Panel:
Trends in Digital Transformation
(Transportation, Online Citizen Services, Telemedicine, Precision Agriculture, Online classes)

DATASYS 2020

September 27 – October 1, 2020 – Lisbon, Portugal

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Trends in Digital Transformation
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DataSys 2020

Chair

Jaime Lloret Mauri, Universitat Politecnica de Valencia, Spain

Panelists

Javier Fabra, Universidad de Zaragoza, Spain

José Miguel Jiménez Herranz, Universitat Politecnica de Valencia, Spain | University of Haute Alsace, France

Petre Dini, IARIA, EU/ USA

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Chair

Jaime Lloret Mauri, Universitat Politecnica de Valencia,
jlloret@dcom.upv.es

- Transportation
- Online Citizen Services
- Telemedicine
- Precision Agriculture
- Online classes

Panel:
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2020

Panellist Position

Improving the Teaching-Learning Process in Virtual Training by means of Data Analysis and Process Mining

Javier Fabra, Universidad de Zaragoza, jfabra@unizar.es

- **Data analysis & process mining**
- **Service-oriented computing**
- **Cloud architectures**
- **eHealth systems & services**

Panel:
Trends in Digital Transformation
(Transportation, Online Citizen Services, Telemedicine, Precision Agriculture, Online classes)

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Panellist Position

Comprehensive security framework on an System applied to Smart Agriculture

Jose Miguel Jimenez, Universitat Politècnica de València, jojiher@dcom.upv.es

- **Smart agriculture**
- **Securing the systems**
- **Physical attacks**
- **Attacks on the data in transit**
- **Attacks on the data**

Panellist Position

Digital Society; Downsides ahead the Roads

Petre Dini, IARIA, EU/USA petre@iaria.org

- **Smart phones**
- **Pollution**
- **Energy consumption**
- **Waste management**
- **Robots, drones, fleets, automation**
- **AI | Liability/Rights/Ethics/Empathy/Trust**

→ Fake news

→ Digital awareness

→ Simple-to-apply legislation

→ ePunishment

→ ePruning

→ 5G/6G | intercept/localize devices are not longer valid (welcome infractions!)

→ …… (yours)

DataSys 2020

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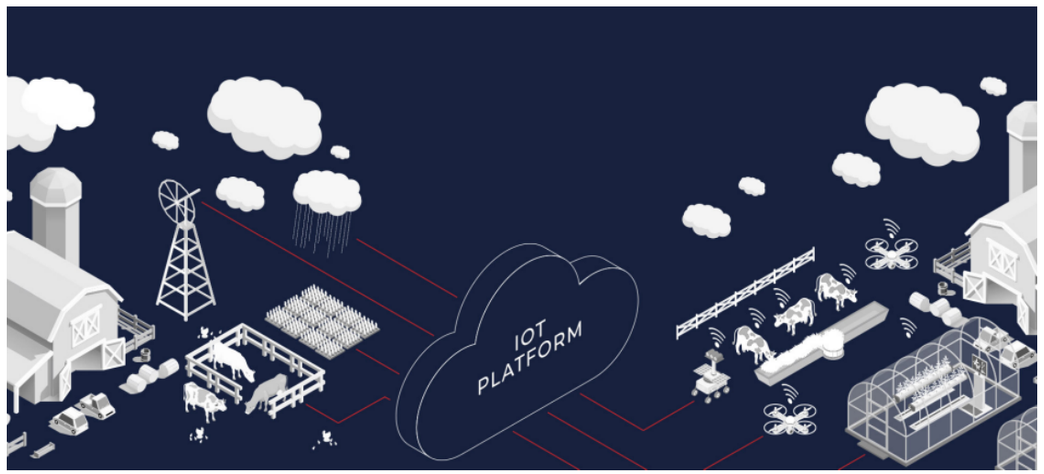
Comprehensive security framework on an System applied to Smart Agriculture



UNIVERSITAT POLITÈCNICA DE VALÈNCIA

By Jose M. Jimenez

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Instituto de investigación para la gestión integrada de zonas costeras

Smart agriculture

- Is mostly used to denote the application of IoT solutions in agriculture.
- By using IoT sensors to collect environmental and machine metrics, farmers can make informed decisions, and improve just about every aspect of their work.

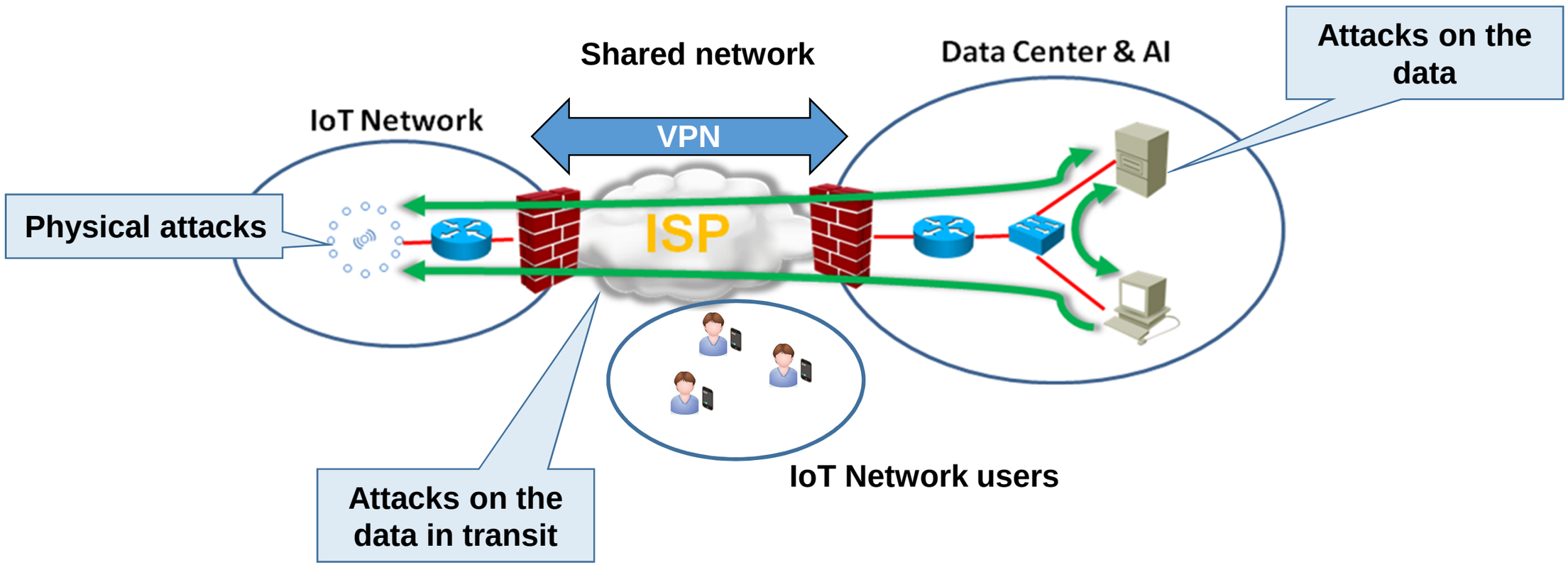
Smart agriculture

- Smart Farming is closely related to 3 interconnected technological fields, which are:
  - **Management Information Systems**: Planned systems for collecting, processing, storing, and disseminating data in the form needed to carry out a farm's operations and functions.
  - **Precision Agriculture**: Management of spatial and temporal variability to improve economic returns following the use of inputs and reduce environmental impact.
  - **Agricultural automation and robotics**: The process of applying robotics, automatic control and artificial intelligence techniques at all levels of agricultural production

Securing the systems

- It is paramount to guarantee the availability and accessibility to all the devices at any time.
- It is crucial ensuring the correct performance of the system.
- These systems are not only susceptible of attacks from people with malicious intentions but also may be affected by animals, weather conditions and people that accidentally compromise the system.
- Scenario where people is interested in controlling the devices according to their own interests is also possible.
- The main problem with IoT devices is that they are not designed considering that their security, is paramount on certain fields.

Basic security scheme that we will implement



Physical attacks

- Comprise those attacks that require the physical access to the device.
  - removing the sensors
  - accessing the nodes through the serial port
  - removing the batteries
  - possible presence of animals that could bite the wires or take the devices
  - possibility of losing the devices in case of flooding or extreme rain
  - access the node through ports that are open unnecessarily
- Measures
  - disable the rest of the ports so as to avoid the unauthorized access from attackers external to the project.
  - reducing the usage of USB memory drives or other external memory devices (may be infected with malware)

Attacks on the data in transit (I)

- These attacks would aim at making the system unable to communicate or intercepting the transmitted data so as to gain knowledge on the information gathered by the system.
  - may try accessing through the physical network infrastructure
  - through the software components provided by the services of the network itself
- Measures
  - forwarded data encryption
  - protection of the networks where the transmission is performed
  - for the wired communication, a VPN will be established so as to avoid eavesdropping and access to the network

Attacks on the data in transit (II)

- If system utilizes Fog computing so as to manage alerts and control the nodes from the edge. May try accessing through the physical network infrastructure.
  - Fog servers are susceptible of attacks of Denial of Service (DoS), Man in the Middle (MITM) or placing a rogue gateway
- Measures
  - proper encryption techniques should be utilized
  - the system should be designed so as to avoid the introduction of rogue gateways that could disrupt the correct functioning of the system
  - all devices must be configured with passwords and access codes that will only be known by the authorized management personal
  - different access levels to management privileges will be established according to the activities related to each job position.
  - actualizing firmware and the operating systems of all the utilized devices is critical.

Attacks on the data

- The aspects that concern data security are integrity, confidentiality and availability.
  - the integrity and availability of the data is preferred to its confidentiality.
  - enough encryption techniques should be utilized so as to provide the system with enough confidentiality.
  - information stored on Fog servers and the cloud should be properly protected.
  - at the data center, our data is previously protected by a firewall
  - data of our system must be isolated from the data from any other network at all time.

Table summarizes the proposals to reject the attacks

Attacks	How our proposal refuses the attack
Access to physical device.	Hardening devices and facilities. Access control in the facilities. Alarms. Periodic inspections of the sensor nodes.
Compromised physical Device.	User/password access. Visual identity verification (authentication phase).
Compromised node.	Use of algorithms to detect compromised nodes. Change of trust level. trust elimination.
Malfunctioning or lost the nodes or equipment.	Replacement of the damaged devices.
Power failure.	Equipment protection against failure to supply power. Persistent storage.
Lost data because of failures or battery discharge.	Persistent storage. Authentication.
Access to user date in physical device.	User/password access. Privileges management.
Infestation with Malware.	Reducing the usage of USB memory drives or other external memory devices Control ports.
Loose of connectivity.	Persistent data storage. Authentication.
Identity impersonation.	Visual identity verification (authentication phase). Control ports. Use of short-range technologies. Firewall. Trust policies.
Phishing, active spoofing, compromised data	Hashing and authentication. Use of a trusted chain. VPN IPSec. Firewall.

Table summarizes the proposals to reject the attacks

Attacks	How our proposal refuses the attack
Network data access using passive spoofing.	Control ports. Ciphered using session key. Key management. Firewall.
Access to network key using passive spoofing. (man-in-the-middle)	Asymmetric encryption. Key-regeneration using trusted chains. Firewall.
Access to private user delivered data using passive spoofing	Asymmetric or symmetric encryption guaranteeing confidentiality. VPN IPSec.
Data modification. Compromised data	Hash function to guarantee data integrity. VPN IPSec.
Overload and/or loose of resources.	Capacity plan and forecast. Control the number of asymmetric operations. Firewall. Persistent data storage.
Erroneous packets delivery	Control sent and received packets. Packet retransmission.
Data storage overload	Distributed data management and storage.
Denial-of-Service / Data availability	Distributed data management and storage. Distributed access to data services. Distributed security processes. Firewall.
Access to not reliable data. Data disclosure.	Data access only through trusted nodes. Session key regeneration.

Related Papers

- Jose M. Jimenez, Laura Garcia, Miran Taha, Lorena Parra, Jaime Lloret, Pascal Lorenz, Comprehensive security framework of an Intelligent Wastewater Purification System for Irrigation, The Twelfth International Conference on Communication Theory, Reliability, and Quality of Service (CTRQ 2019) March 24, 2019 to March 28, 2019 - Valencia, Spain
- Laura Garcia, Lorena Parra, Jose M. Jimenez, Jaime Lloret, P Lorenz, IoT-Based Smart Irrigation Systems: An Overview on the Recent Trends on Sensors and IoT Systems for Irrigation in Precision Agriculture, Sensors 2020, 20(4), 1042; https://doi.org/10.3390/s20041042
- Laura García, Lorena Parra, Jose M. Jimenez, Jaime Lloret, Abdelhafid Abouaissa, Pascal Lorenz, Internet of Underground Things ESP8266 WiFi Coverage Study, The Eighth International Conference on Communications, Computation, Networks and Technologies (INNOV 2019), November 24, 2019 to November 28, 2019 - Valencia, Spain

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Universidad Zaragoza

Improving the Teaching-Learning Process in Virtual Training by means of Data Analysis and Process Mining

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e-Learning & Online training

- These terms have become quite popular during the year because of COVID-10
- *Learning Management Systems (LMS)*
  - Web-based systems for the administration, documentation, tracking, reporting and delivery of e-learning courses
- LMS purpose
  - Managing online courses and augmenting on-campus courses
  - Helping teachers to organize and delivery educational resources
  - Communication tool between teachers and students
  - Tracking and logging users' actions

Use of logs for data analysis

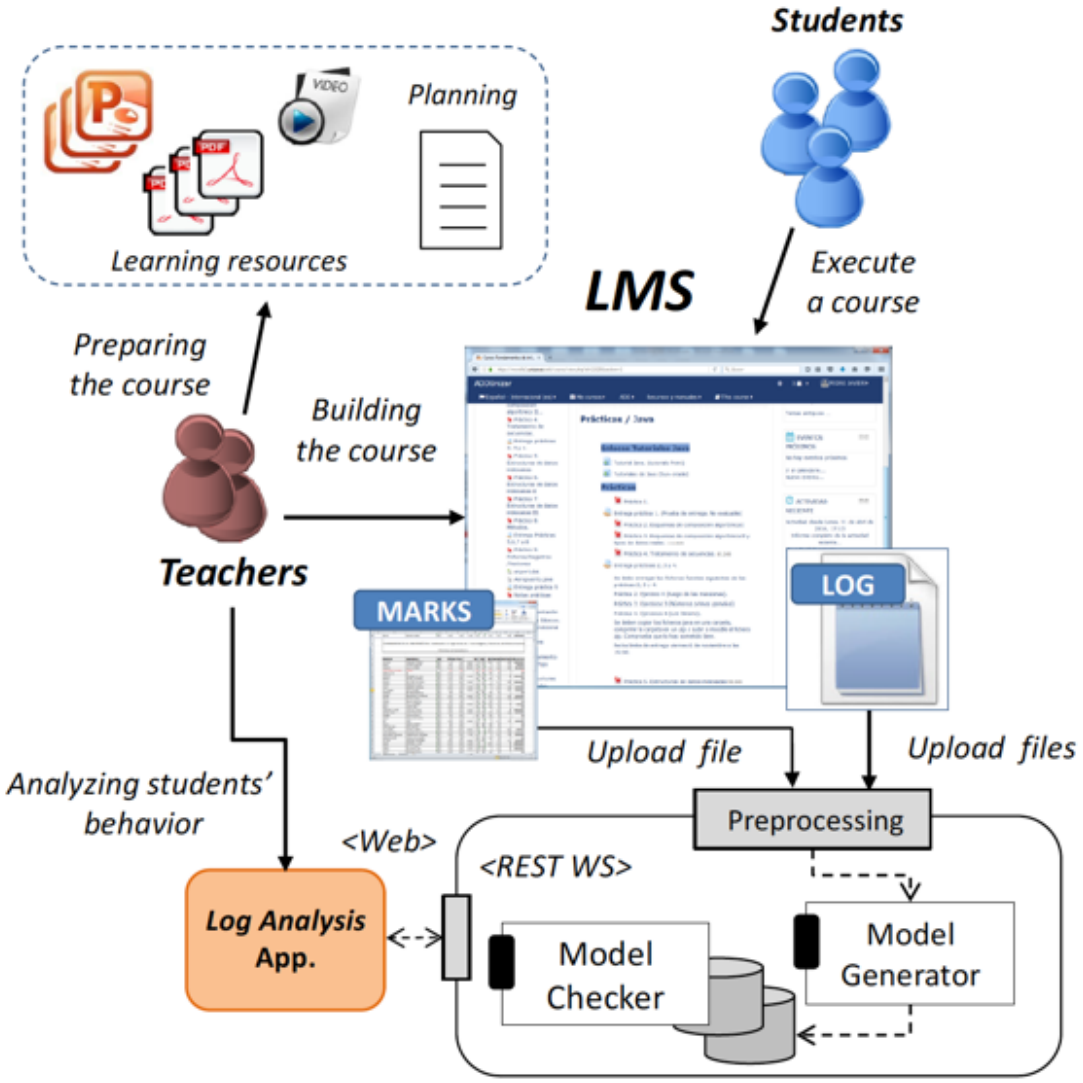
- Logs are time-ordered sequence of events
- Events can be grouped
- In LMS, logs allow identifying users' behavior
- Some additional data: timestamp, resource, etc.

Timestamp	User id	Moodle Element	Resource	Moodle Event	Resource id
< 09/11/15 11:29,	123456,	Archive,	Lesson 3,	view resource,	934626 >
< 10/11/15 14:34,	123456,	Forum,	New forum,	view a discussion,	650215 >
< 10/11/15 15:32,	654321,	Assignment,	Assignment 2,	submit a file,	283223 >
< 10/11/15 15:32,	654321,	Assignment,	Assignment 2,	upload a file,	283223 >

Improving the Teaching-Learning Process

- Using a specific LMS logs (Moodle), data analysis and process mining techniques have been applied to develop a support system that guides the learning process for the student
- The evolution of the learning process is monitored and adapted in base to a set of dynamic rules
- The proposed approach has been conducted through its application to a Course in Nutritional Care (Health Sciences)
  - 8 editions in 2020

Previous work



J. Fabra, P. Álvarez, and J. Ezpeleta. "*Log-based Session Profiling and Online Behavioral Prediction in E-commerce Websites*", IEEE Access, 2020.

P. Álvarez, J. Fabra, S. Hernández, and J. Ezpeleta. "*Alignment of teacher's plan and students' use of LMS resources. Analysis of Moodle logs*", ITHET 2016.

S. Hernández, P. Álvarez, J. Fabra, and J. Ezpeleta. "*Analysis of Users' Behavior in Structured e-Commerce Websites*", IEEE Access 5: 11941-11958, 2017.

Experimentation

- **Nutritional Care course**
  - All editions have been run using a customized Moodle platform
  - Student's engagement was over 76%
  - Data from logs in the three first editions were used to create the first set of rules
  - Next editions used the support system
- Engagement has improved **from 76%** (3rd edition) **to 95%** (8th edition)

Conclusions & Further work

- The study of LMS logs can help to provide a support system that efectively adapts to the learning process of the student
- Teachers benefit as well from this system, as students engagement improves significantly
- Different techniques for daya analysis as well as for process mining have to be studied, compared and applied
- The developed approach can be easily applied to different subjects in other areas

Universidad Zaragoza

Improving the Teaching-Learning Process in Virtual Training by means of Data Analysis and Process Mining

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DataSys 2020

Digital Society: Downsides of the Roads Ahead

Prof. Dr. Petre Dini, IARIA, EU/USA
petre@iaria.org
http://www.iaria.org/fellows/PetreDini.pdf

Technology Speed

- **The Future is Already Happening**
- Law of Growth: To Progress one should try Something New

- *Technology absorption: Logarithmic scale in the past (slow speed) vs. super-Logarithmic scale (high speed)*
- *See: http://www.bbc.com/future/story/20190207-technology-in-deep-time-how-it-evolves-alongside-us (DeepTime)*

  - **When equating 4.7 billions of years ~ one day (24 hours), then, everything, technologically, was developed in the last 5/1000 of the last second.**

  - **??? Long-term side effects of technology adoption**

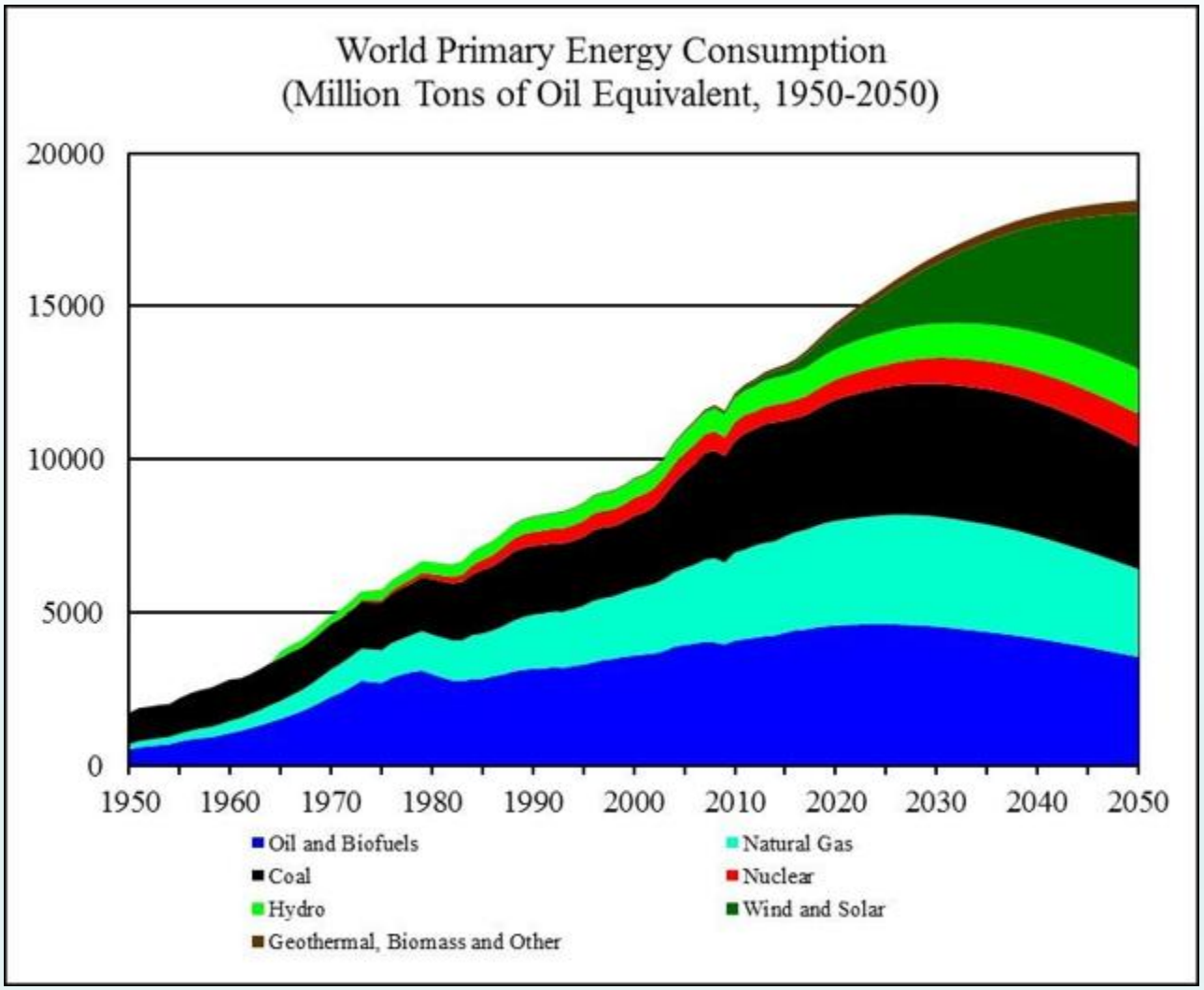
Smart-phones as a Linear Adoption: Our Near-by IoT Spies

- Everybody has a smart-phone
- Excellent marketing tool
- Convenience: alarms, health,
  - ? Electromagnetic fields
  - ? Rare materials (cobalt), Social issues (mines)
  - ? Addiction
  - ? Privacy-breach
  - ? Apps Invasion
  - ……

Pollution via Electric Cars Migrating the Source

- Smart Cities vs. Energy Consumption
- Migrating the Pollution | Energy
- Eco
  - ? Another kind of pollution: 15 kg/cobalt/car
  - ? Battery management (cobalt, nickel, graphite, lithium)
  - ? Changes in Automotive Industry
  - ? Changes in Transportation Infrastructure
  - ? Social Adoption / Prices / Habits / Legislation

Energy Consumption



https://seekingalpha.com/article/4083393-world-energy-2017minus-2050-annual-report

Digital Waste Management
Case study: Batteries

- **Gas Car batteries, Electric Car batteries, Computer batteries, SmartPhone batteries**
- Universal Waste (lead-acid **batteries**) vs. Hazardous Waste ()?
- *If a **lithium battery** does not exhibit any characteristic of a hazardous **waste** (ignitability, corrosivity, reactivity or toxicity), you are not required to manage it as a **universal waste** or a hazardous **waste**.*

- According to the U.S. government, **lithium ion batteries** aren't an environmental hazard:"**Lithium Ion batteries** are classified by the federal government as non **hazardous waste**
- -> are safe for disposal in the normal municipal **waste** stream

- Dell plans to recycle however many of the 4.1 million recalled batteries that customers turn in but what happens to the other 2 billion lithium ion batteries which will be sold this year? Most will last for 300 to 500 full recharges (one to three years of use) before failing and ending up in your local municipal landfill or incinerator.
- Recycling: the fundamental problem is that while the cost of fully recycling a battery is falling toward €1 per kilo, the value of the raw materials that can be reclaimed is only a third of that.

  - ? Cost of recycling is the barrier
  - ? Waste Mgmt infrastructure not yet set
  - ? Cobalt and nickel OK | one cannot directly recover the vital lithium
  - ? Legislation is yet to come
  - ? Incentives

Robots, you are Welcome! Not quite! Unplug them, firstly!

- Surgeries (nano-robots, bio-robots, telemedicine)
- Space exploration
- Children and robots (haptic touch, feeling)
- Industry 4.0 (Internet of Things)
- Disables and robots (profound motor impairments)
- Mission critical uses
- Digital assistants
  - ? Human languages and robot languages
  - ? Uncontrolled actions (AI, ML, DeepX, …)
  - ? Aloofness (specific to digital society, anyways!)
  - ? Duty partner or duty servant (rights, liability, ….)
  - ? Personality confusions (babies, toddlers)
  - ? Job Competitors (skilled peoples)
  - ? Human Frustration (by robot perfection, empathy)

Drones Dynasty: Pros and Cons for Flying Engines

- Home surveillance (nesting drones, …)
- Postal/shopping delivery
- Dangerous missions | rescues
- Underground/mines | explosive environments, poisonous,..
- Utility services | windows cleaning
- Army surveillance | scouts, 150-fleet,
- Taxi-drones | 1-2-3-4 seats
- Drone-based agriculture (IoT, livestock, pollination, marine, flocks)
  - ? Privacy Invasion | Territorial images
  - ? Energy Challenges | Short-term Missions
  - ? Flying dynamite (no control on the parcel content)
  - ? Regulations
  - ? Docking, Landing, Charging

Societal issues/technology

- Stress | too much | 360 degrees
- Remote working | less traffic | more work
- Nanophobia | negative (implicit) side effects
- Ecology activists | pros/cons
- Space garbage collection | net of flying satellite pieces / burning in the atmosphere
- Body-chip payment tools [Sweden]
- - ? Adaptation | Small-scale vs. Humankind
- - ? Skills conversion (jobless people)
- - ? Environmental/Energy

Social issues/society

- Anonymity vs. responsibility vs. liability vs. e-punishment
- Online voting | cheating
- Social/virtual communities | pros/cons | education for good/bad thinking | leading to unknown…
- ☹ fork-equipped smartphones (damaging addiction, …
- Yet, forgotten communities | no energy | no Internet connection (digital divide).. ; well, no food, water, either
- Wearable/implantable devices | heat, discomfort..
- Digital Wellbeing [controlling the technologies; Google]
- News \ news garbage collection,

Information/knowledge/cognition issues

- Remote learning | missing the classes | smart blackboards
- Zero-knowledge systems | rules vs. self-learning
- AlphaGo-Zero, DeepMind
- DeepLearning | ‘new-AI’ | machine learning
- Forecasting models (financial, demographic,..)
- - ? Uncontrolled cognition
- - ? Accepting other ways of thinking
- - ? Remote working | aloofness

One Application: Babies

- Dangerous: before a given age
- Some react to the ‘robot name’… as being the most heard in the crib room

- Baby cribs
- Rocking – autonomous systems
- Cognitive rocking
- Cognitive lullaby (calming, plying personalized relaxing music, bany songs,…)
- Embracing, rocking, and singing

  - - ? Dangers of ‘digital assistants’
  - - ? Perfect pronunciation vs. mother-like caressing pronunciation
  - - ? Biased learning, as associations are not longer traditional
  - - ? Biased feeling/touching, as robot arms are not as mother-hands
  - - ? Biased recognition and face grimaces / body languages favoring foreign language learning
  - -? Discharging parents of tiring routines

Already… Robots, Digital Assistants: Liability/Rights/Ethics/Empathy/Trust

Robot Empathy
Ethical issues
Social care, elderly companion | Compassion
Hospital transportation / hospital guidance / surgeries | Liability
Robots rights (e.g.,military robots)
Trust (robot-judge)

AI, AI, AI,.. ? (still, humans are behind)

? - AI Algorithm that alter criminal records, faces,
(An algorithm which speeds up the process of removing eligible marijuana convictions from people's criminal records in California has been developed)
? - The AI clearing conviction backlogs
? – AI changing 'face-recognition algorithms' (FaceApp), 'baring images', ..

In the next Decade, or so..

- Logistics: Toyota's ePalette
- https://www.youtube.com/watch?v=XmoPQuMlOYE

- Mobility-as-a-Service
- https://www.youtube.com/watch?v=4B7mZFU2sB4

- ? Storm Area 51 / misleading https://www.foxnews.com/science/creator-of-storm-area-51-reveals-identity-after-satirical-facebook-page-takes-off
- ? Blackmailing / extortion

- ? :(**O, sancta simplicitas!**
- Hacking millions of ID/private data
- Organized crimes groups (illicit traffic, cyber crimes, …)
- Threatening vital systems (water, electivity, hospitals, transportation,..)
- Increasing insecurity, fear,

Let us avoid behaving like an ostrich!

TO DO

- Fake news classes
- Digital awareness
- Simple-to-apply legislation
- ePunishment
- ePruning

- 5G: 4G intercept/localize devices are not longer valid (welcome infractions!)