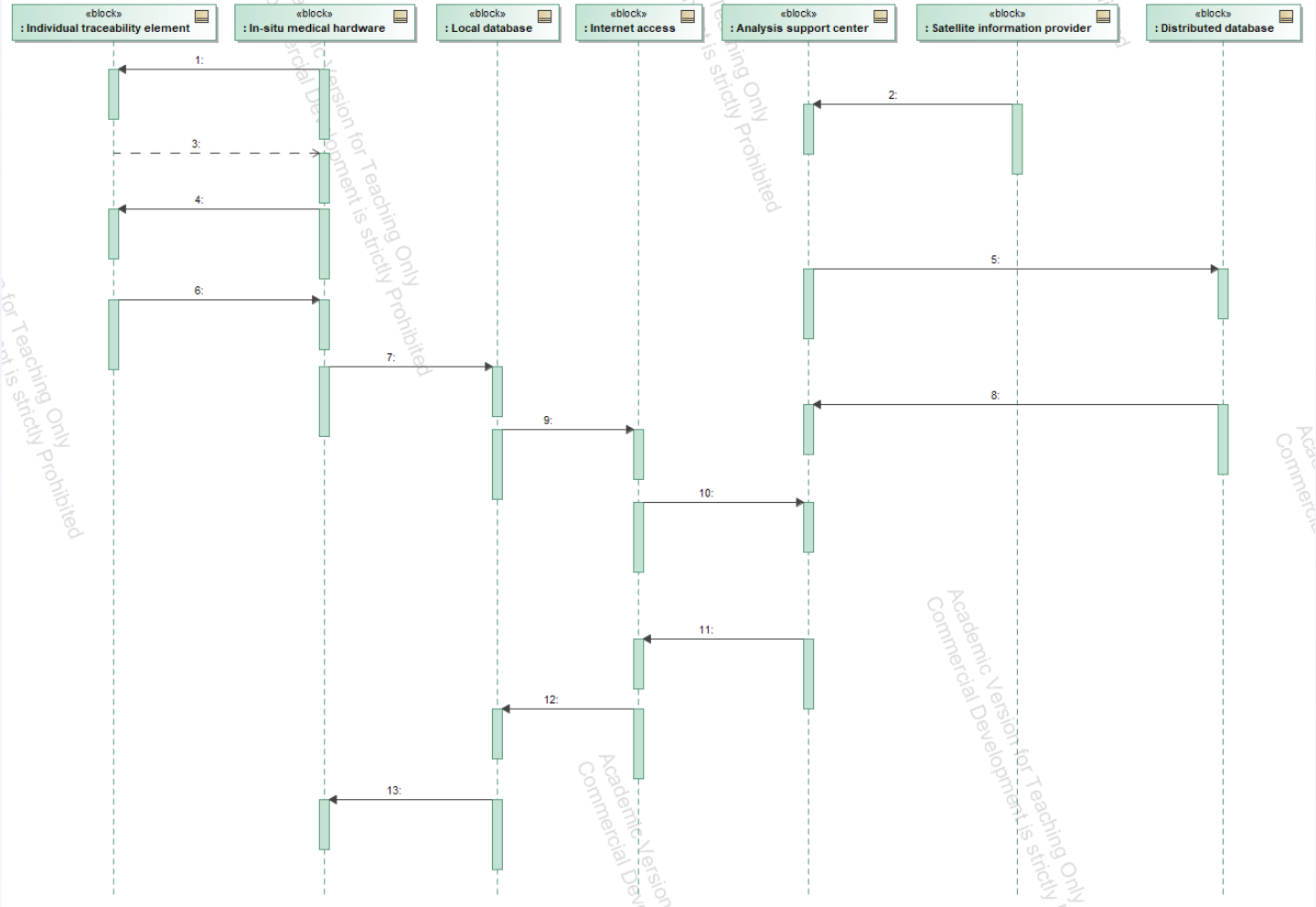


MODELS (1/3)

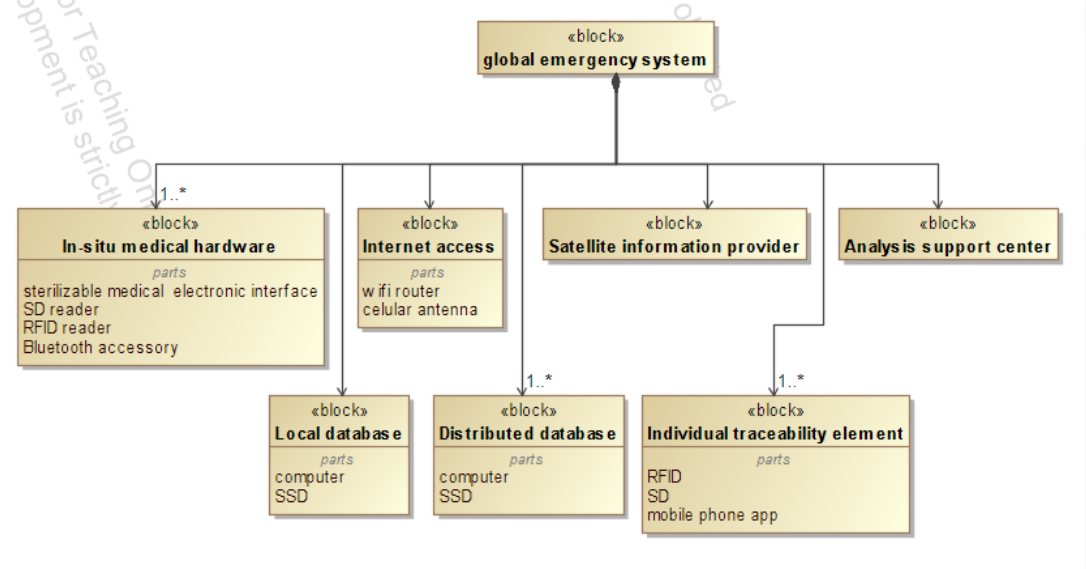


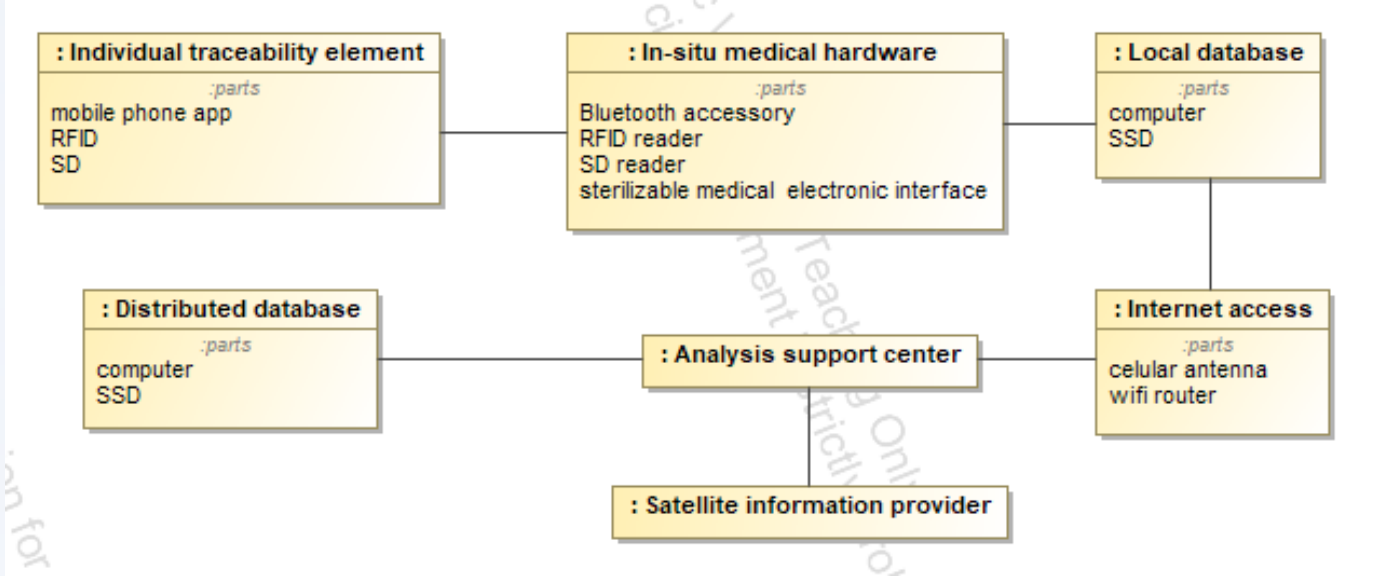


MODELS (2/3)



MODELS (3/3)





COVID19

EXTRA: Not in the paper

- **EMERGENCY CONTEXT**
- Ventilator design Approval legislation
  - **Strict Tests for Software!**
  - **Strict Tests for Firmware!**
- Local / National / Regional policies
- Ventilator stock
- Global Ventilator´s components stock
- Spreading statistics
- Vaccination statistics

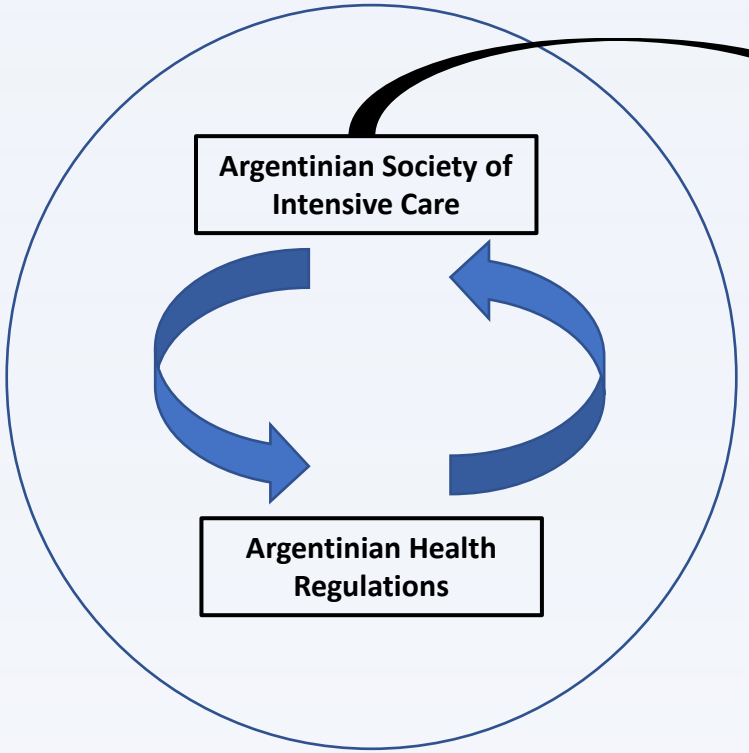
Image source: https://lh3.googleusercontent.com/proxy/0ofcdtFm1Wvv-aM7IlRiErGxDbMBu4ksvdoEzwQIc4P21N1rdta0ZlWe4XABP1ViSCIkV87qdgUvZWoZ69oiuI5XJBKfACr6xjAAJFb6EA_WdYJlBGnhXbbzINTcRnzATvD0KZqfSdqobspMGDhb9VJ

COVID19: Discrete-electronics based ventilator

EXTRA: Not in the paper

- Non Profit / Volunteer
- Requirement Capture
- Systems Context
- Use Cases // Models
  - Model 1: Ventilator for big cities (large automatized factories for I&T)
  - Model 2: Ventilator for small towns (electronic technicians for I&T)
- Subsystem // Functional decomposition
- State Machines
- Physical Architecture
  - Component Cost
  - Stock research
  - Subsystem implementation options (Argentina´s context: delivery times and importation changing policies due to pandemics).
  - PCB technology, integration & testing
- **Simulations**

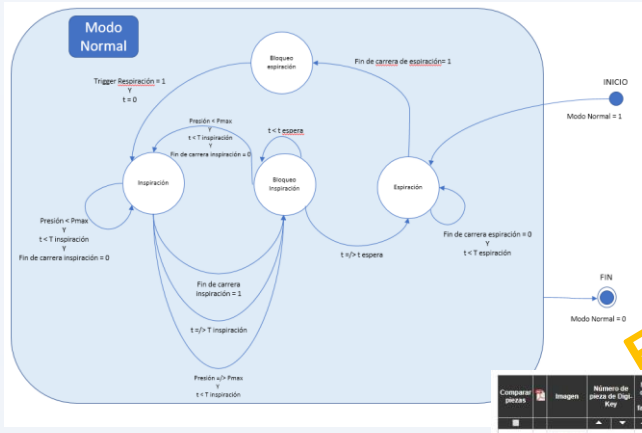
COVID19



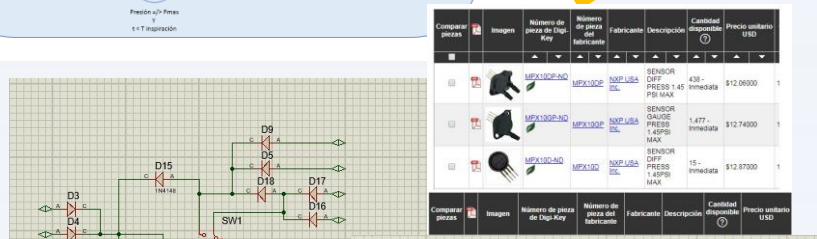
Emergency context

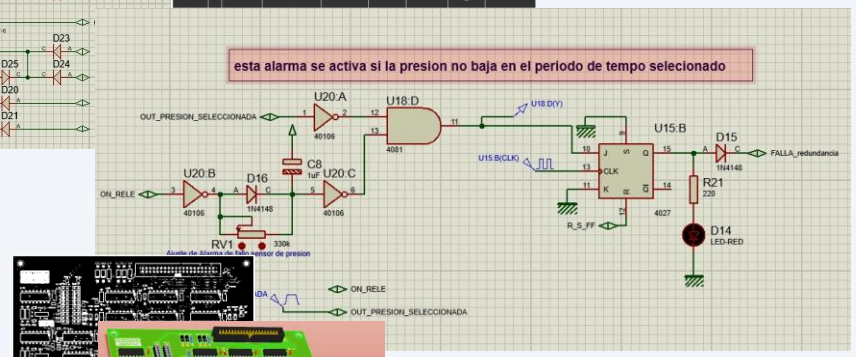
High-Level Customer Requirements

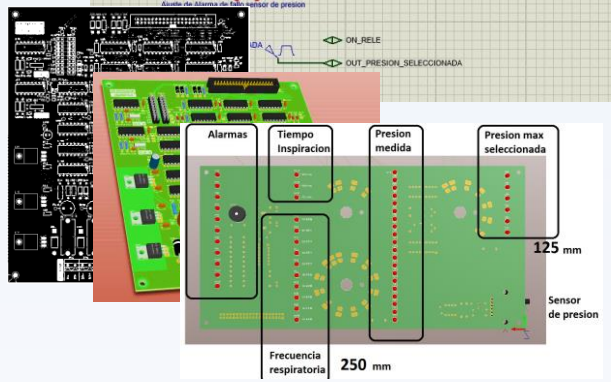
Engineering Requirements



EXTRA: Not in the paper







+ Simulations

RECOMMENDATIONS & CONCLUSIONS

- Recommendations

- SysML models
- Simulations
- Robustness analysis
- Adaptive policy
- Collaborative structure emergent behavior
- Metrics

- Conclusions

- General and specific problems addressed
- Comprehensive view
- Partitioned solutions and diversity
- **COVID // Pandemics: shared efforts.**

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- Georgia Tech Professional Education

- PMASE instructors

- COVID discrete electronic-based ventilator team:
  - Eng Adrian Laiuppa (developer): linkedin.com/in/adrian-laiuppa-36189514
  - Eng. Juan Pablo Sala (developer): linkedin.com/in/juan-pablo-sala-120a3018
  - MEng Adrian Unger (Sys Eng)

Thank you for your time

Now, Q&A

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