



# Blockchain Opportunities

*Trust, Privacy and Utility for the Consumer Electronics & Vehicular Technology Industries*

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# Who am I (Presenter)?



## ▶ Professional Volunteer (Electronic & ICT Engineer)

- Board Member of IEEE Consumer Electronics Society (*6 years*)
- Editor-in-Chief of IEEE Consumer Electronics Magazine (*2010-2016*)
- IEEE Fellow in 2010 (*Contributions to Digital Camera Technology*)
- IEEE Distinguished Lecturer, Conference Chair, Editor & Reviewer

## ▶ Day Job(s):

- University Professor & Former Vice-Dean (*Research & Grad Studies*)
- Active Researcher (*currently 10 PhD & 3 PostDoctoral researchers*)
- Entrepreneur, Inventor & Technologist
- Industry Consultant

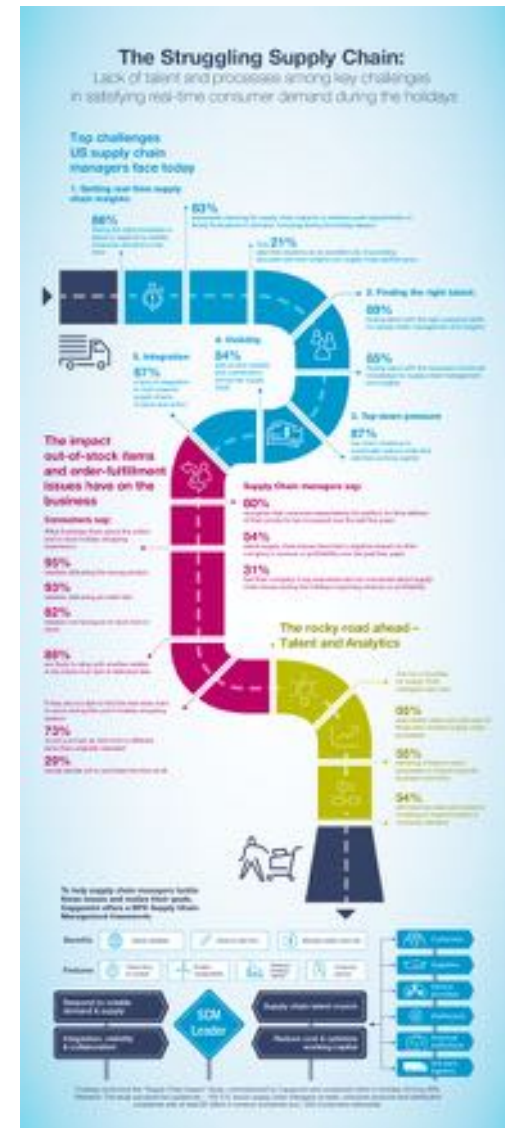


# Some CE Use Cases (1)

*Products & Manufacturing*

# Supply Chain Management

- ▶ CE Industry projected to grow at CAGR of 5% to \$1.8 trillion by 2023, with smartphones leading the way
- ▶ The industry relies on complex supply chain management to support manufacturing of today's CE devices
- ▶ Increasing emphasis on
  - ethical sourcing for manufacturing;
  - management of product lifecycle for environmental
  - legal & taxation issues that span jurisdictions; e.g. 13 billion in taxes owed by Apple to Irish government, but enforced by EU
- ▶ Blockchain provides much needed traceability and transparency



# Counterfeit Components

- ▶ Costs the semiconductor industry 75B USD per annum; 3B for automotive industry but increasing;
- ▶ Counterfeit components & subsystems don't have safety & compliance certification so represent a high risk to manufacturers
- ▶ Difficult to detect where and how they enter the supply chain
  - generally cannot be distinguished from original components; often originate from the same factory but from a batch that failed safety or compliance tests;
  - many competitive pressures within the supply chain; counterfeit components allow cost savings; often mixed with genuine components
  - human element is difficult to control;
- ▶ Blockchain provides much needed traceability and transparency for the semiconductor & CE industry sectors



# Fake Consumer Products

- ▶ Globalization has led to an even bigger problem – completely fake products that are almost identical to the original!
- ▶ AliBaba handles around 1.7B in fake products (2017 figure); a huge problem for its credibility as a global online retailer
- ▶ Globally the market for fake electronic products is estimated at 30-50B; (500B for all categories of product!)
- ▶ Solution: a public blockchain for product registration and tracking – from manufacturer to consumer and beyond (e.g. verification of device repair & refurbishment).

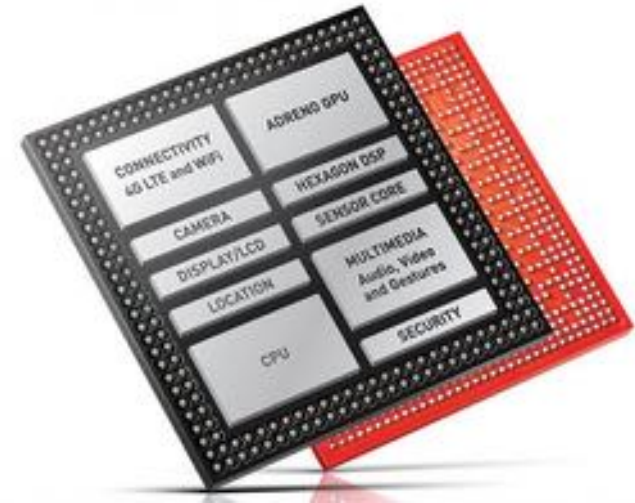


# Some CE Use Cases (2)

*System-on-Chip Challenges*

# The System-on-Chip is the Device

- ▶ Modern SoC combines multiple hardware engines & processing units from multiple vendors
- ▶ SoC Intellectual Property is highly valuable, requiring many man-years of engineering effort; many new companies are 'fabless', relying on their IP-Core designs for commercial success
- ▶ Increasing challenges for the industry wrt
  - Protecting IP-Core designs from theft & piracy; can occur at various stages in the design & manufacturing pipeline;
  - Verifying the inclusion of IP in production systems; how many units shipped, etc ...
  - Protecting IP from reverse engineering without compromising performance and silicon area
- ▶ Blockchain can provide solutions



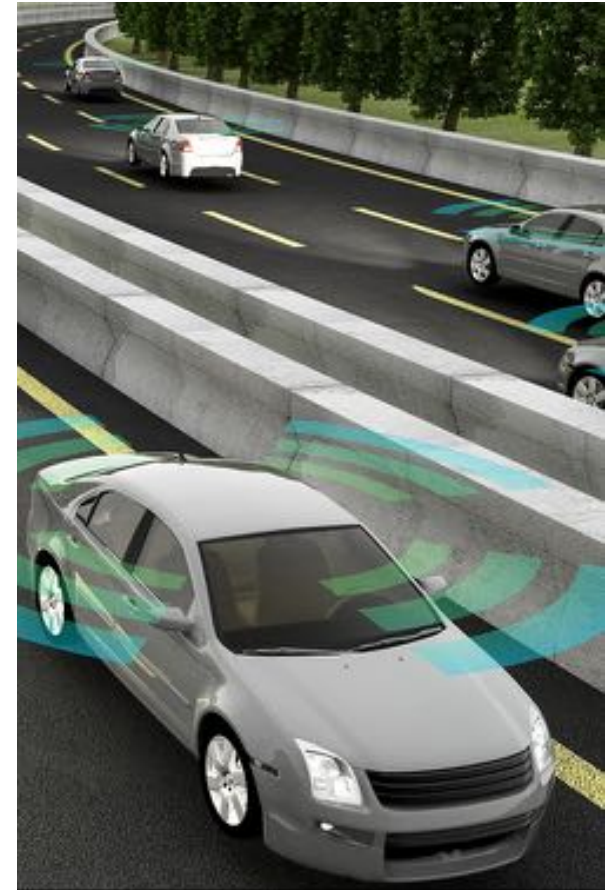


# Some VT Use Cases (1)

*Connected Vehicles Challenges*

# The Environment

- ▶ Connected vehicles must work in many different environments, without relying on central trust
  - Visiting other jurisdictions
  - Provenance of infrastructure
  - Unconnected highways
- ▶ Connected vehicles must interact – at high speed – with many other vehicles
  - Safety systems must operate with very low latency
  - Provenance of sensor data
  - Provenance of vehicle intentions
- ▶ Blockchain can avoid the requirement for a central trusted authority
- ▶ Blockchain can allow control to be devolved and work offline



# Some VT Use Cases (2)

## *Vehicle Charging Challenges*

# Vehicle Charging

- ▶ Electric vehicles must work in many different environments, without relying on central trust
  - Visiting other jurisdictions
  - Provenance of infrastructure
  - Payment for charge – in both directions
- ▶ Electric vehicles have the potential to revolutionise energy storage in a smart grid
  - Load balancing in place
  - Geographic load balancing
- ▶ Blockchain can avoid the requirement for a central trusted authority
  - Except in an automotive environment, we have options for trusted parties
  - Energy distribution network could be used for auditing/scalability



# More CE Use Cases (3)

*Devices & Data*

# The Age of the Smartphone

- ▶ (Almost) Everyone has one now – it is the most ubiquitous personal device and a pinnacle of consumer electronics
- ▶ The smartphone is the gateway to wealth of personal & private data; and “data is the new gold” ...
- ▶ It is the bridge between CE and the Cloud ...
- ▶ But this raises many challenges:
  - How to protect user privacy?
  - How to manage & share personal/semi-private data? (e.g. pictures & video)
  - How to manage cross-jurisdictional issues (e.g. safe-harbour between US and EU)
  - Smartphone & user biometrics



# Some articles to consider ...

*These aren't about blockchain; rather they outline problems where blockchain can offer a potential solution ...*

## ▶ Privacy & Smartphones

- P. Corcoran, “The Battle for Privacy In Your Pocket” [Notes from the Editor], IEEE Consumer Electronics Magazine. **2016** Jul;5(3):3-36.
- P. Corcoran, “Privacy in the Age of the Smartphone”. IEEE Potentials. **2016** Sep;35(5):30-35.
- P. Corcoran, “A privacy framework for the Internet of Things”, In Internet of Things (WF-IoT), **2016** IEEE 3rd World Forum on 2016 Dec 12 (pp. 13-18). IEEE.

## ▶ Biometrics

- P. Corcoran, “Biometrics and consumer electronics: A brave new world or the road to dystopia?” [Soapbox]. IEEE Consumer Electronics Magazine. **2013** Apr;2(2):22-33.
- P. Corcoran, C. Costache, “Biometric Technology and Smartphones: A consideration of the practicalities of a broad adoption of biometrics and the likely impacts”, IEEE Consumer Electronics Magazine, 5 (2), pp. 70–78, **2016**.
- P. Corcoran, C. Costache, “Smartphones, Biometrics, and a Brave New World”, IEEE Technology and Society Magazine. **2016** Sep;35(3):59-66.

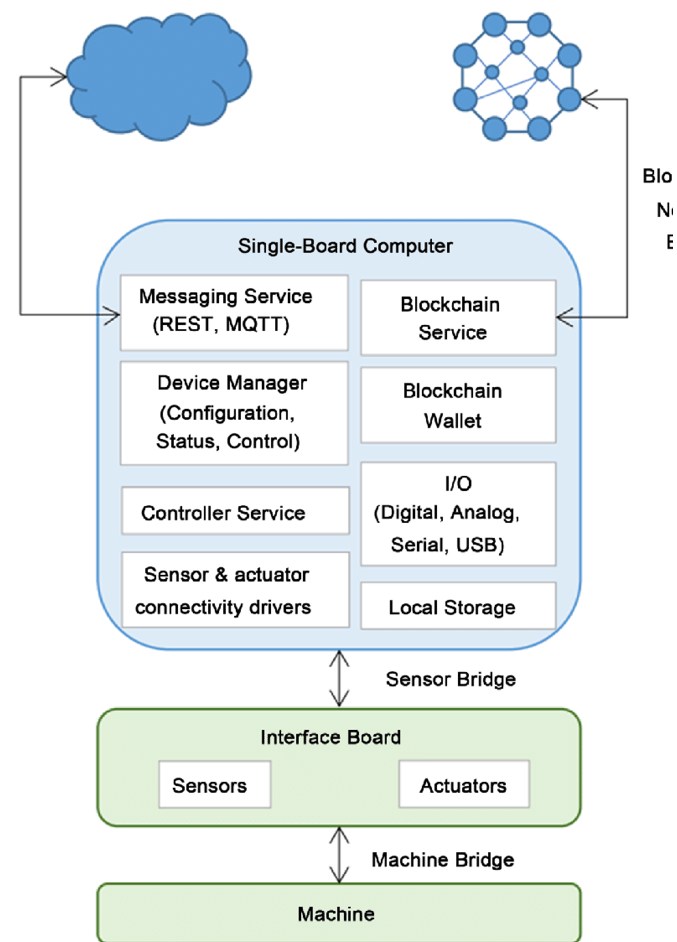
# Some CE Use Cases (4)

*The Internet of Things*



# The Internet of Things (IoT) - 1

- ▶ Multiple connected devices are invading your home ...
  - Smart-TV
  - Smart Speakers (Alexa, Google Home, etc ...)
  - Cameras (security, baby monitor, doorbell, TV, tablets, phones, etc ... )
  - connected HVAC systems (NEST, etc ... )
- ▶ Multiple networking technologies & command protocols ...
- ▶ Many devices connected to Cloud/Web services ...
- ▶ Multiple Challenges:
  - Security & Privacy of the Household?
  - Management of all these devices?
  - Prevention & Detection of Cyber-attacks?
    - Pen-Testing the Home?
  - Transactions between devices, services and your bank a/c ?
- ▶ How to establish Consumer Trust in such a complex environment?



A GUIDE TO THE CE INNERVERSE

# IEEE Consumer Electronics

MAGAZINE

VOL. 4, NO. 3, July 2015



**The Devil  
You Know...**

Marvelous  
New Distribution  
Models Set the Pace



IEEE

**IEEE Consumer  
Electronics Magazine**

**July 2015 Issue –**

**The Dark Side of IoT**

**Editorial -  
“I Am Game of  
Thrones”**

About the risks of our  
digital lives being ‘stolen’  
as easily as a certain hit  
TV-Series ...

 **IEEE**

# The Internet of Things (IoT) - 2

## Three key benefits of using blockchain for IoT



### Build trust

- Build trust between parties and devices
- Reduce risk of collusion and tampering



### Reduce costs

- Reduce costs by removing overhead associated with middlemen and intermediaries



### Accelerate transactions

- Reduce settlement time from days to near instantaneous

# Some thoughts on disruptions in Consumer Space ...

*(These reflects some more 'personal' interests ... )*

# 1. Biometrics, Smartphones & Blockchain ...

# Biometrics & Smartphones

Smartphones can solve the problem of cancellable biometrics ...



Soapbox Article – IEEE Consumer Electronics Magazine – April 2013

## Biometrics and Consumer Electronics: A Brave New World or the Road to Dystopia?

By Peter M. Corcoran

**B**iometric systems confirm a person's identity by extracting and comparing patterns in their physical characteristics against computer records of those patterns. Examples include scans of the face, iris, or retina; measurements of hand geometry, palm or finger vein patterns; fingerprints, ear structure, voice patterns, or any other characteristic of the physical person that represents a unique attribute. The extracted patterns are matched against previously registered patterns, and, within certain tolerances, a confirmed match can be used to authenticate an individual's identity. In most practical systems, there is a need

processed to provide a unique identifying formula for each police offender.

First introduced into practical use in 1882, Bertillon's system was used in 1884 to confirm 241 repeat offenders in the Paris area. Its use was then widely adopted by the French police force. Although the system was later shown to be flawed because different police

particular space and the placement of objects in it.

Fingerprinting is one of the earliest biometric techniques. In fact, fingerprints were used as signatures in ancient Babylon. However, the first scientific research began in the 17th and 18th centuries. Nehemiah Grew (1641–1712) published the first scientific paper to describe the ridge structure of the skin covering the fingers and palms [16]. A century later, in 1788, the German anatomist Johann Mayer (1747–1801) recognized that fingerprints are unique to each individual.

In modern times, fingerprints were first used as a form of legal authentica-



People are generally suspicious of biometrics and, if biometrics are not introduced carefully into a

# Which is more secure?

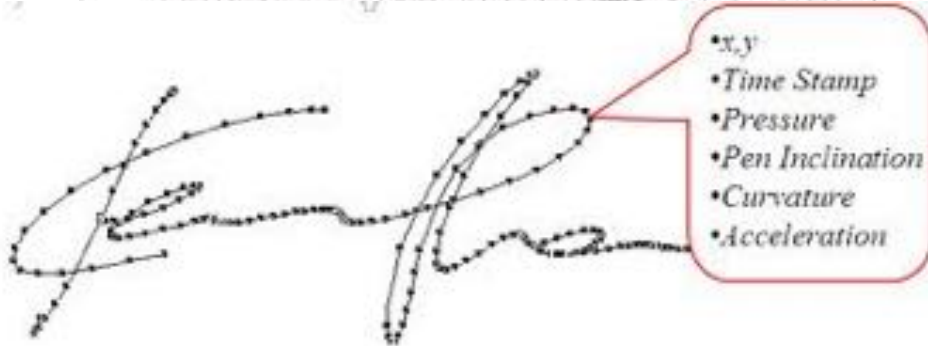
*Remember – your device can constantly authenticate you!*

**WARNING:** Petitioner/applicant is cautioned to avoid submitting personal information in documents that contribute to identify them. Personal information such as social security numbers, biometrics (other than a check or credit card authorization form PTO-2038 submitted for payment to support a petition or an application. If this type of personal information is included in an application, the USPTO, petitioner/applicant should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

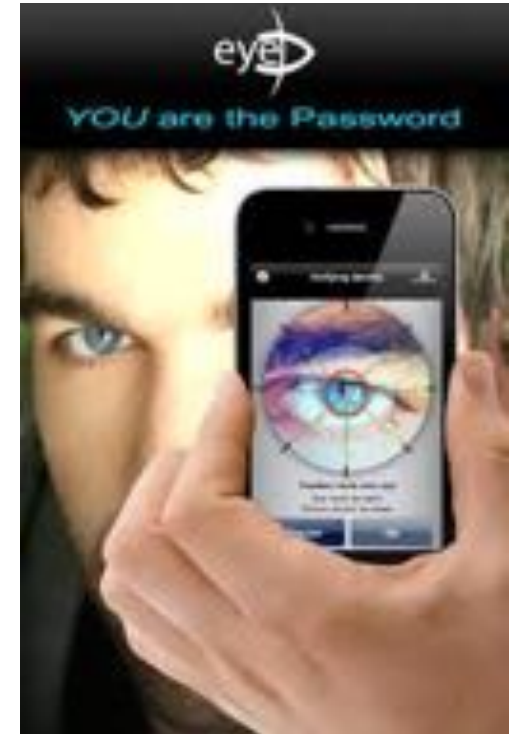
LEGAL NAME OF INVENTOR  
Inventor: Peter Corcoran Date (Optional) 20th October 2015  
Signature: *Peter Corcoran*

Note: An application data sheet (PTO/SB14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/DA01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 116 and 37 CFR 1.83. The information is required to obtain or retain a benefit by the public, which is to file and by the USPTO to process an application. Confidentiality is governed by 35 U.S.C. 132 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete.



Vs



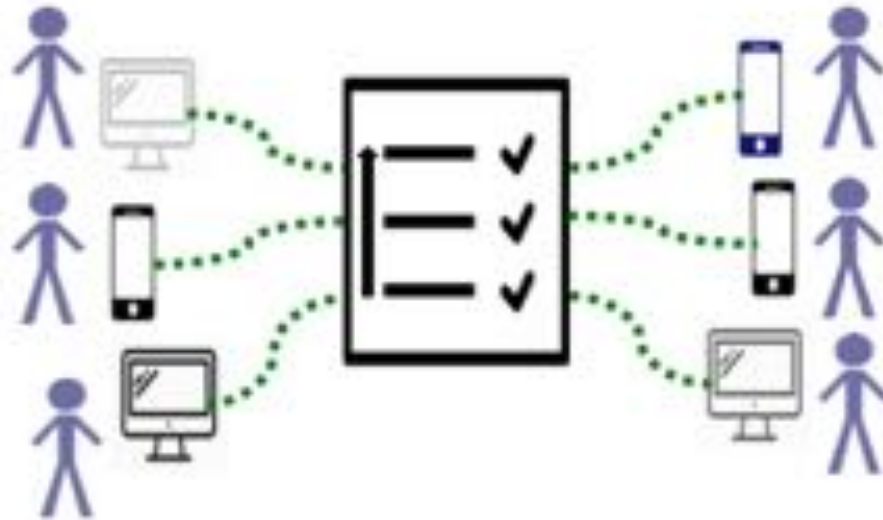
# But for Biometrics to Work ...

- ▶ ... you can't store the "Biometric" in a centralised database ...
- ▶ IT is too attractive for Cyber-criminals ..





# But you could BLOCKCHAIN it with a bit of help from our smartphones ...



- ▶ Blockchain enables **new forms of distributed software architecture** where agreements on shared state for decentralised and transactional data can be established in a network of peers – this can be a key enabler for secure & ubiquitous “cancellable Biometrics” ...

## **2. Big Data, Consumer Content & Blockchain ...**

# Growth in Data Traffic on Internet

*The Age of the Zetabyte (Yottabyte?) ...*

- ▶ Total data approaching 0.2 ZB per month ...
- ▶ 70%-80% is Video Data
- ▶ Mobile Data CAGR is c.50%
- ▶ Consumers are now major generators of content ...

## Online Video Boom Leads to Surge in Data Traffic

Estimated monthly consumer data traffic (in petabyte)



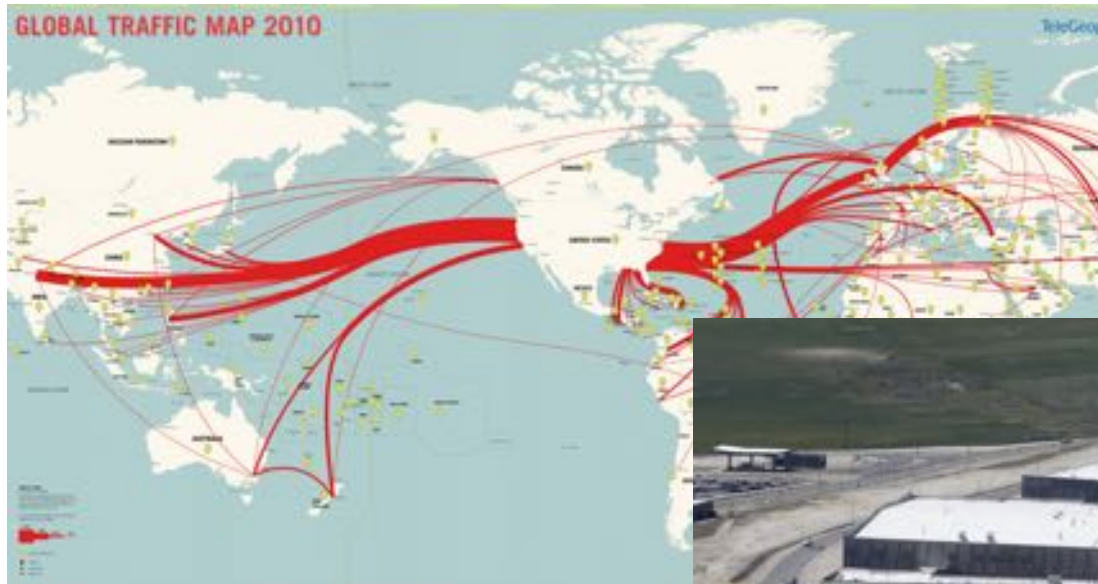
Web, email, instant messaging and other non-file-sharing traffic via HTTP and FTP

statista



**When you are THE World's DATA HUB ...**

*... You need the World's Biggest Data Center to store all that Cloud Data!*



But Governments aren't the only ones who want you to trust them with your data ...

YouTube

What Google Knows

Google collects enough data to build comprehensive profiles of most users - who they are, where they go and what they do - and the information is all available at [www.google.com/history](http://www.google.com/history)



GMAIL 134,966

All of Tony's emails since he first got a Gmail account in 2004. Google also stores his 6,347 chats.

CONTACTS 2,702

Google knows the people that Tony emails the most. At the top is a friend of Tony's.

YOUTUBE 9,220

When Tony has watched videos in chronological order, including a video viewed in June about cars.

NEW Google

Privacy Policies



Instagram



facebook



# Today Big Corporations Control the Data Flow ... & the \$\$\$

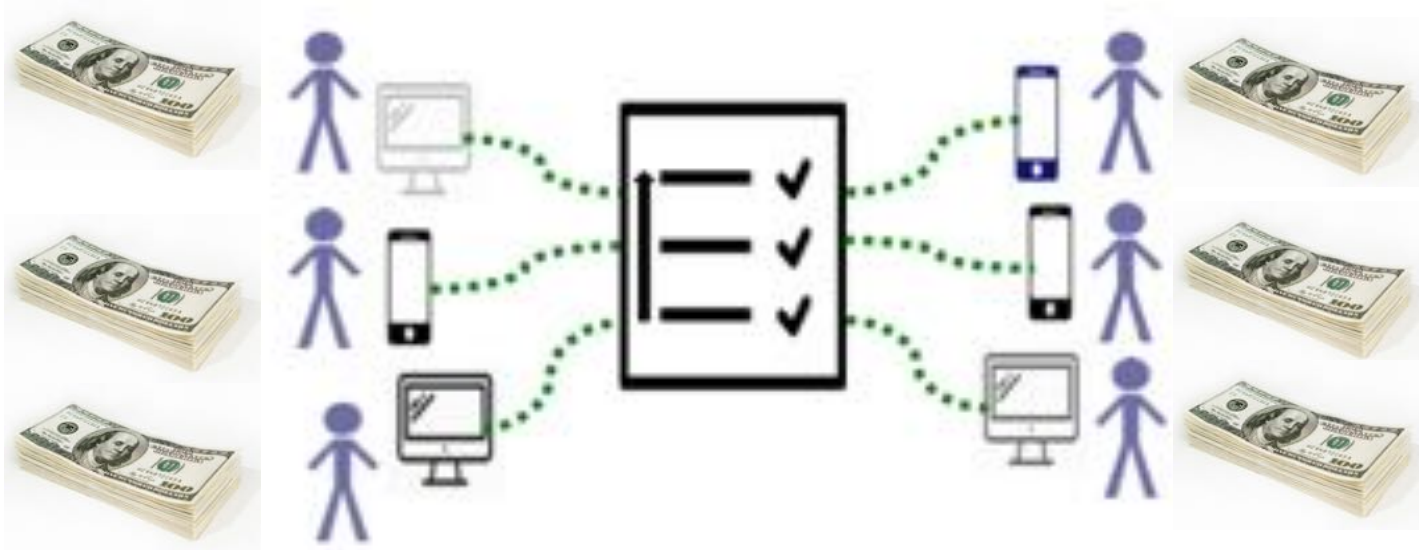
- ▶ User content attracts viewers and advertisers ...
- ▶ Corporations keep the Lion's share of profits ...



- ▶ The people who create the content get the crumbs ...



# But BLOCKCHAIN could commodotise the management & monetisation of content distribution ...



- ▶ Blockchain enables **new forms of distributed software architecture** where agreements on shared state for decentralised and transactional data can be established in a network of peers – this can be a key enabler for an open marketplace for data & content ...

# Summary/Conclusions

*Something Old, Something New, Something Borrowed, Something Green ...*

- ▶ Supply Chains & Manufacturing both in CE & VT Ecosystems
  - Something we would have expected ...
- ▶ Some Interesting New Ideas for Application of Blockchain
  - Security, Privacy & Trust challenges in relation to both our Automobiles and our Smartphones!
  - Vehicular Charging
  - Biometrics Infrastructure
  - Blockchain to manage & monetise ‘user-generated’ content?
- ▶ Challenges
  - Blockchain requires ‘energy’ to enable all these wonderful opportunities
  - And it requires a broad adoption to enable a sufficiently large consensus for any of these use cases to be successful



# I'm Done ...

*????? Any Questions ... ????*