

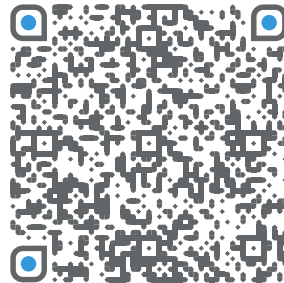


IPB University
— Bogor Indonesia —

Penerapan Teknologi 4.0 (IoT, Blockchain dan Artificial Intelligence) pada Rantai Pasok Industri Peternakan (Ternak Hidup dan Hasil Olahannya)



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- Peneliti BRAIN (Blockchain, Robotic, Artificial Intelligence Networks) IPB





Keywords

- Industry 4.0
- Artificial Intelligence
- Innovative Technologies
 - Advanced Digital Technologies (ADT) other than AI?
 - Blockchain
 - Quantum computing?
 - Advanced Technologies in farm?
- ADT in FARM (Use Case)





Industri 4.0





Manufacturing Revolution – From Industry 1.0 to Industry 4.0

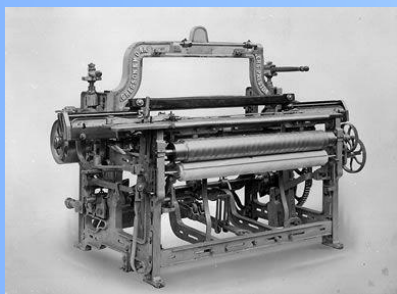
Industry 1.0

FIRST

Industrial Revolution

Key Change:

Introduction of Mechanical Production Equipment driven by Water and Stream Power



18th Century Mechanical Loom

End of 18th Century

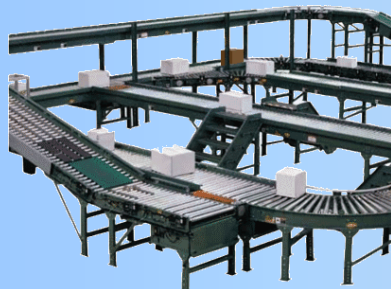
Industry 2.0

SECOND

Industrial Revolution

Key Change:

Introduction of mass Manufacturing Production lines powered by Electric Energy



Vintage Electric Conveyor Belt

End of 19th Century

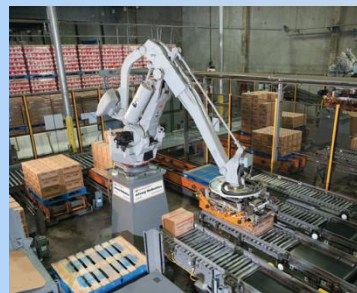
Industry 3.0

THIRD

Industrial Revolution

Key Change:

Introduction of Electronics, PLC Devices, Robots and IT to automate Production



PLC Driven Robots

Q4 of 20th Century

Industry 4.0

FOURTH

Industrial Revolution

Key Change:

Introduction of IoT and Cyber-Physical Systems driven by Augmented Reality & Real Time Intelligence



Augmented Reality Driven CPS

Start of 21st Century

Level Of Complexity



APPLICATION OF DIGITAL TECHNOLOGY IN FARM



APPLICATION OF INDUSTRY 4.0 IN FARM



FARM 4.0

LOGISTICS 4.0

SUPPLY CHAIN MANAGEMENT 4.0





Why AI?





AI is the “brain” of advanced digital technologies in today’s and tomorrow’s economy





“Everything that can be digitized in our industry will be digitized.”

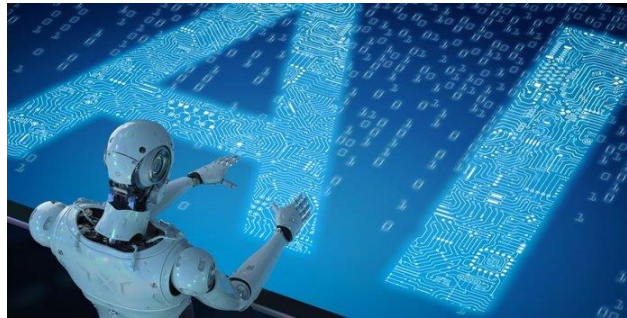
—

Jakob Stausholm, Chief Strategy, Finance and Transformation Officer, Maersk.





Advanced Digital Technology (ADT)



Artificial Intelligence



Supported by high speed internet





Types of ADT



Smart Drone



Smart Robot



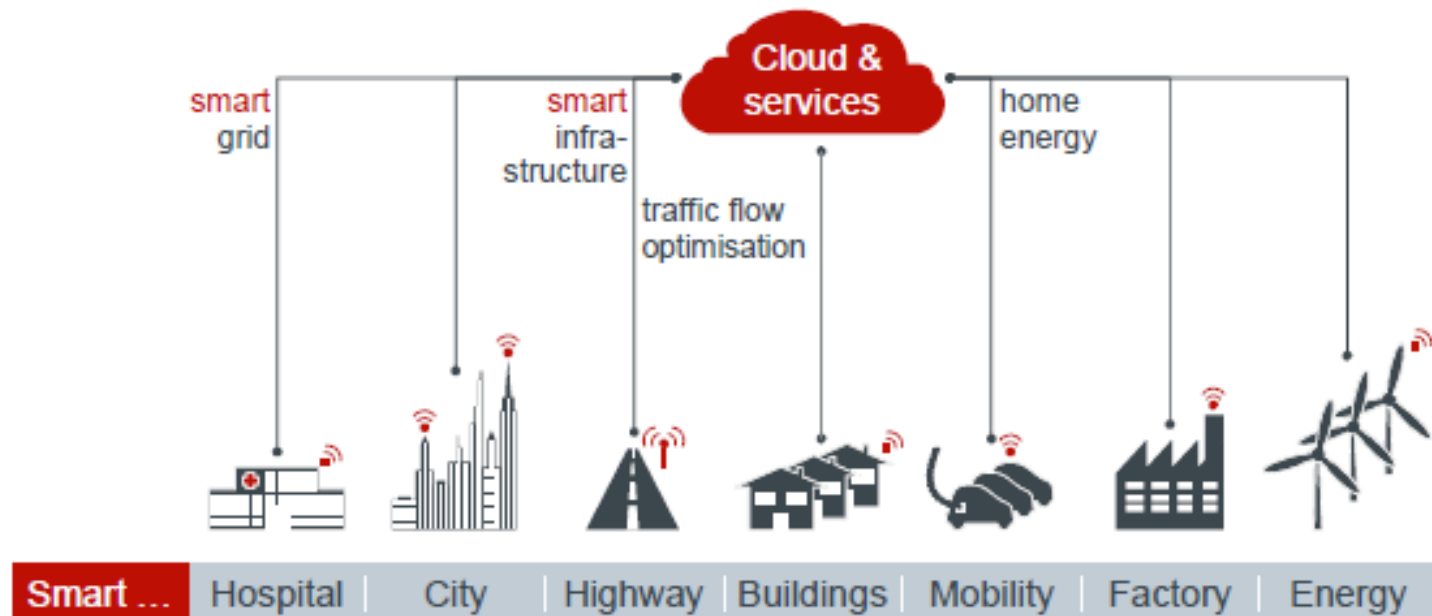
Intelligent Decision Support System



Big Data Analytic

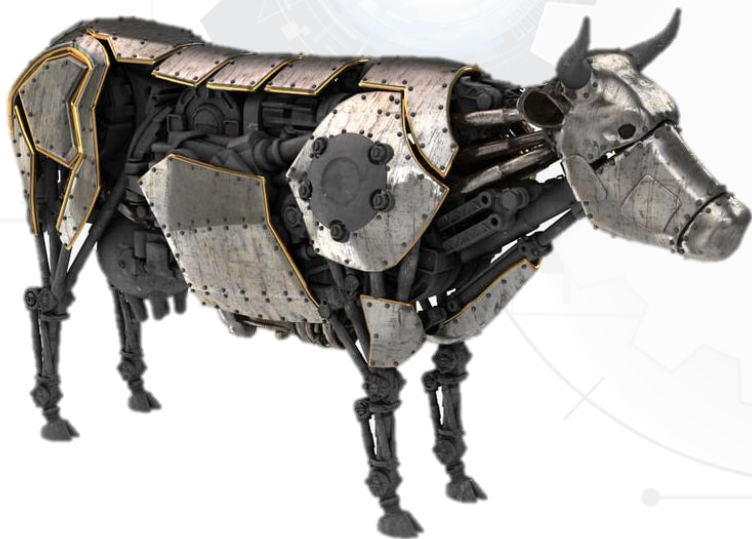


The Internet of Things (IoT)





Artificial Intelligence





Artificial

Produced by human art or effort, rather than originating naturally.

Intelligence

is the ability to acquire knowledge and use it





So AI was defined as:

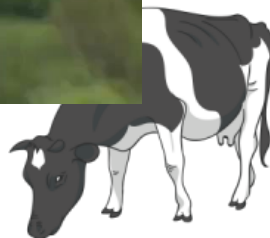
AI is the study of ideas that enable computers to be intelligent

AI is the part of computer science concerned with design of computer systems that exhibit human intelligence





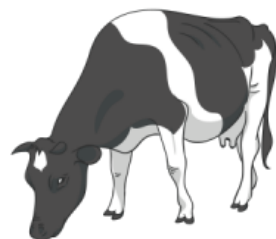
Artificial Intelligence





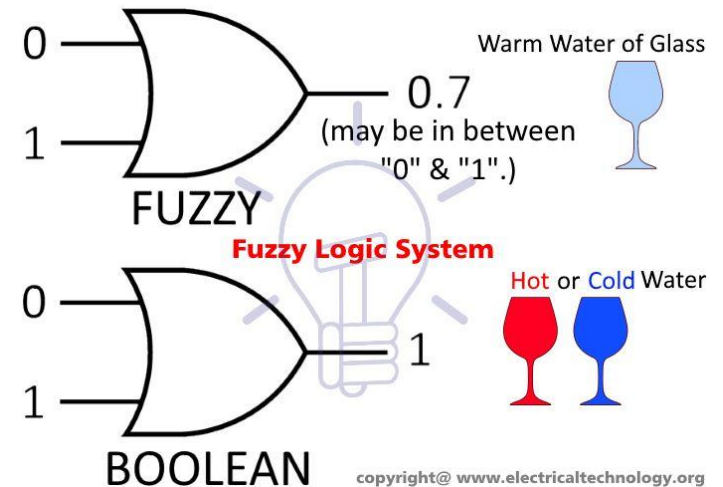
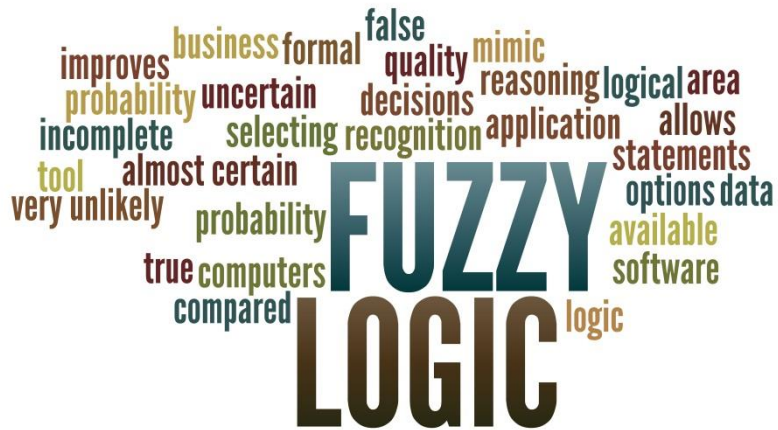
The Tools of Artificial Intelligence

- Fuzzy Logic
- Neural Networks
- Expert Systems
- Genetic Algorithms
- Others





1. Fuzzy Logic

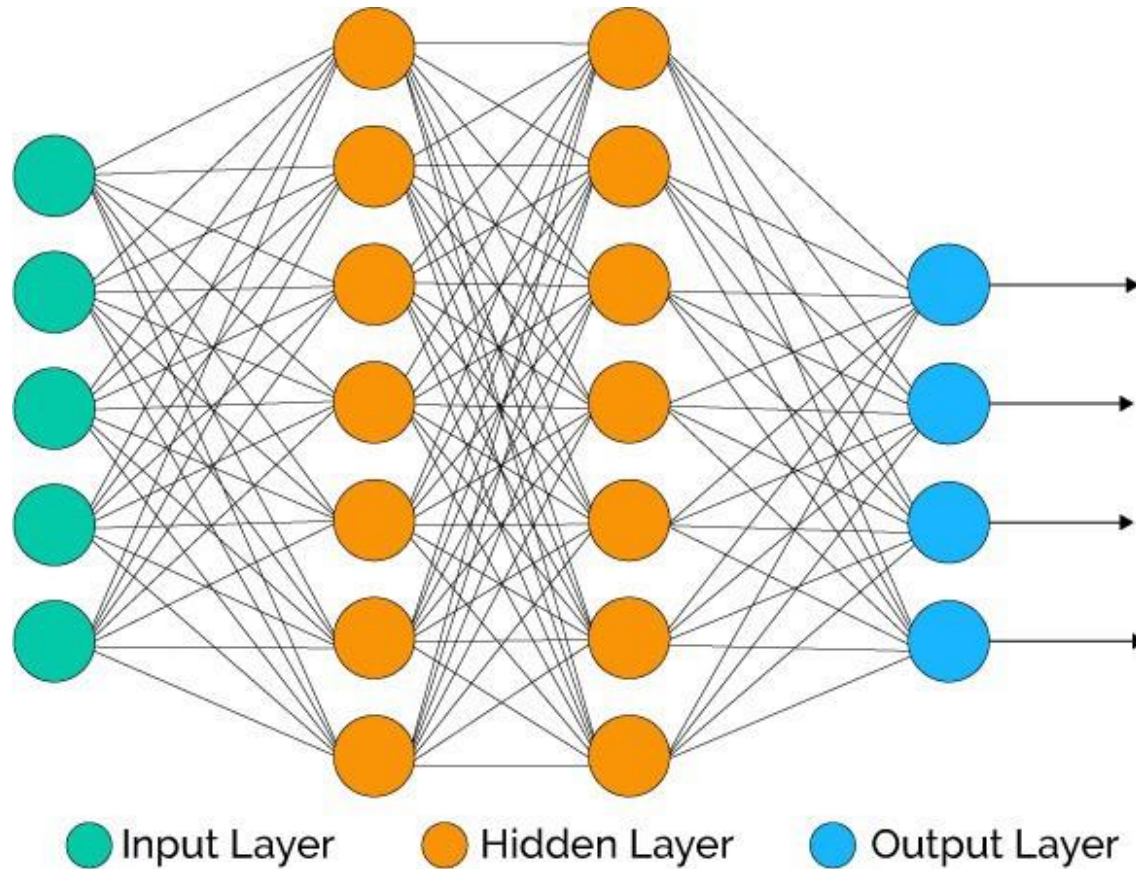


Making inference based on precise input





2. Neural Networks

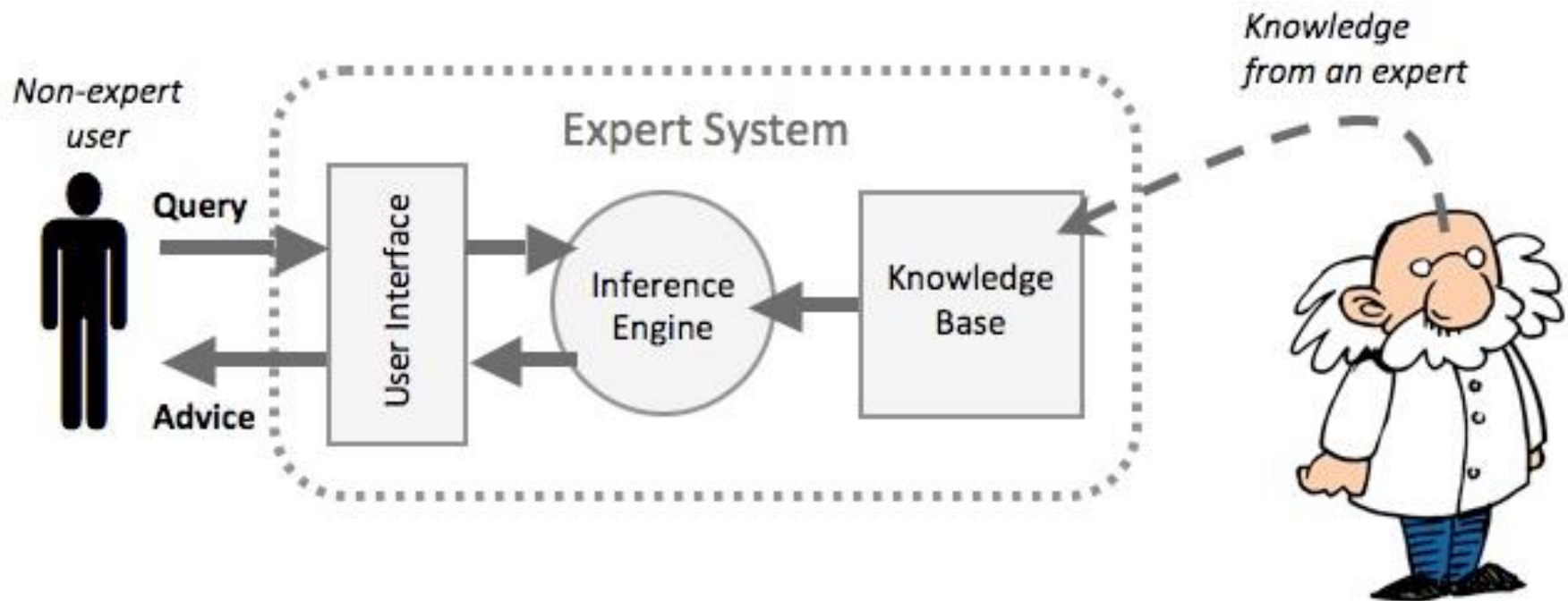


Learning by example





3. Expert Systems

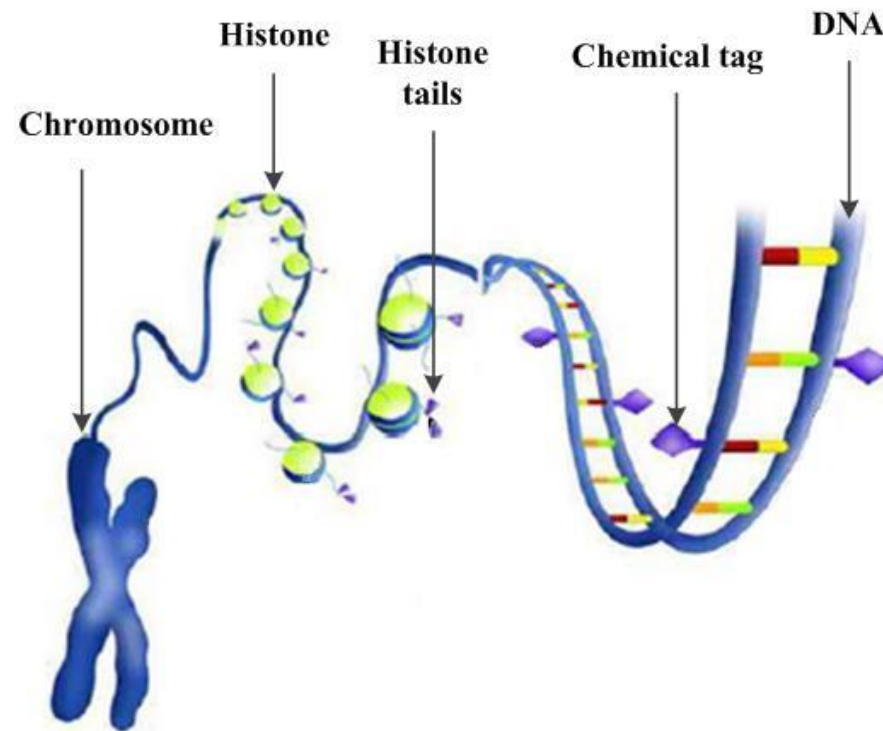


Acquiring and formalizing expert knowledge





4. Genetic Algorithms



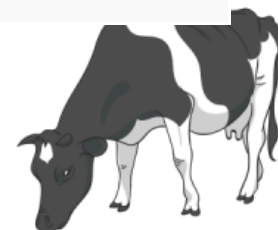
Searching the best by genetic and evolutionary principles





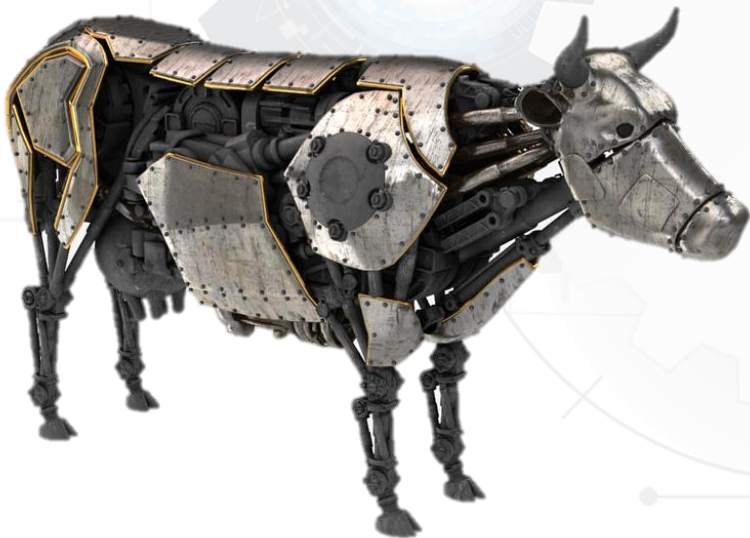
The Benefits of Artificial Intelligence

Traditional Tools (Intuitions, Judgments and Rules of Thumbs)	Modern Tools (Quantitative, Scientific, Knowledge-based and Intelligent)
Manual	Computer-based
Inconsistent	Consistent
No Explanation	Explanation Capability
Imprecise	Precise (e.g. with Fuzzy Logic)
Small-scale and simple problem	Large-scale and complex problem
Limited learning capability	Unlimited learning capability (with super-computer)



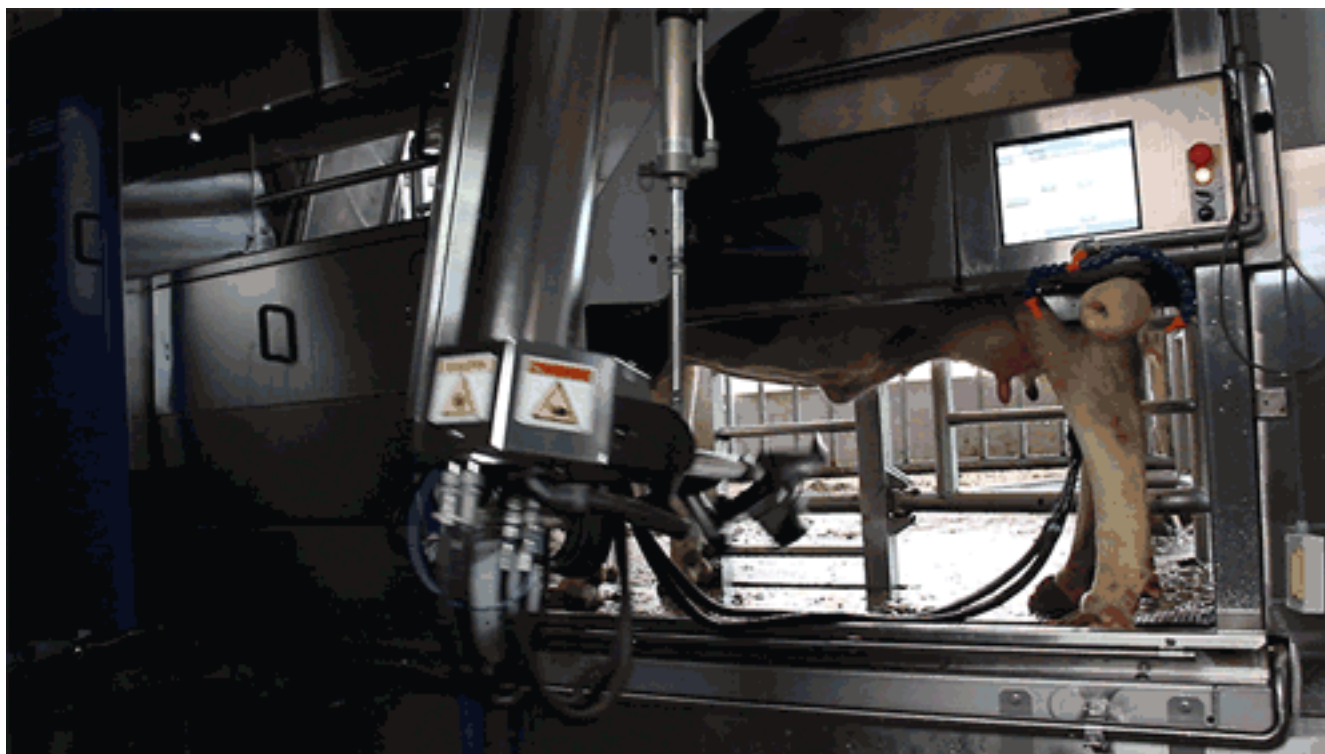


Application of Advanced Digital Technologies





Milking robot

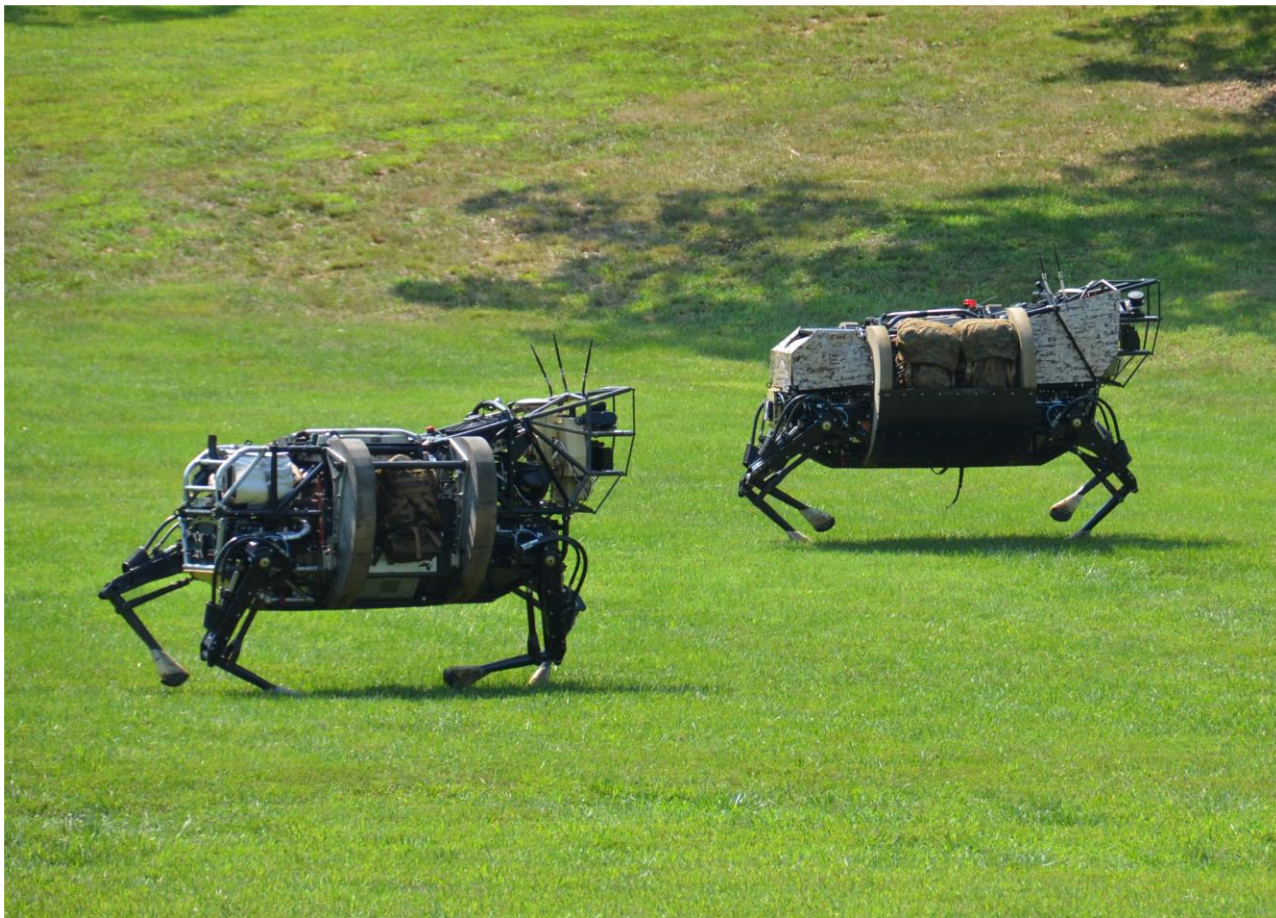


Credit: Dan Charles/NPR





Robotic Dairy Cow



Credit: DARPA

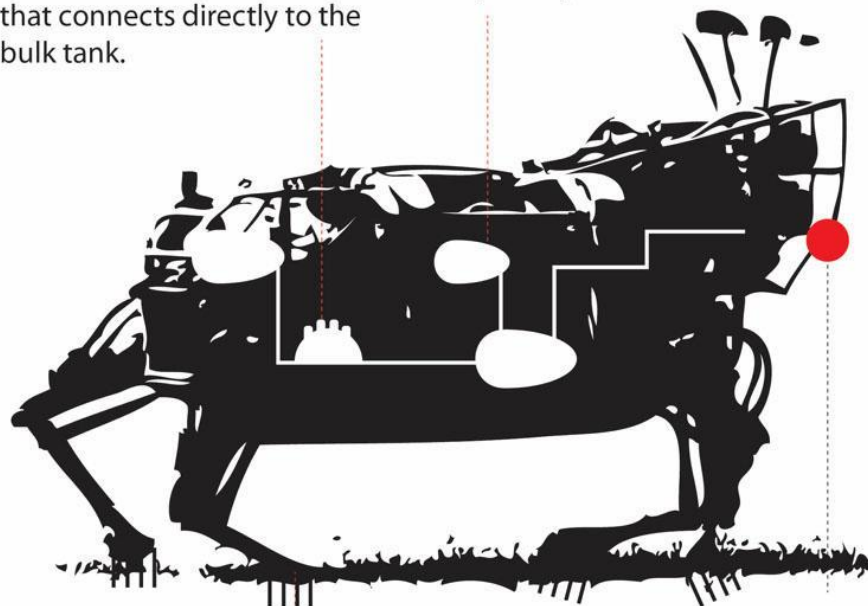




RoboCow

Revolutionary cyberteat technology, incorporating synthetic glands and a hormone production system, is used to generate milk, which is stored in a reservoir that connects directly to the bulk tank.

Gas byproducts are stored in a separate tank to be used for on-farm energy production or to supplement RoboCow's solar power pack.



Spikes incorporating sensors ensure the RoboCow stays stable, while recording soil fertility and PH data, which is transmitted directly to the cloud and interpreted in the iCow app.

Grass is taken in by RoboCow and processed through its iRumen stomach system



Ear tag



Photo credit: Craig Chandler, University of Nebraska

Quantified Ag's "Smart Ear Tags" tags can identify when cattle are sick and light up to identify them.

- An ear tag is a plastic or metal object used for identification of domestic livestock and other animals.
- If the ear tag uses Radio Frequency Identification Device (RFID) technology it is referred to as an electronic ear tag.
- Electronic ear tags conform to international standards ISO 11784 and ISO 11785 working at 134.2 kHz, as well as ISO/IEC 18000-6C operating in the UHF spectrum.



EID Tags and RFID Technology

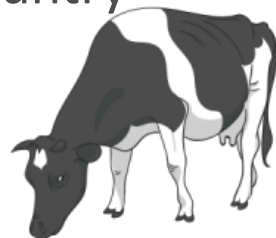
- If an ear tag uses Radio Frequency Identification (RFID) technology, then those tags are referred to as electronic ear tags, or EID tags.
 - EID stands for Electronic Identification.
- Many people use the terms RFID and EID interchangeably.
 - In reality, RFID refers to the technology in the tag.
- EID tags are one way to **tracks** livestock sold for profit or that are moved across regions.





Function

- Tags help show, for instance, what animals came from a herd infected by, or exposed to, disease.
- Electronic identification is an important tool if these animals need to be **traced**.
- The tags are paired with software packages that producers can use to analyze herd health over time.
- These data collection and record keeping is important for public health.
 - It helps ensure that we have only healthy meat for sale, and if a recall is necessary, it helps alert what regions of the country are affected, in the event of a disease outbreak.





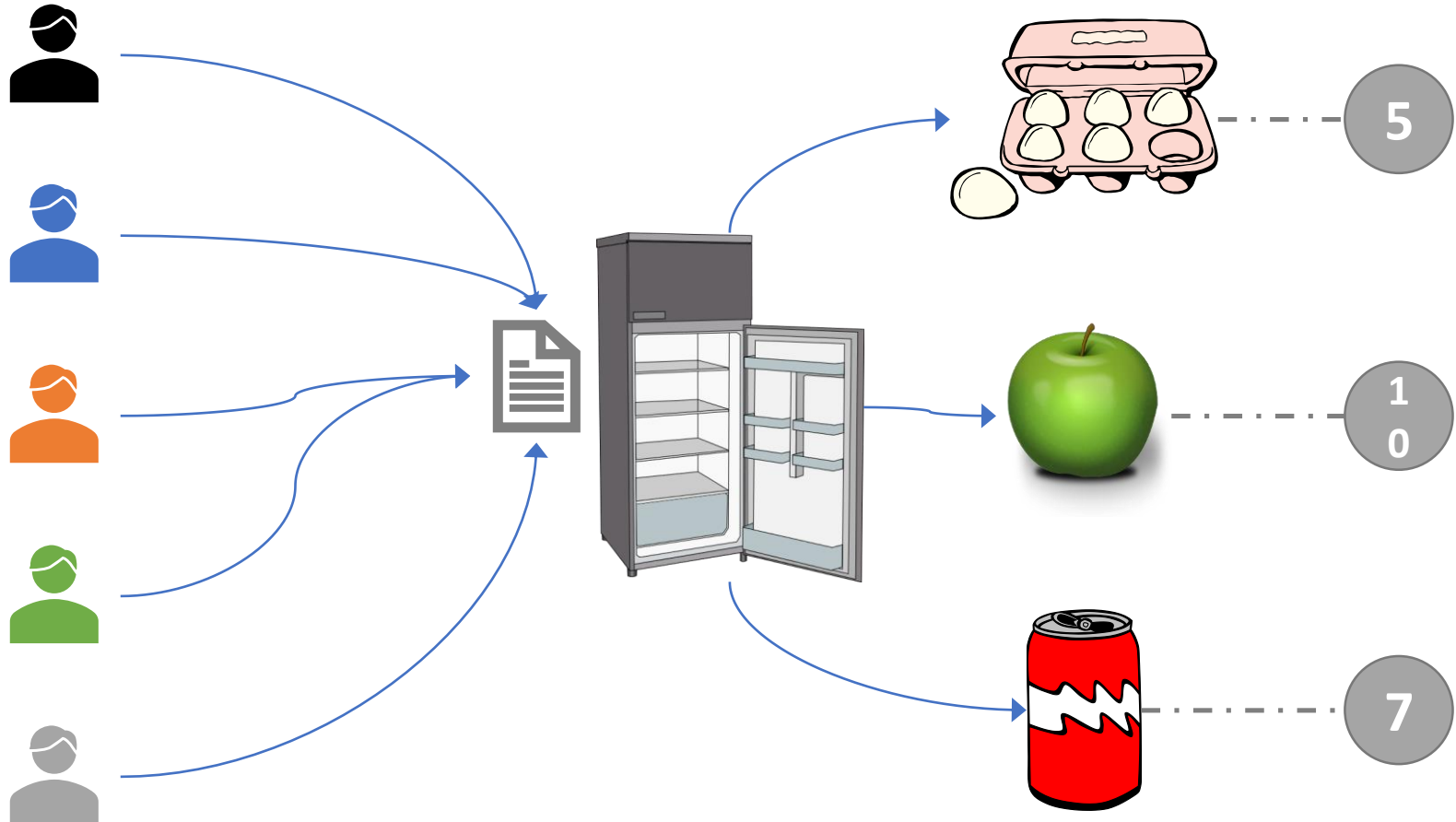
Other Emerging Digital Technology



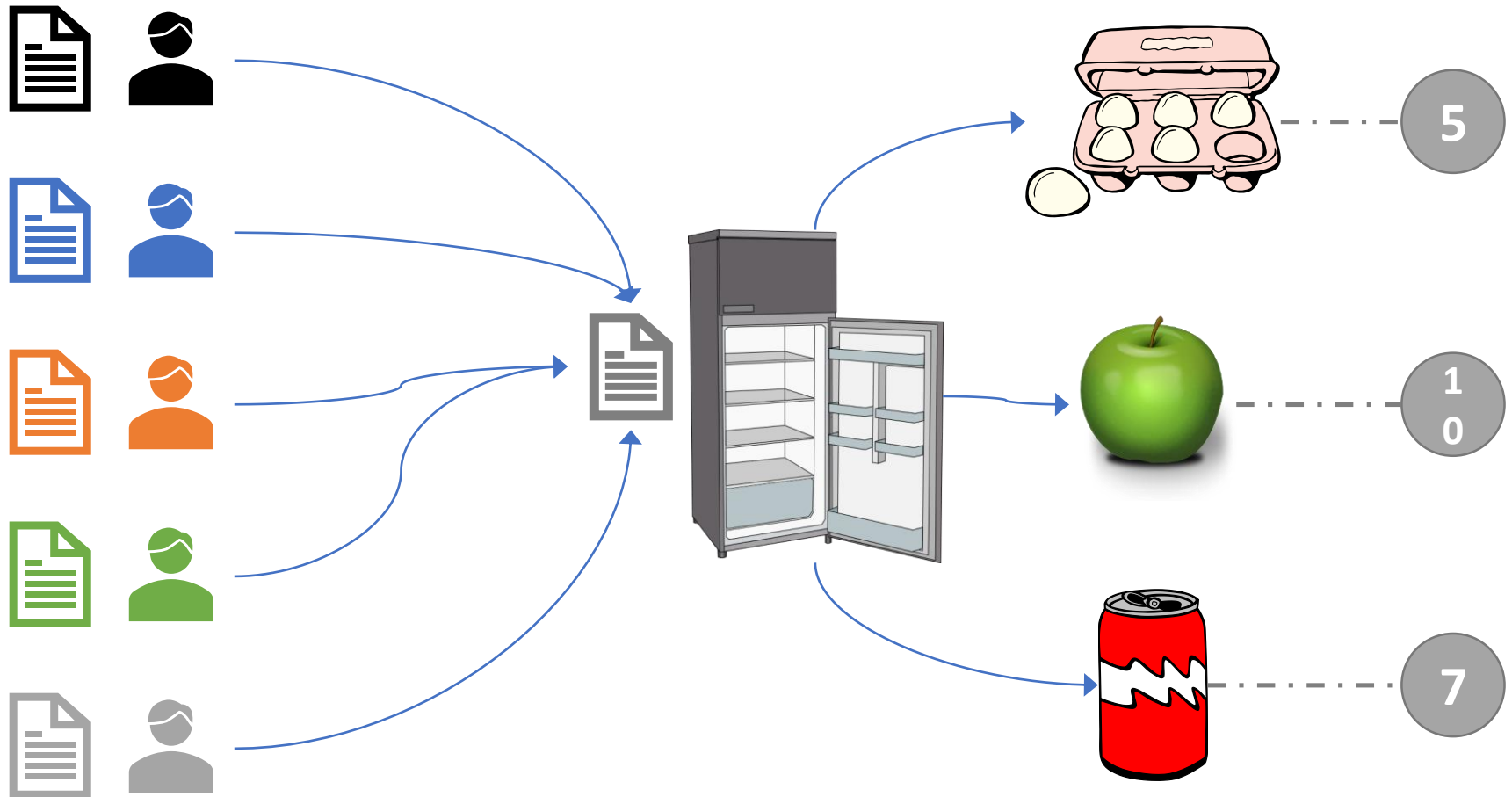
Blockchain Technology
(Distributed General Ledger)



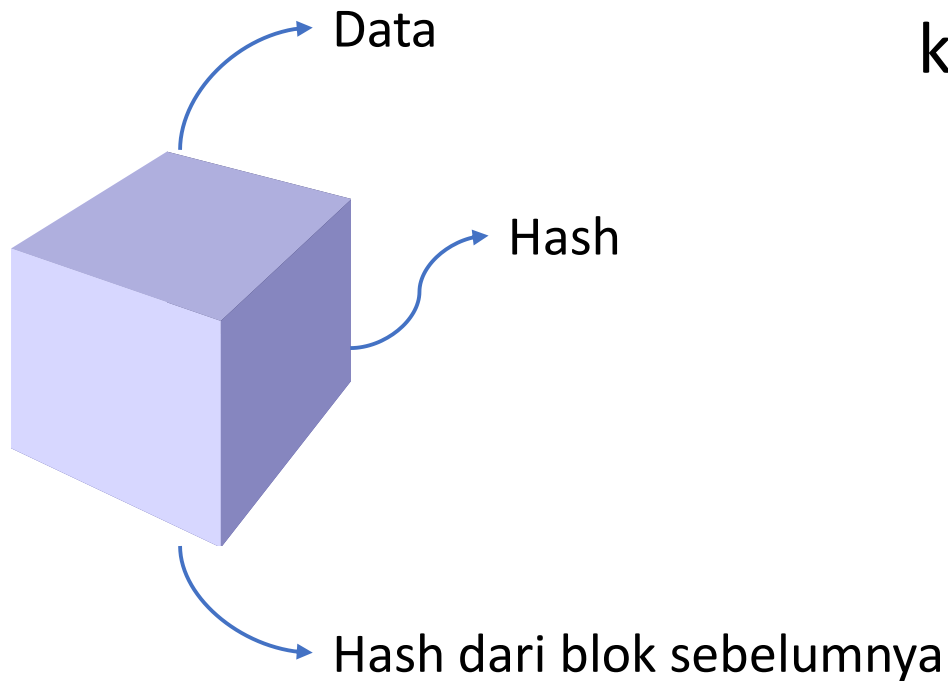
Common General Ledger



Distributed General Ledger "Blockchain"



Block

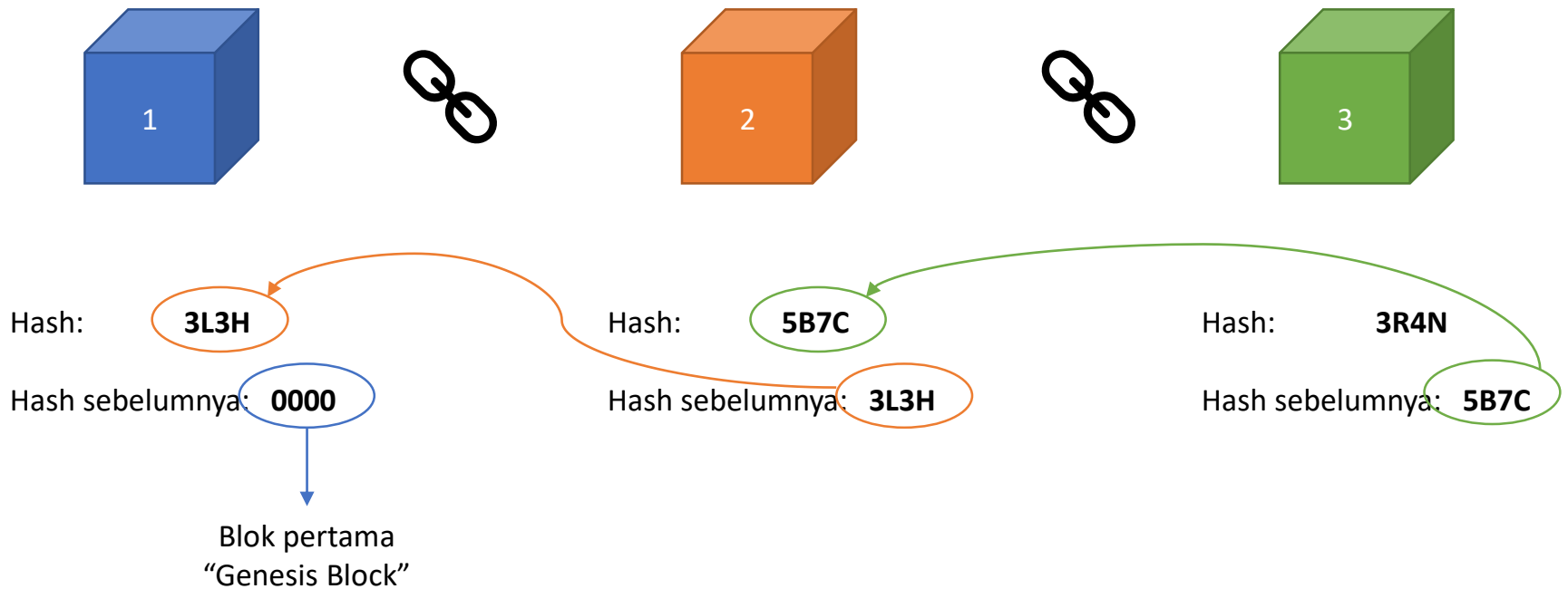


- “Block” terdiri dari 3 komponen utama:
 - Data
 - Hash
 - Hash dari blok sebelumnya

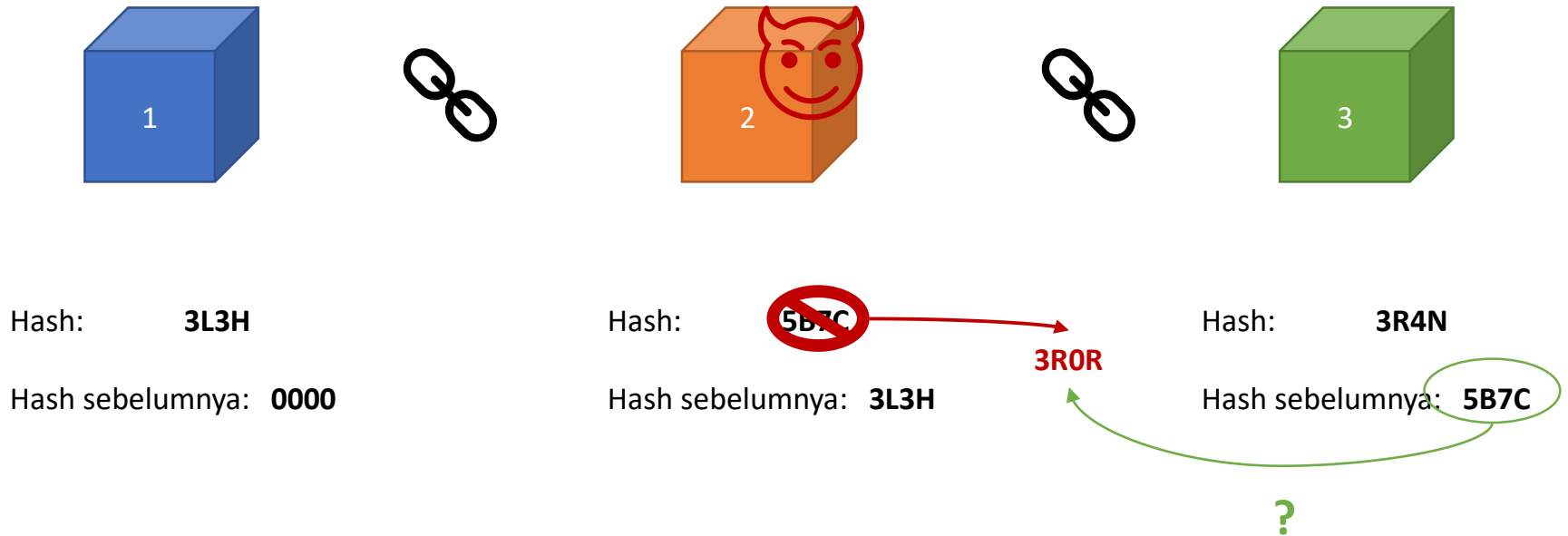
Block

- Data pada suatu blok
 - Dapat berisi apa saja tergantung kebutuhan
- Hash
 - Hash bersifat unik, mirip dengan sidik jari
 - Hash berfungsi untuk identifikasi blok dan isinya
 - Hash dikalkulasi setelah blok dibuat
 - Mengganti isi blok, maka hash juga akan berubah sehingga bermanfaat untuk mendeteksi perubahan isi suatu blok
- Hash dari blok sebelumnya
 - Hash dari blok sebelumnya akan terkait dengan blok setelahnya sehingga membentuk rantai atau “chain” → Blockchain

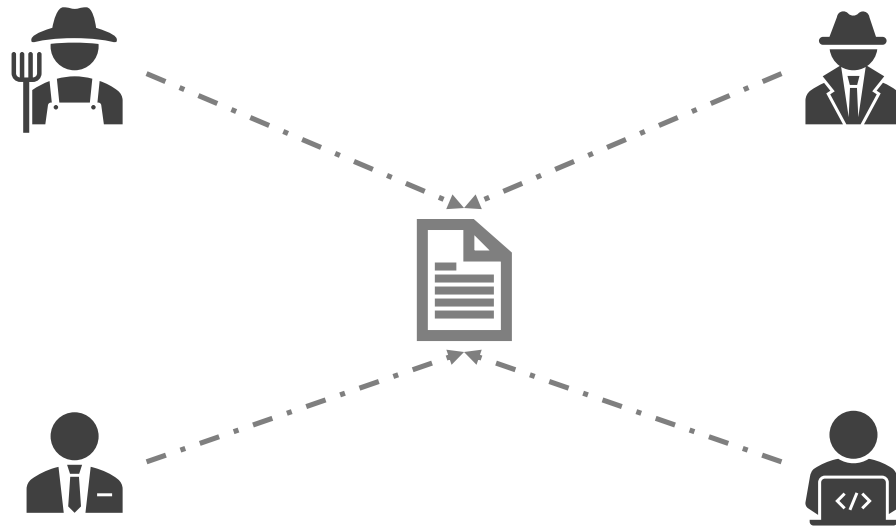
Contoh suatu Blockchain



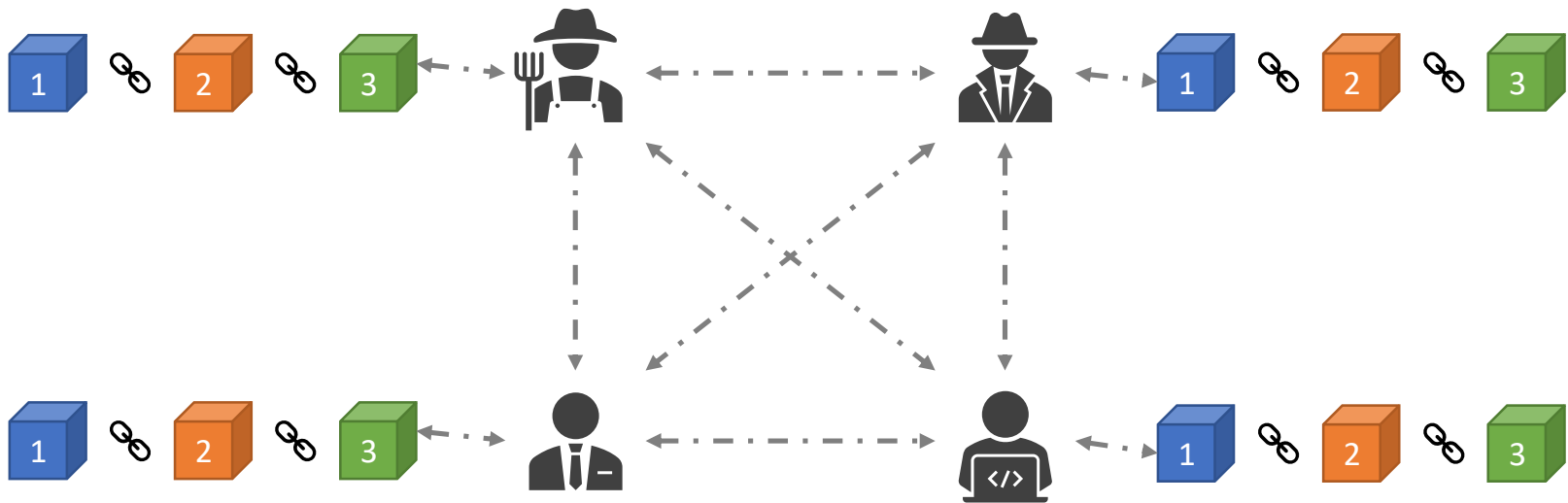
Perubahan Data Sepihak



Initial System



Distributed General Ledger





Characteristics of Blockchain

- ✚ Traceable
- ✚ Efficient
- ✚ Transparent



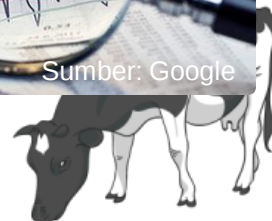
Source: Google



Sumber: Google

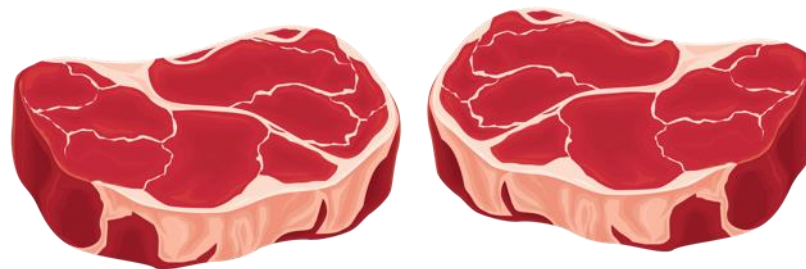


Sumber: Google





Blockchain for Farm SCM



Meat Agrologistics





Synergy of Blockchain and AI

Artificial Intelligence vs.
Blockchain:
Two Innovative
Approaches to Digital
Transaction
Management

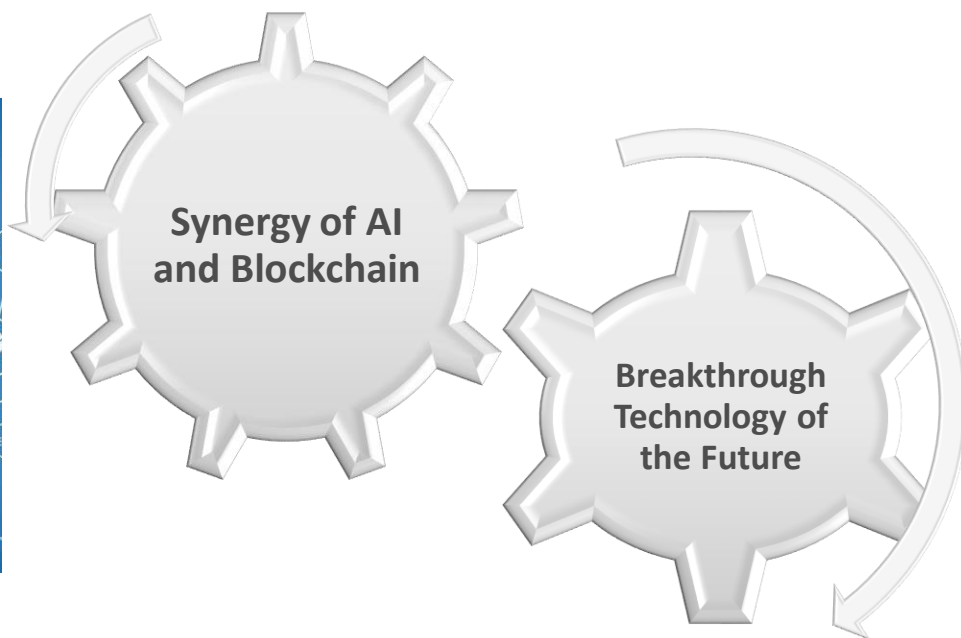
Blockchain + AI = ?

AI + Blockchain = ?





Why Synergy?





My Past and On Going Research Projects about AI and Advanced Digital Technology in Farm SCM





A Founder of Research Group BRAIN[©]

BRAIN[©]

Blockchain, Robotics and Artificial Intelligence Networks
IPB University, Bogor, Indonesia





- RANCANG BANGUN SISTEM RANTAI PASOK DAGING SAPI DENGAN MENGGUNAKAN TEKNOLOGI BLOCKCHAIN
 - Pengembangan Sistem Traceability dengan Teknologi Blockchain
 - Pengembangan sistem dilakukan dengan menggunakan platform Hyperledger Composer.





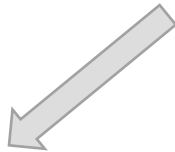
Problems of Meat Supply Chain

- High Price
- Insufficient Domestic Production
- Not Suitable Import (Not Fresh)
- Long Supply Chain
- Low Quality of Products due to Misconduct
- Food Safety





Design Objectives



Transparency
Traceability
Safety
Quality
Halalness

Cost
Quality
Risk
Delivery Time
Safety
Security



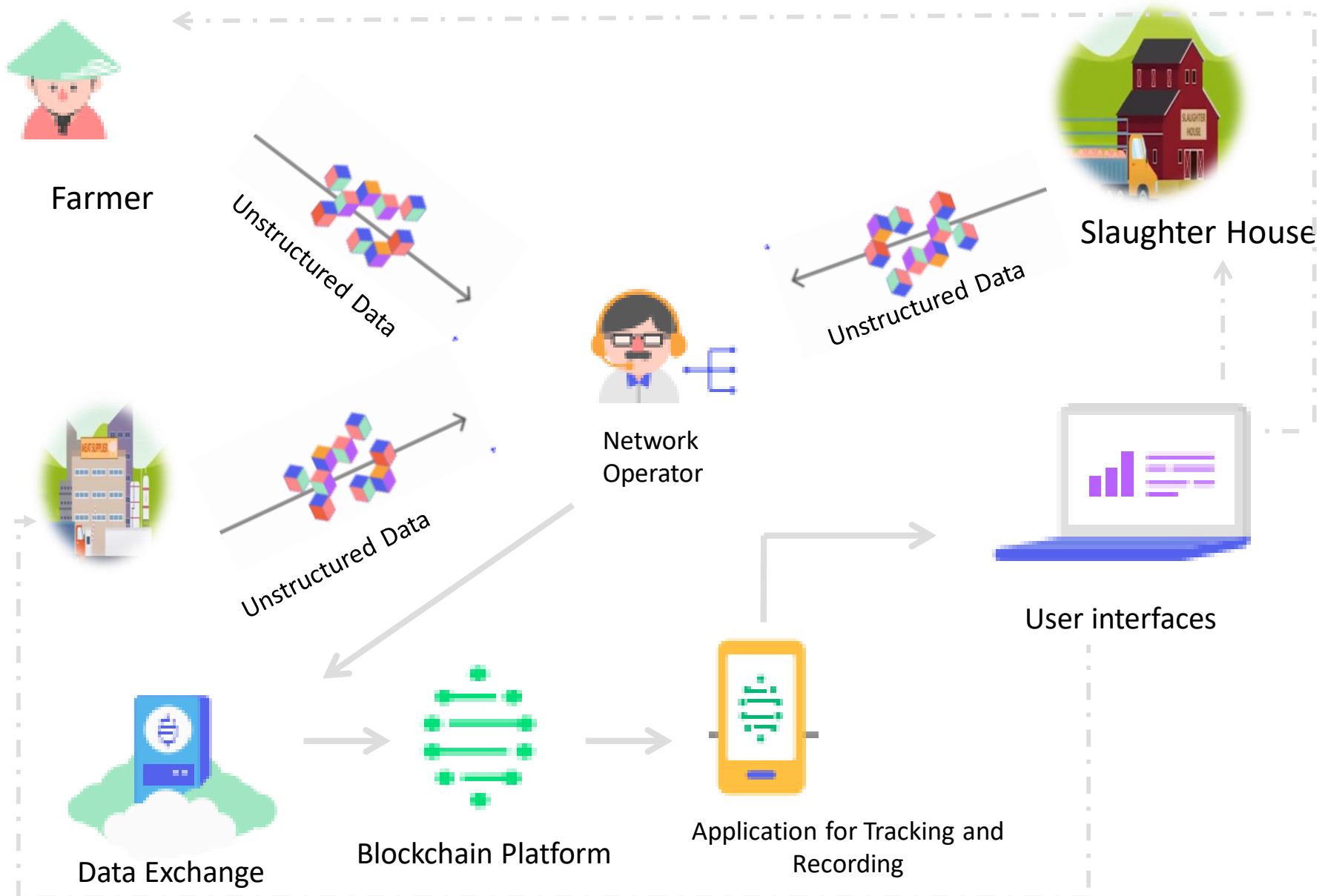
Blockchain



Many Objectives Genetic Algorithms



Design of Traceability System for Meat Supply Chain





IPB Agromaritim 4.0

- Pengembangan Sistem Registrasi dan Pencatatan Digital Berbasis e-ID Untuk Manajemen Ternak Di SPR Bojonegoro





Conclusions

- AI can be used for farm SCM
- Should be integrated with other innovative technologies in farm systems
- Spectrum
 - From upstream to downstream process (from farm to consumers)
 - From strategic level to operational level





Future Projects

“Everything that can be digitized in our **Farm Industry** should be digitized.”

—

Yandra Arkeman, IPB University





Interesting Ideas

- Digitizing Product Value?
- Blockchain for Halal Supply Chain, especially for meat?





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Pascasarjana

SEGERA DIBUKA PROGRAM STUDI LOGISTIK AGRO-MARITIM

Tujuan dari pembentukan Program Magister Multidisiplin Logistik Agro-Maritim, SPs IPB adalah menghasilkan lulusan yang mempunyai kemampuan dalam merancang dan mengelola sistem agrologistik dengan menggunakan pendekatan teknik dan manajemen

Visi

Menjadi penyelenggara pendidikan berkualitas terbaik dalam bidang agrologistik di tingkat internasional

Misi

Mendidik para Akademisi, Birokrat, Praktisi, dan Profesional terkait untuk menjadi perancang dan pengelola sistem agrologistik yang berkualitas



Pendaftaran Program Studi akan dibuka mulai Semester Genap T.A 2019/2020
Pendaftaran Online: <http://pendaftaran.admisi.ipb.ac.id>
Informasi Pendaftaran: <http://pmbpasca.ipb.ac.id>



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Thank You!

