

28th national conference with international participation **TELECOM 2020** 29-30 October

“THE WAYS TO CONNECT THE FUTURE”



Big Data, Internet of Things and Health:
Love all, trust a few, do wrong to none!

Prof. Vladimir Trajkovik



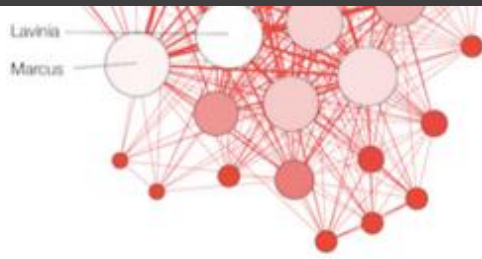
“Ss. Cyril and Methodius” University in Skopje
**FACULTY OF COMPUTER
SCIENCE AND ENGINEERING**

trvlado@finki.ukim.mk



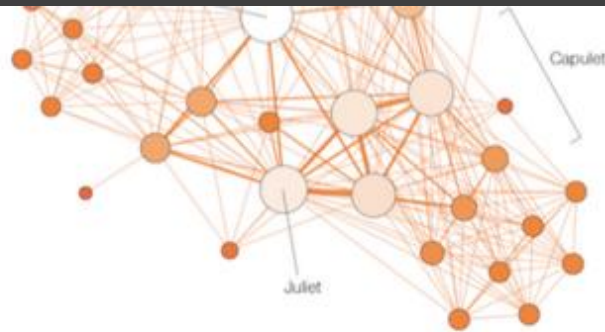
Why?
How?
What?

Challenges...
Possible Solutions...



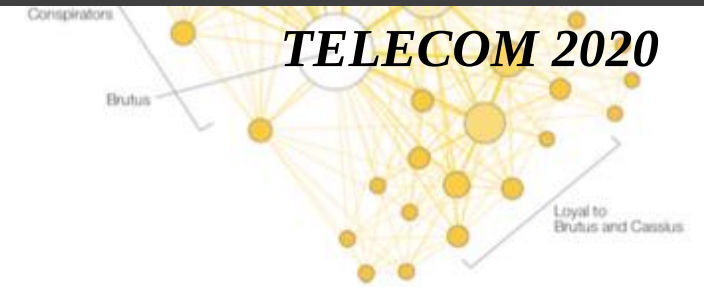
TITUS ANDRONICUS

Number of characters **36** | **50%** Network density



ROMEO AND JULIET

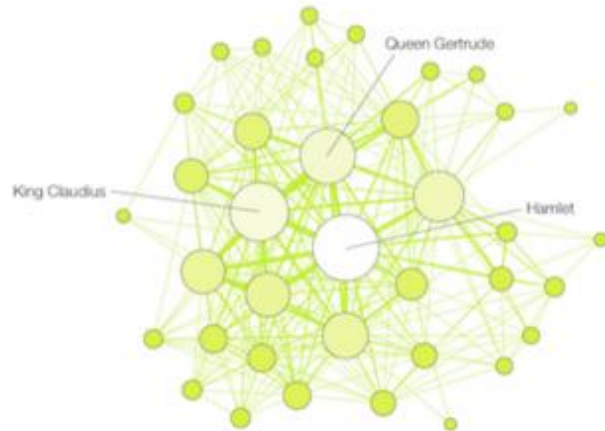
Number of characters **41** | **37%** Network density



TELECOM 2020

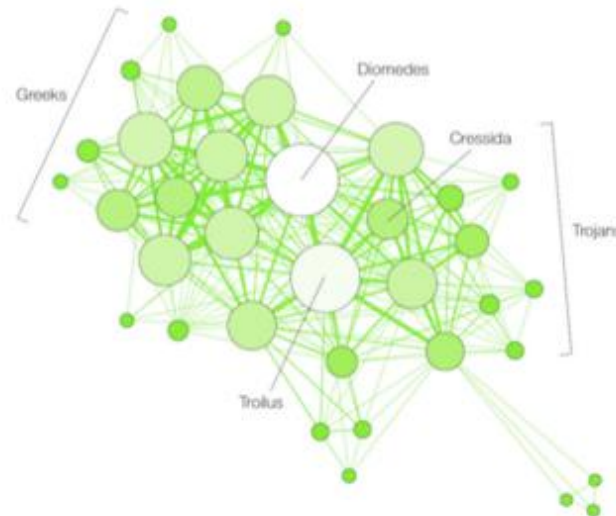
JULIUS CAESAR

Number of characters **46** | **34%** Network density



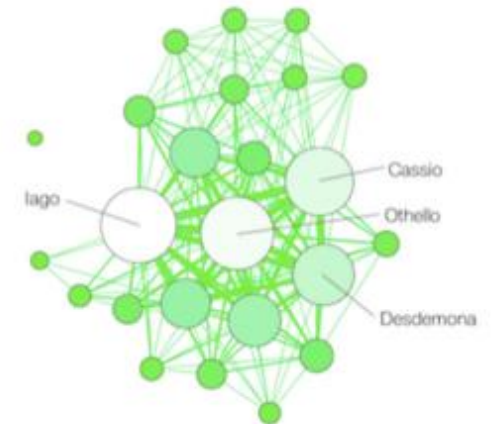
HAMLET

Number of characters **37** | **39%** Network density



TROILUS AND CRESSIDA

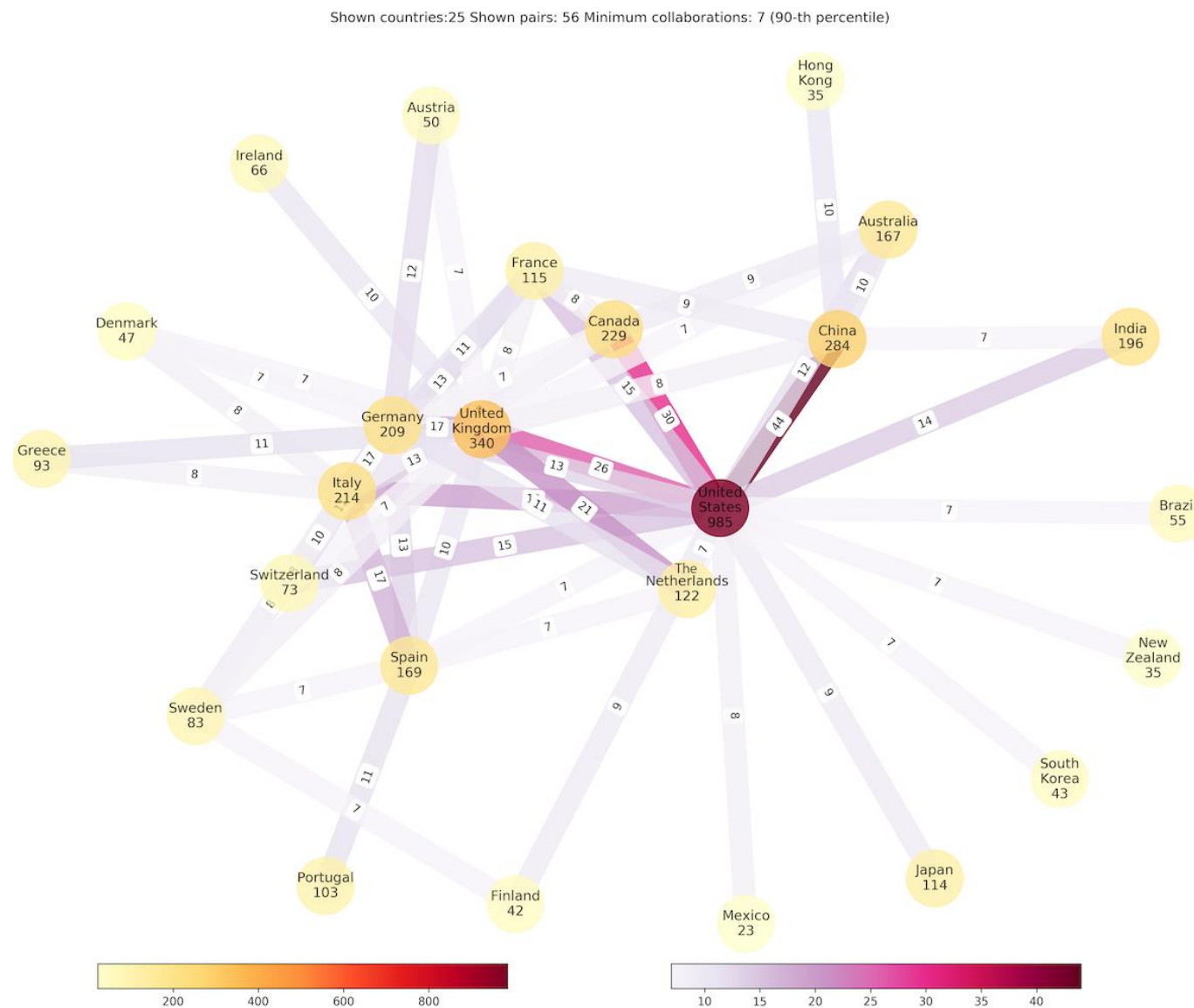
Number of characters **35** | **40%** Network density



OTHELLO

Number of characters **24** | **55%** Network density

Why are networks important?



My Network

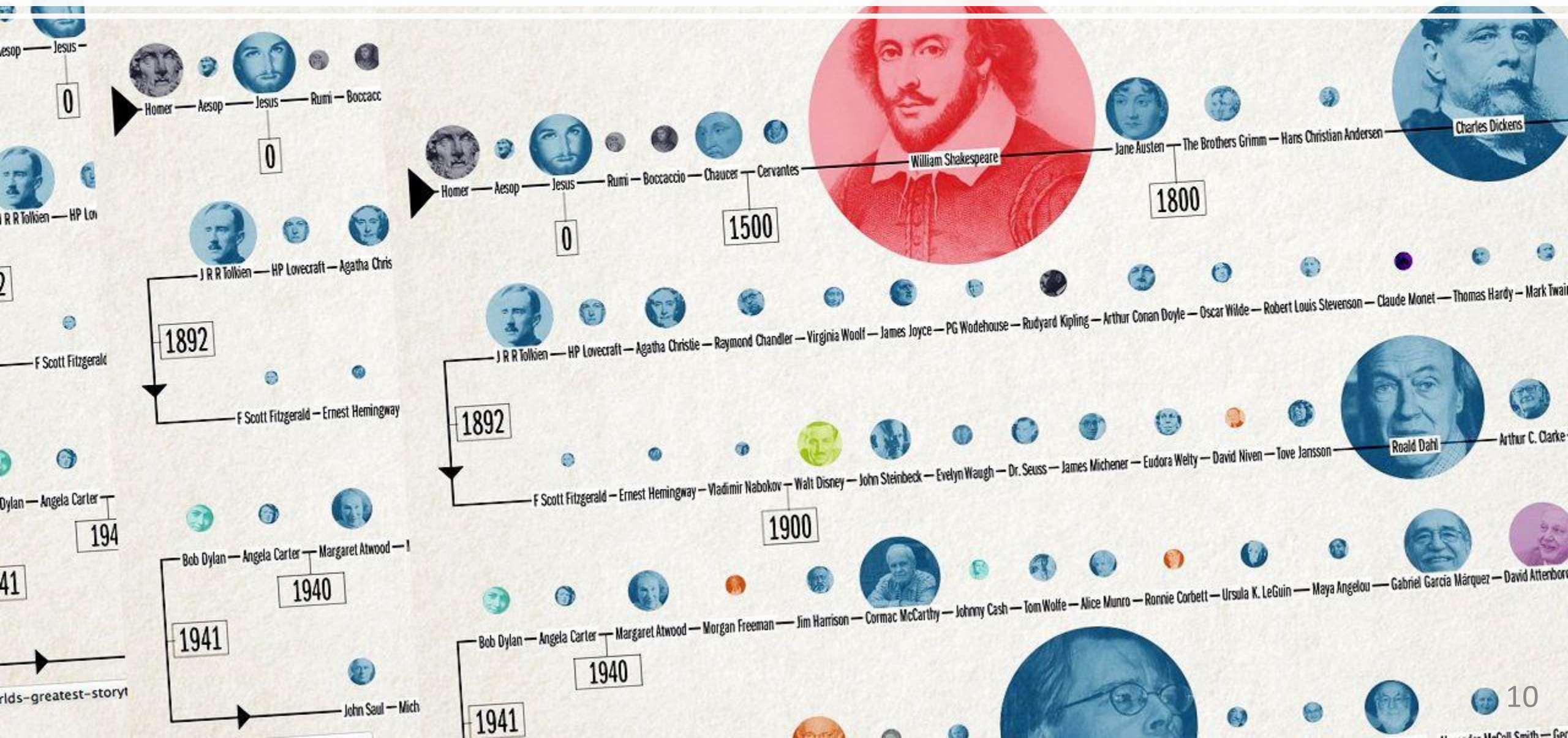
- Prof. Tatjana Loncar Turukalo, University of Novi Sad, Serbia
- Kristina Drusany Staric, University Medical Centar Ljubljana, Slovenia
- Hrvoje Belani, VERN University of Applied Sciences, Croatia
- Ioanna Chouvarda, Aristotle University of Thessaloniki, Greece
- Sabina Barakovic, University of Sarajevo, Bosnia and Hercegovina
- Lina Xu, University College Dublin, Ireland
- Fedor Lehocki, Slovak University of Technology, Slovakia
- Petra Maresova, University of Hradec Kralove, Czech Republic
- Nuno Garcia, Universidade da Beira Interior, Portugal
- **Rossitza Goleva, New Bulgarian University, Bulgaria**

My local team

- Core team
 - Eftim Zdravevski, PhD
 - Petre Lameski, PhD
 - Saso Koceski, PhD
 - Goce Gavrilov, PhD
 - Ace Dimitrievski, MsC
 - Zlate Dodevski, MsC
- Former core team members
 - Elena Vlahu, University of Wollongong, Australia
 - Igor Kulev, ETH, Switzerland
 - Olivera Kotevska, Oak Ridge National Laboratory, USA
- Collaborators
 - Ana Madevska Bogdanova, PhD
 - Ivan Chorbev, PhD
 - Monika Simjanovska, PhD
 - Bojana Kotevska, PhD
 - Sonja Filipovska, PhD
 - Anastas Mishev, PhD
- Companies
 - SportyPal (Not Active)
 - Iborn
 - AirCare
 - Blokverse

Why different technologies (storytelling techniques)?

They create both possibilities and challenges!



They create
both
possibilities
and
challenges!



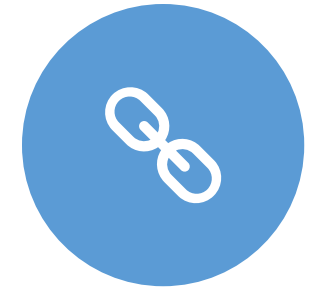
BIG DATA



IOT



MACHINE
LEARNING



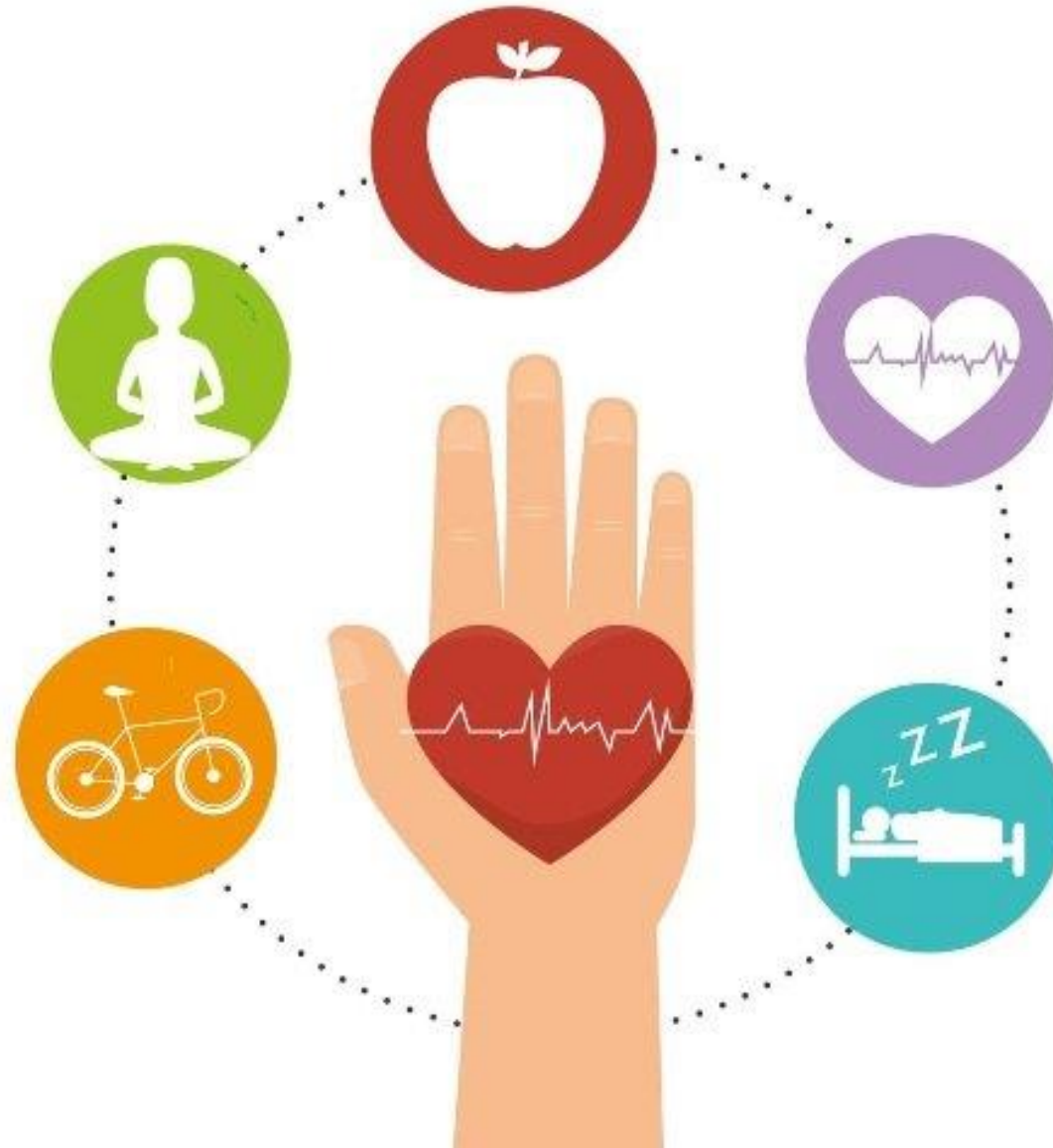
BLOCKCHAIN

Why health?

Good health
is more than
just good
physical
condition!

"Our bodies are
our gardens -
our wills are
our gardeners."

- William Shakespeare



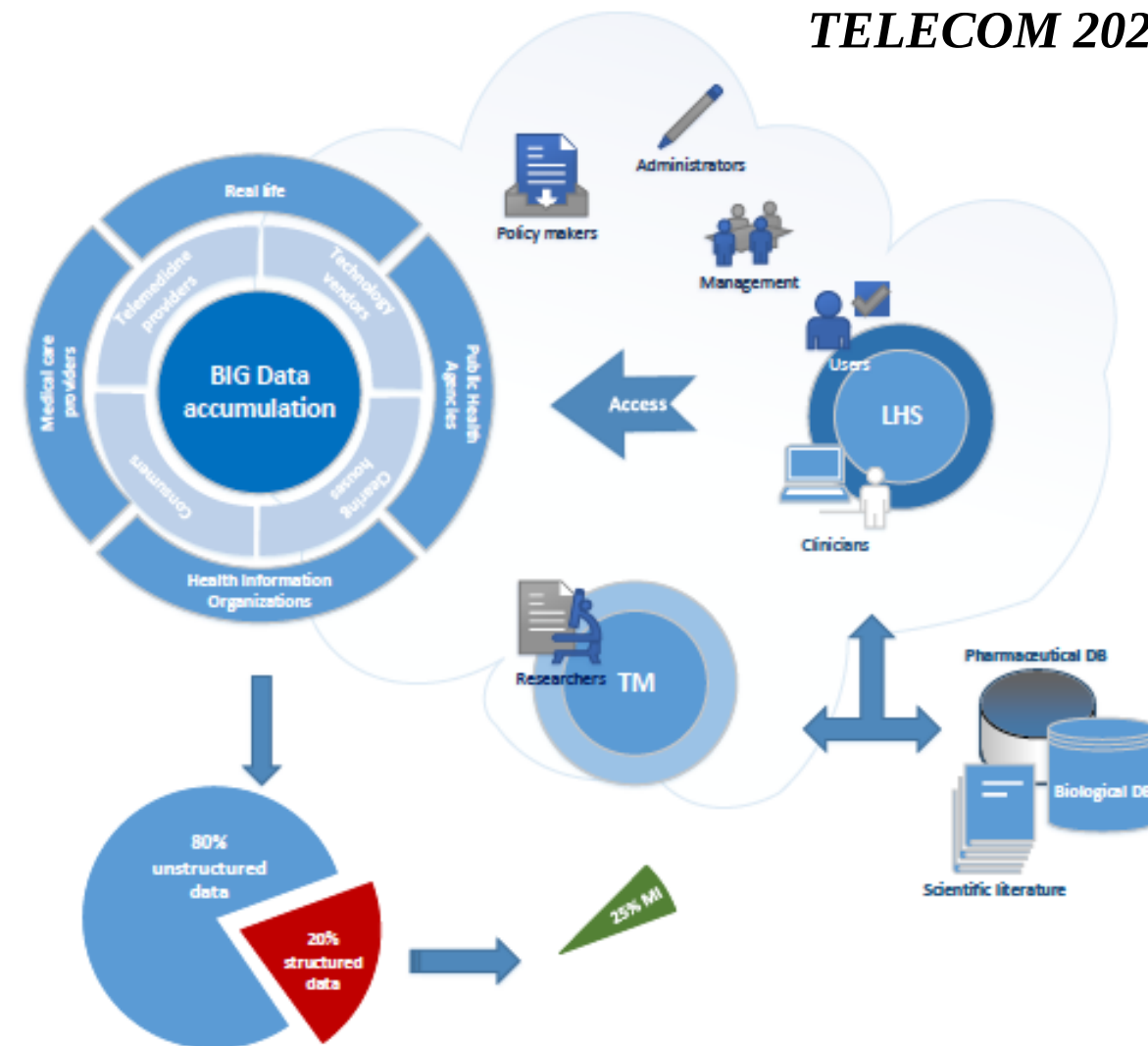
How?

Connected Health (CH)

Translational Medicine (TM)

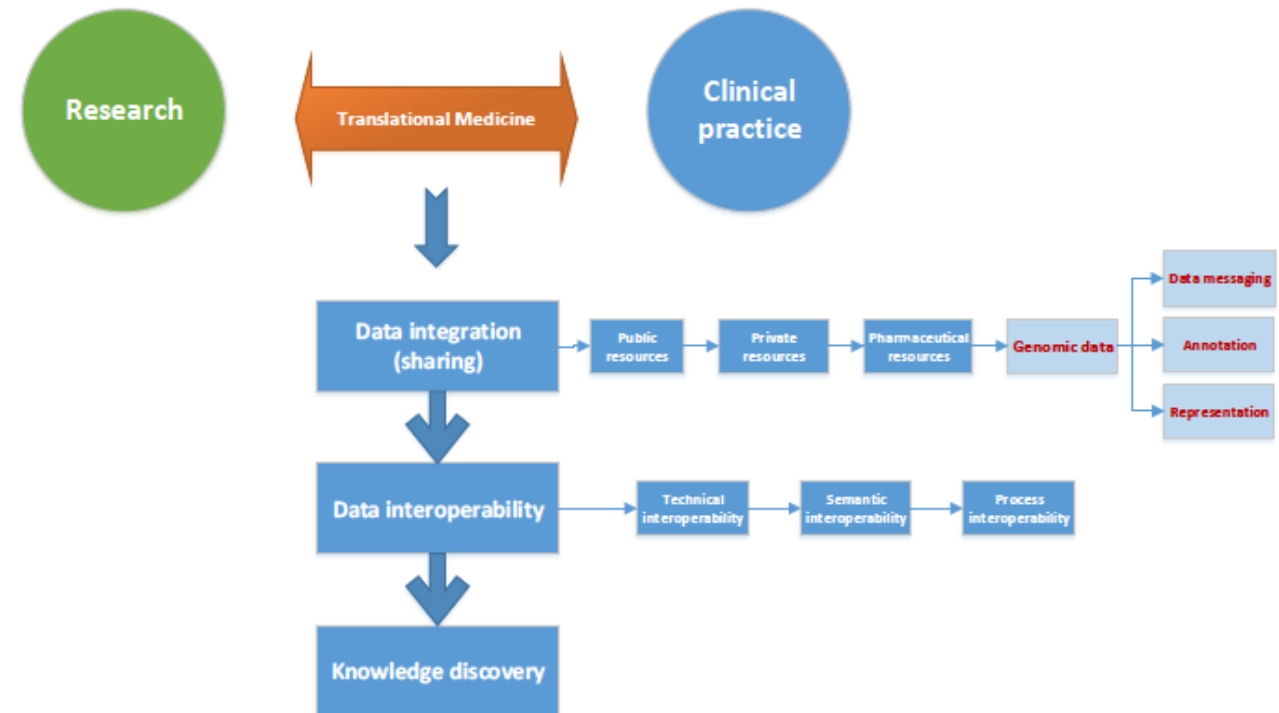
Ambient and assisted Living (AAL)

Connected Health Information Exchange

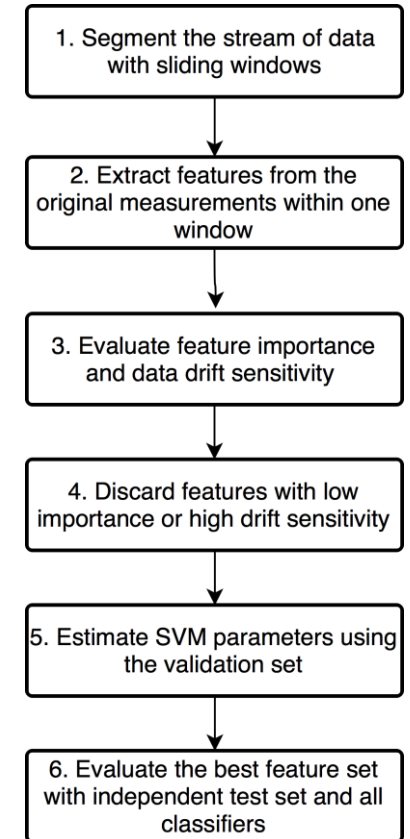
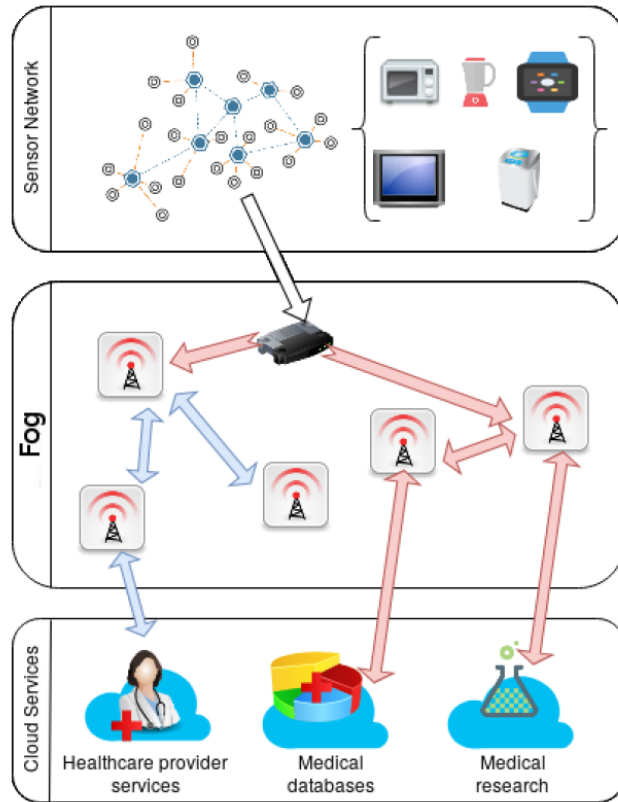


Lina Xu, Monika Simjanoska, Bojana Koteska, Vladimir Trajkovikj, Ana Madevska Bogdanova, Kristina Drusany Starič, and Fedor Lehocki. "What Clinics Are Expecting From Data Scientists? A Review on Data Oriented Studies Through Qualitative and Quantitative Approaches." In IEEE Access Volume 7, January 2019

Translational Medicine (TM) Bridge



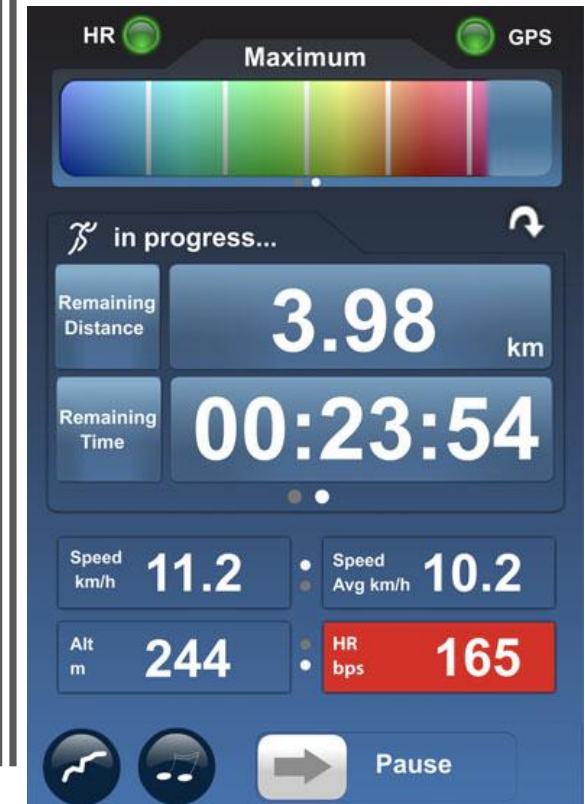
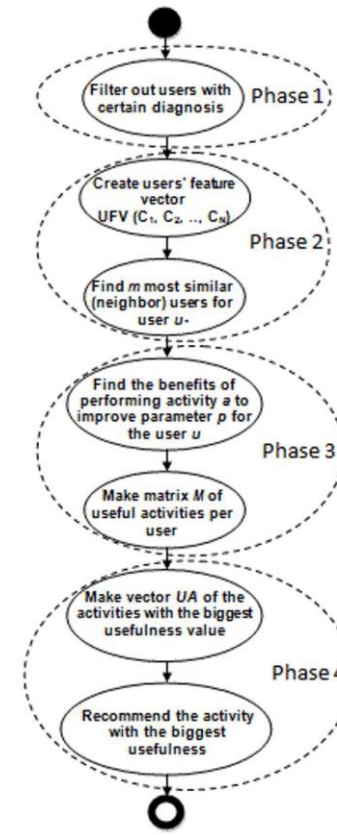
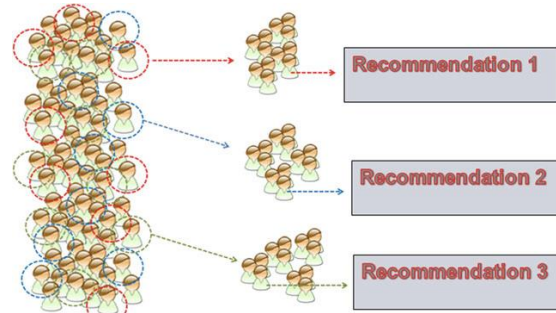
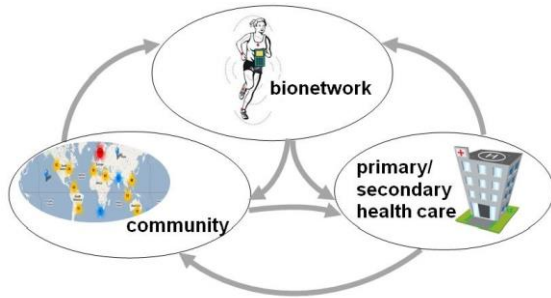
Lina Xu, Monika Simjanoska, Bojana Koteska, Vladimir Trajkovikj, Ana Madevska Bogdanova, Kristina Drusany Starič, and Fedor Lehocki. "What Clinics Are Expecting From Data Scientists? A Review on Data Oriented Studies Through Qualitative and Quantitative Approaches." In IEEE Access Volume 7, January 2019



General AAL Application

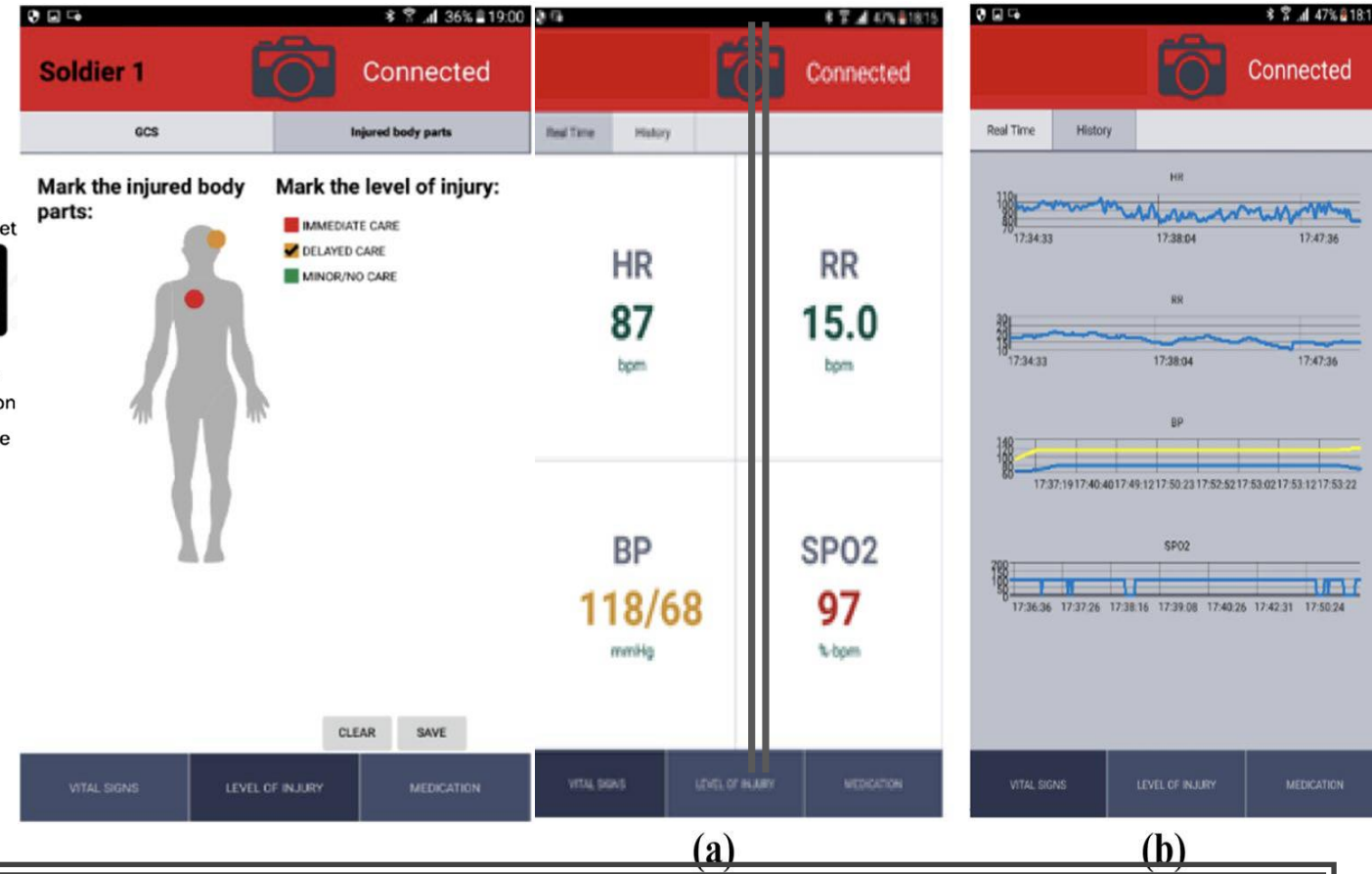
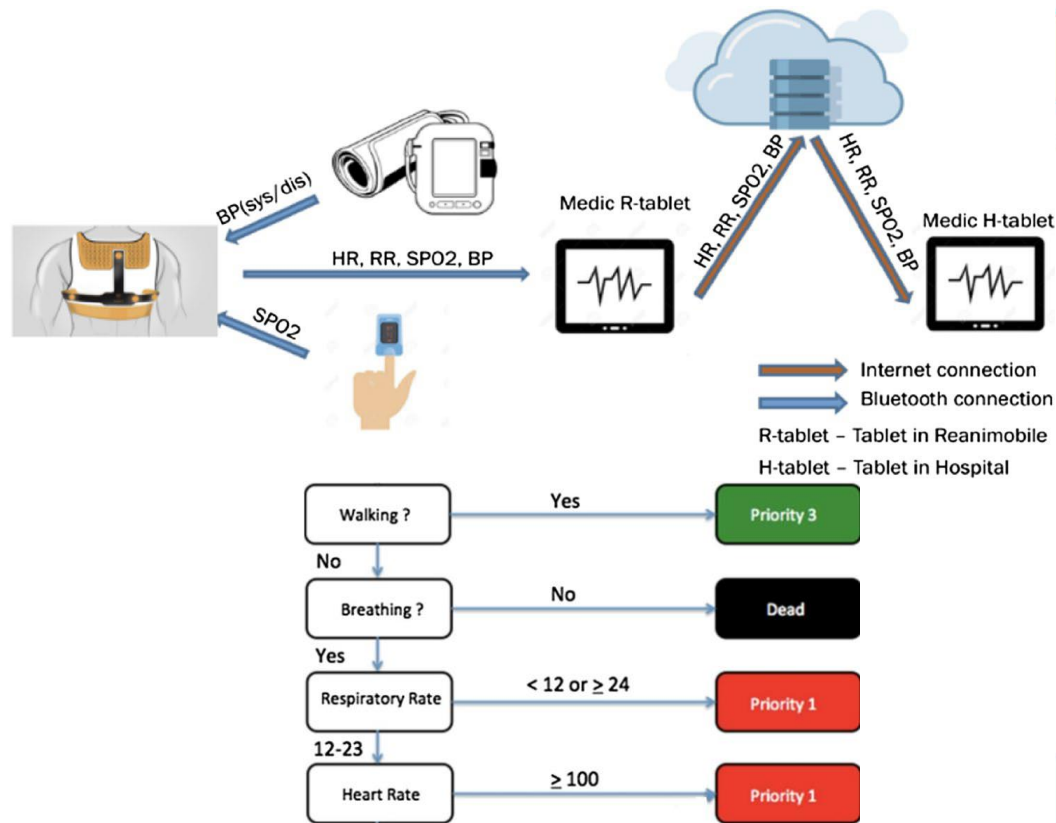
Ace Dimitrievski, Eftim Zdravevski, Petre Lameski, Vladimir Trajkovic, "Towards Application of Non-Invasive Environmental Sensors for Risks and Activity Detection", 12th IEEE International Conference on Intelligent Computer Communication and Processing, Cluj Napoca, Romania, September 8-10, 2016.

What is possible?



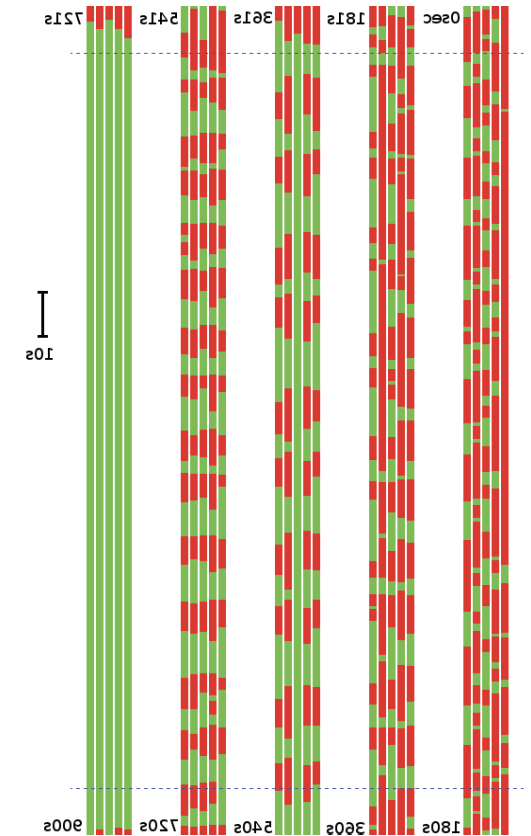
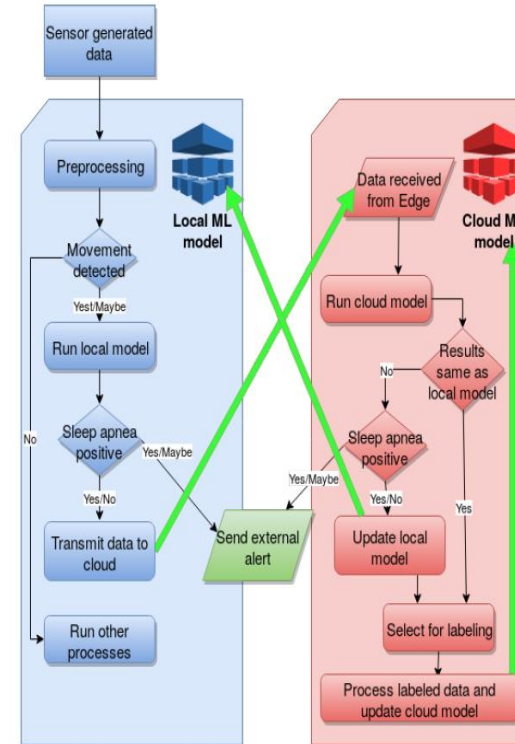
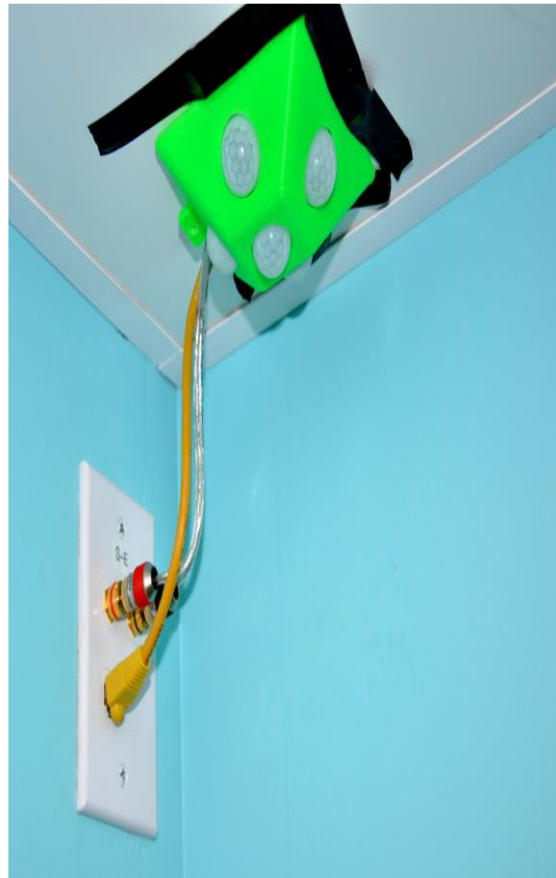
Example: CH Algorithm

Elena Vlahu-Gjorgievska, Saso Koceski, Igor Kulev, and Vladimir Trajkovik. "Connected-Health Algorithm: Development and Evaluation." Journal of Medical Systems pp.1-7, vol. 40, no.4, 2016



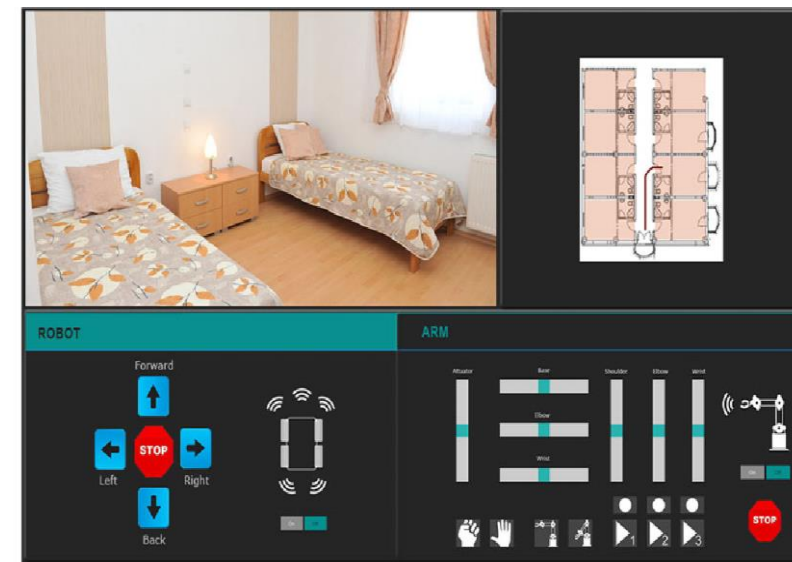
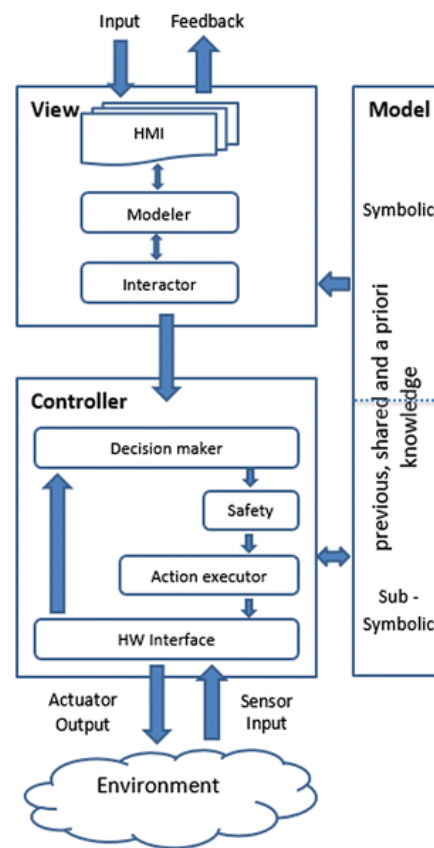
Example: Mobile wireless monitoring system for prehospital emergency care

Natasa Koceska, Radko Komadina, Monika Simjanoska, Bojana Koteska, Andrej Strahovnik, Anton Jošt, Ana Madevska-Bogdanova, Vladimir Trajkovik, Jurij Franc Tasič, and Janez Trontelj. "Mobile wireless monitoring system for prehospital emergency care." In European Journal of Trauma and Emergency Surgery (DOI: 10.1007/s00068-019-01130-4), April 2019:1-8.



Example: AAL Sleep Apnea Recognition

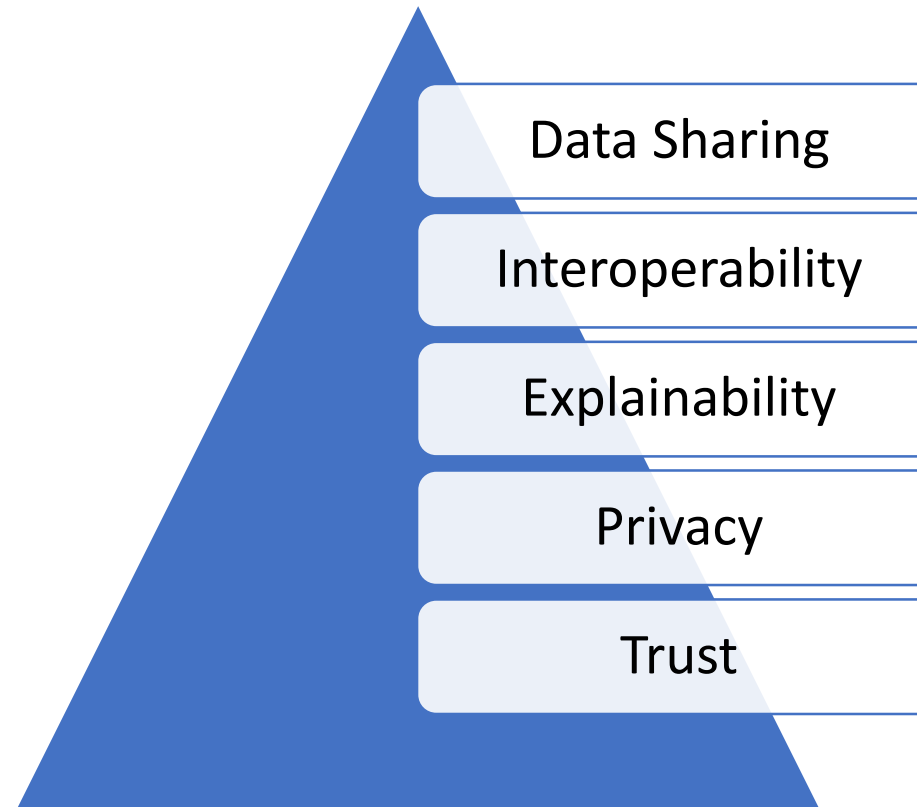
Ace Dimitrievski, Snezana Savoska and Vladimir Trajkovik, “Fog Computing for Personal Health: Case Study for Sleep Apnea Detection”, The 13-th conference on Information Systems and Grid Technologies Sofia, Bulgaria, May 29-30, 2020



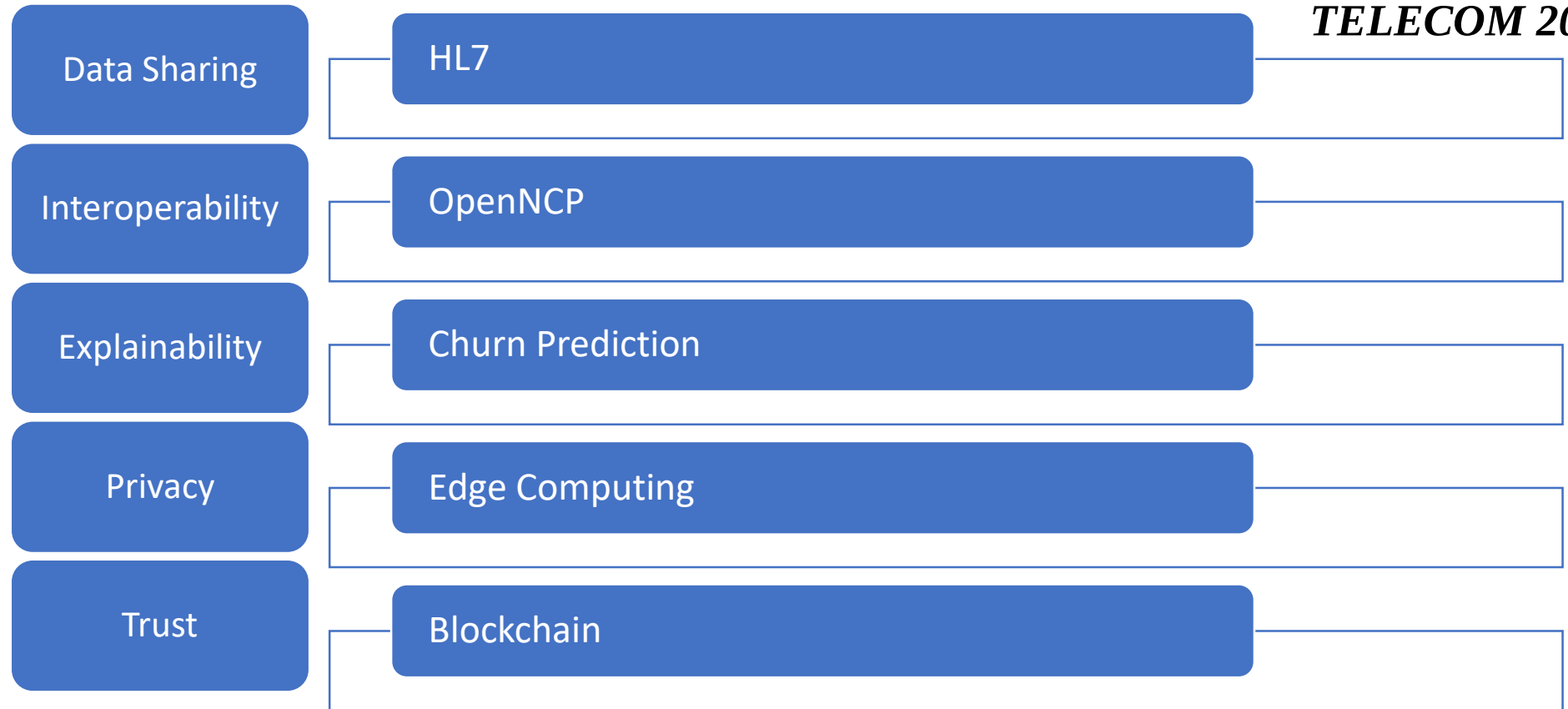
Control interface

Example: Telepresence Robot

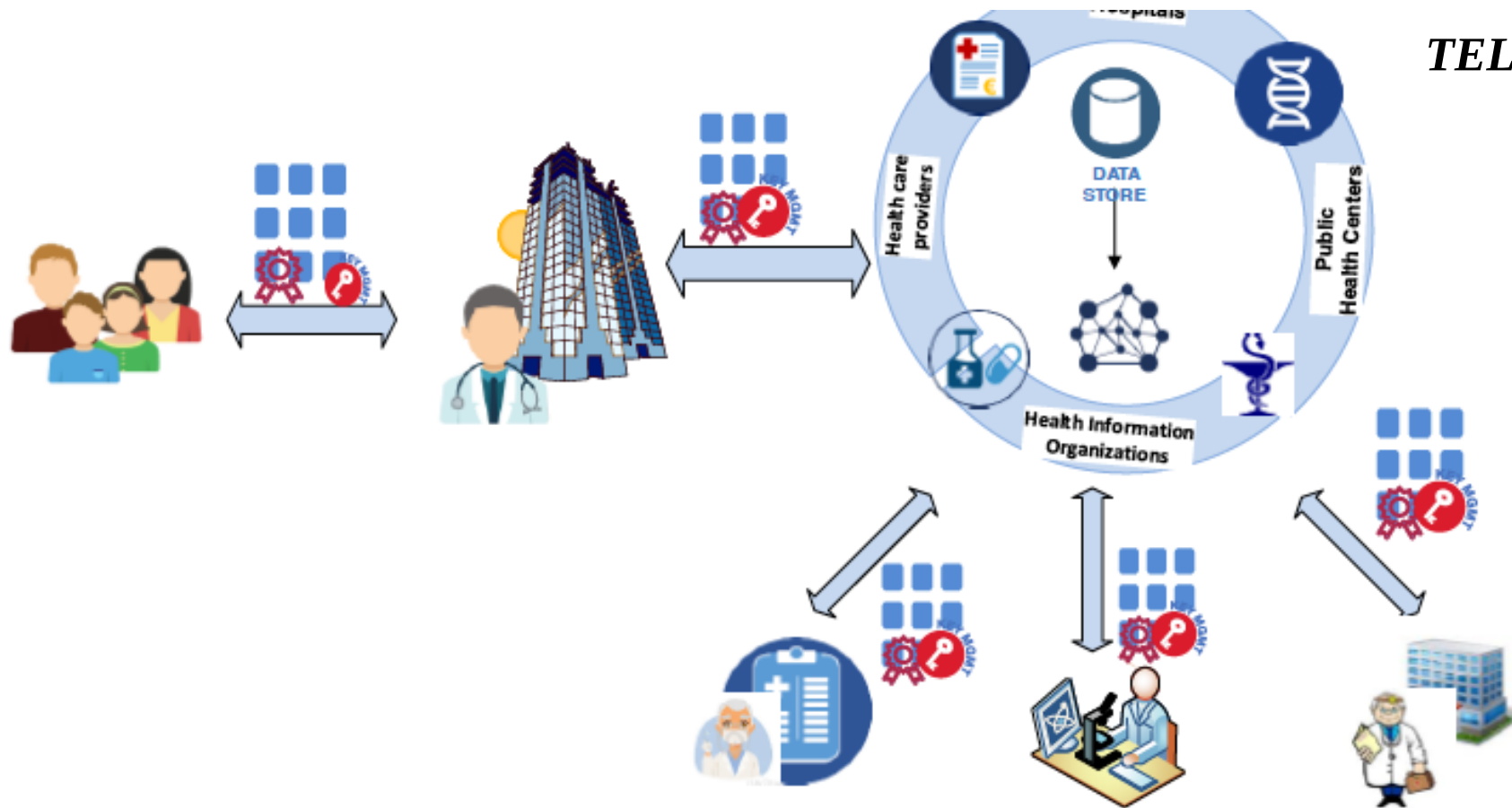
Natasa Koceska, Saso Koceski, Pierluigi Beomonte Zobel, Vladimir Trajkovik, Nuno Garcia. "A Telemedicine Robot System for Assisted and Independent Living." In Sensors, Volume19, no. 4, January 2019



Healthcare Technology Challenges



Possible Solution Examples



Example: Blockchain for establishing trust

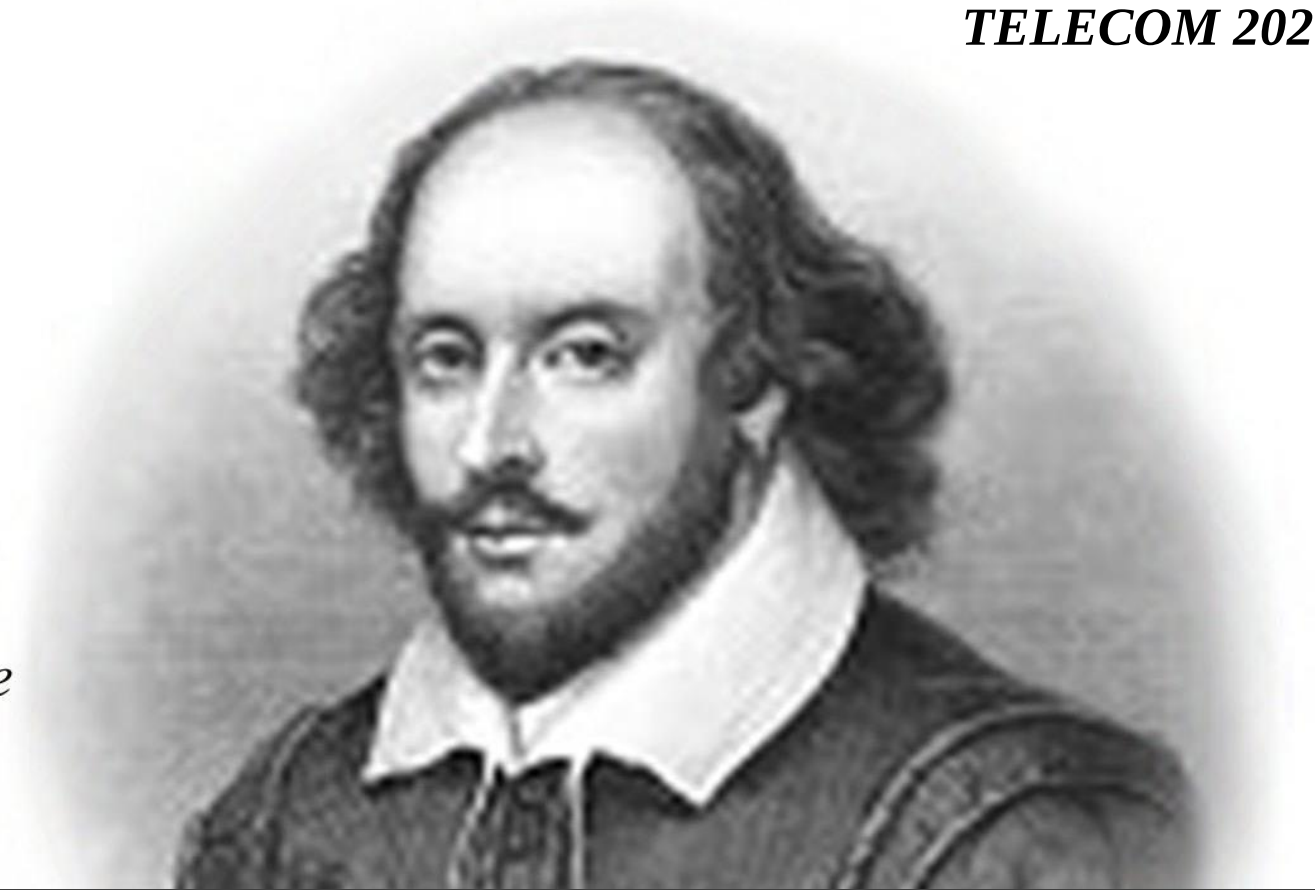
Goce Gavrilov, Orce Simov, Vladimir Trajkovik, "Blockchain-based model for authentication, authorization, and immutability of healthcare data in the referrals process", 17th International Conference on Informatics and Information Technologies - CIIT 2020, May 8-9, 2020

Conclusion

- Interdisciplinary Cooperation
 - Need for such education!
- Never-ending cycle:
 - Find the right technologies to address issue created by technology
- Persistency

Love all, trust a few,
do wrong to none.

William Shakespeare



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- <https://finki.ukim.mk/en/staff/vladimir-trajkovik>
- @trvlado
- https://www.researchgate.net/profile/Vladimir_Trajkovik