Disruptive Innovation:
From Blockchain to DNA as Disk Drives

Mark Wolff, CTO | BCNET Conference 2017

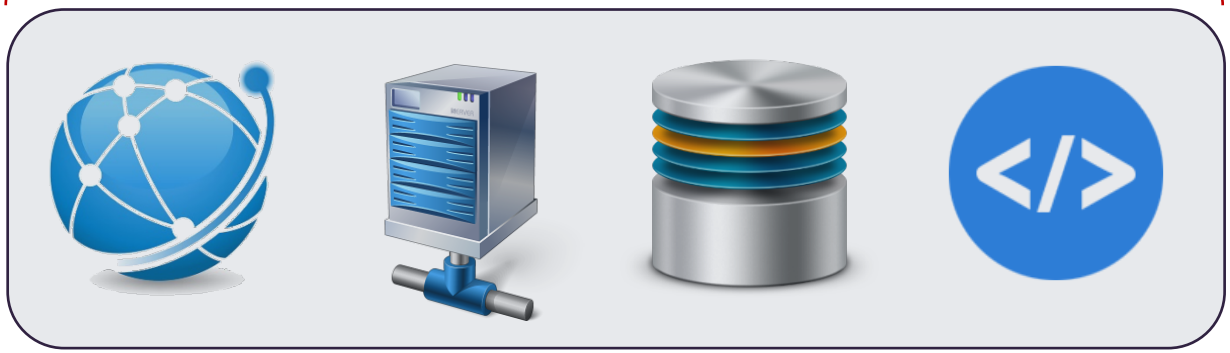
Why are we talking about this?

Research

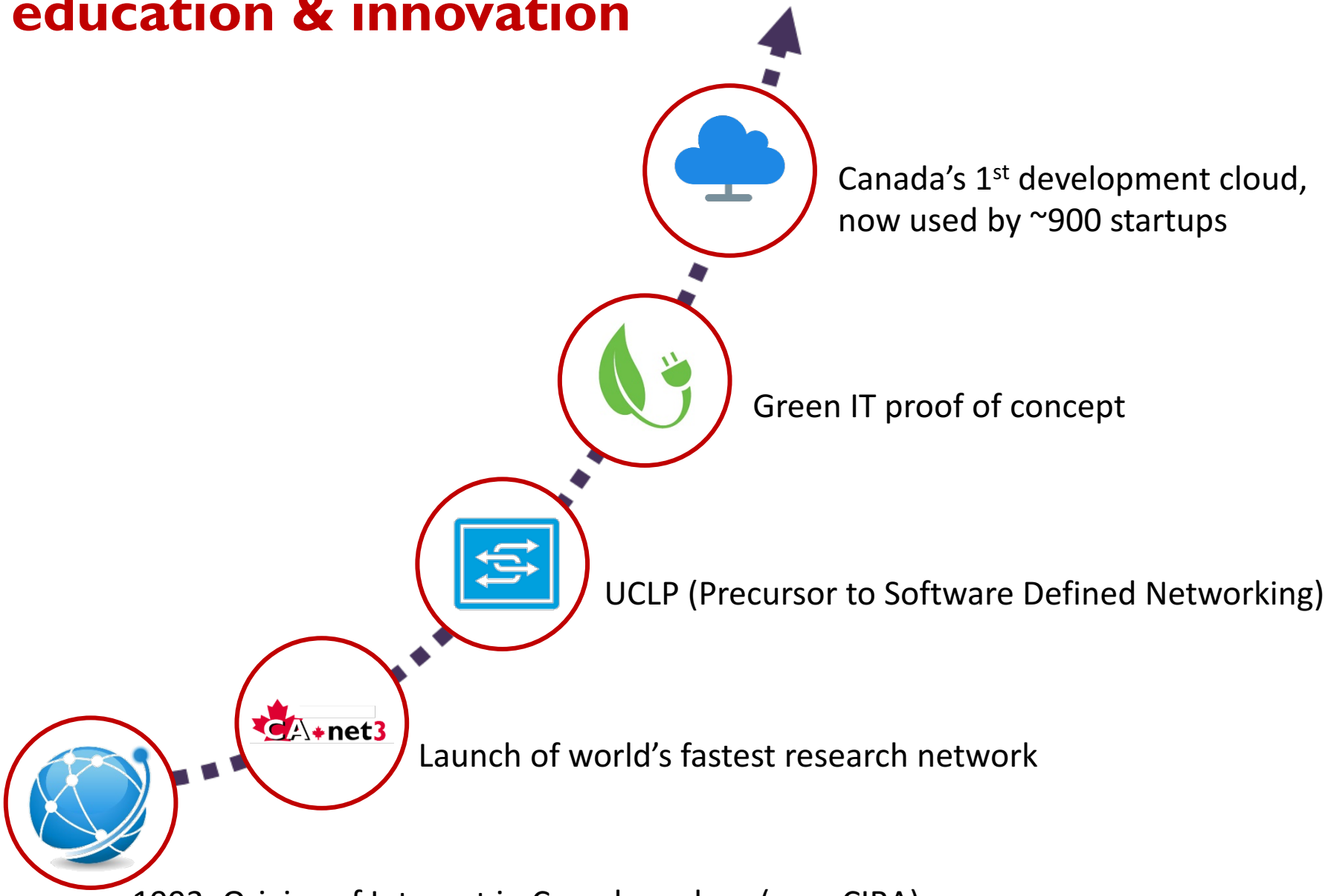
Collaboration

Innovation

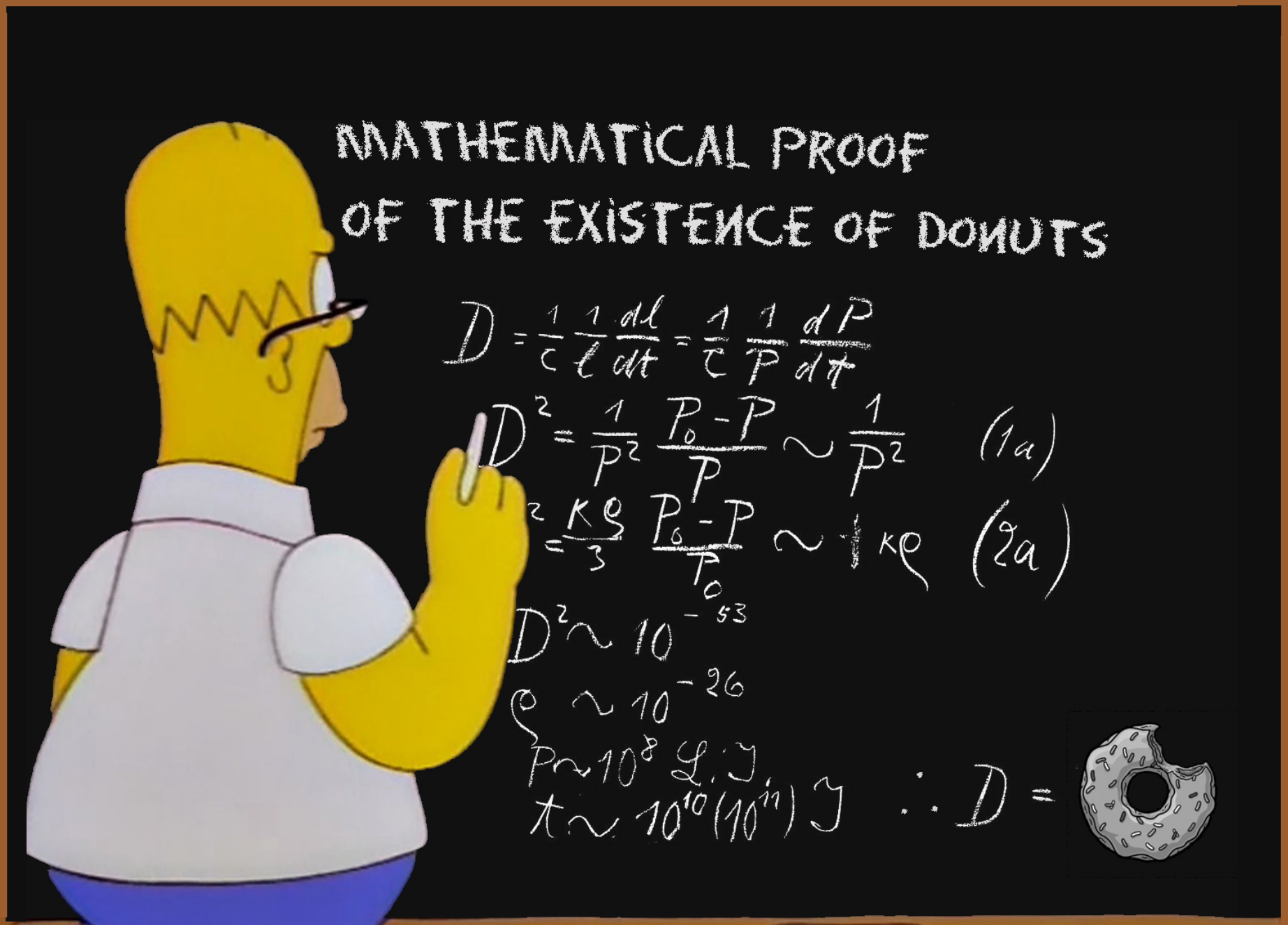
Anytime.



A history of new tech to benefit research, education & innovation

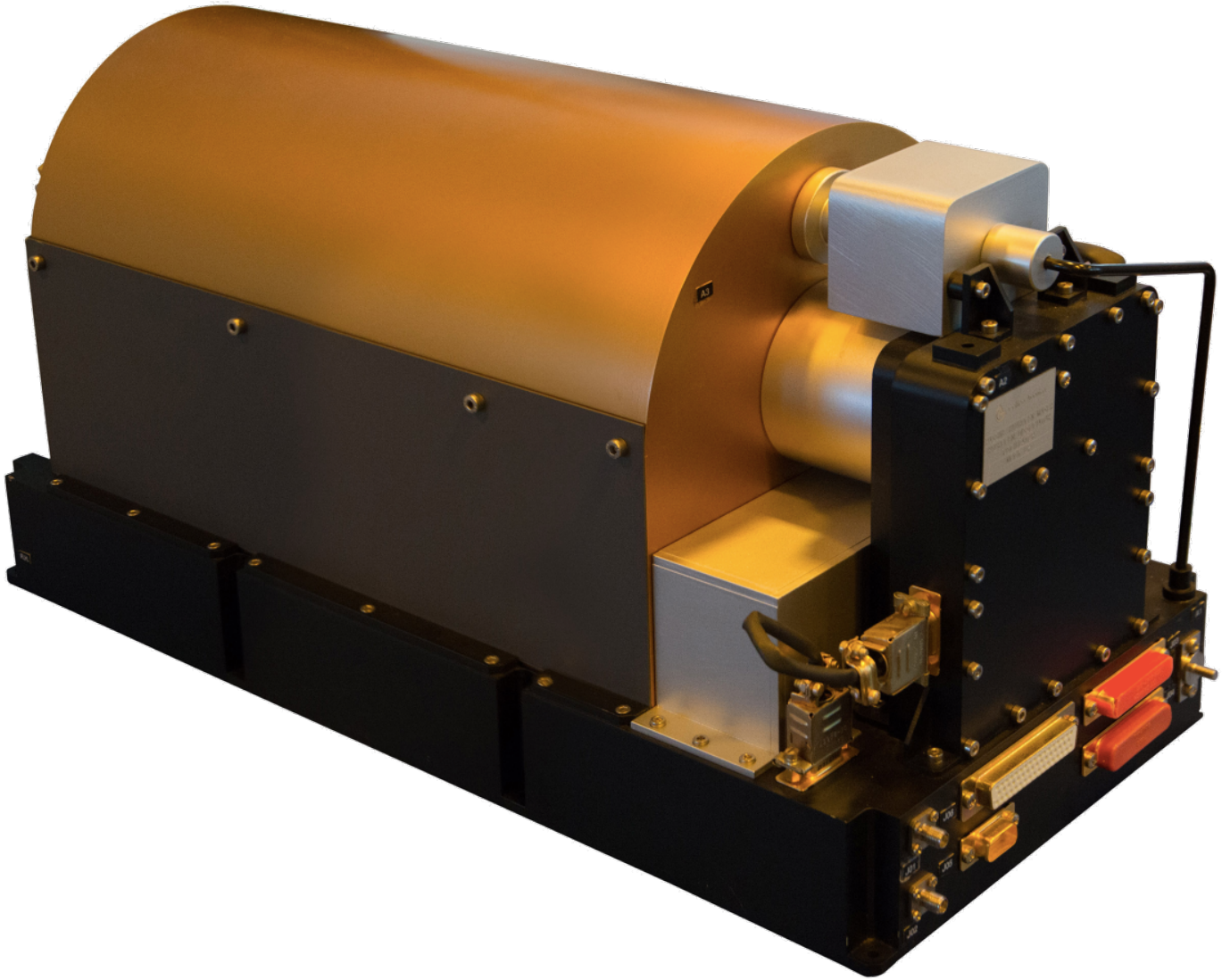


So what comes next?


MATHEMATICAL PROOF
OF THE EXISTENCE OF DONUTS
$D = \frac{1}{c}\frac{1}{l}\frac{dl}{dt} = \frac{1}{c}\frac{1}{P}\frac{dP}{dt}$
$D^2 = \frac{1}{P^2}\frac{P_0 - P}{P} \sim \frac{1}{P^2}$ (1a)
$= \frac{K\rho}{3}\frac{P_0 - P}{P_0} \sim 1 K\rho$ (2a)
$D^2 \sim 10^{-53}$
$\rho \sim 10^{-26}$
$P \sim 10^8 \mathcal{L} : \mathcal{J}$
$t \sim 10^{10}(10^{11})\mathcal{J}$ $\therefore D =$

BMW Laserlight

SEIKO
GPS
SOLAR
UTC
LON
PAR
CAI
JED
DXB
KHI
DEL
DAC
BKK
SIN
TYO
SYD
NOU
WLG
TBU
HNL
ANC
LAX
DEN
CHI
NYC
SCL
RIO
BUE
POL
6



By SkywalkerPL - Own work, CC BY 3.0,
https://commons.wikimedia.org/w/index.php?curid=46693980

Quantum Information Theory

Quantum Information Theory

Better sensors, including gravity detectors

Quantum Information Theory

Better sensors, including gravity detectors

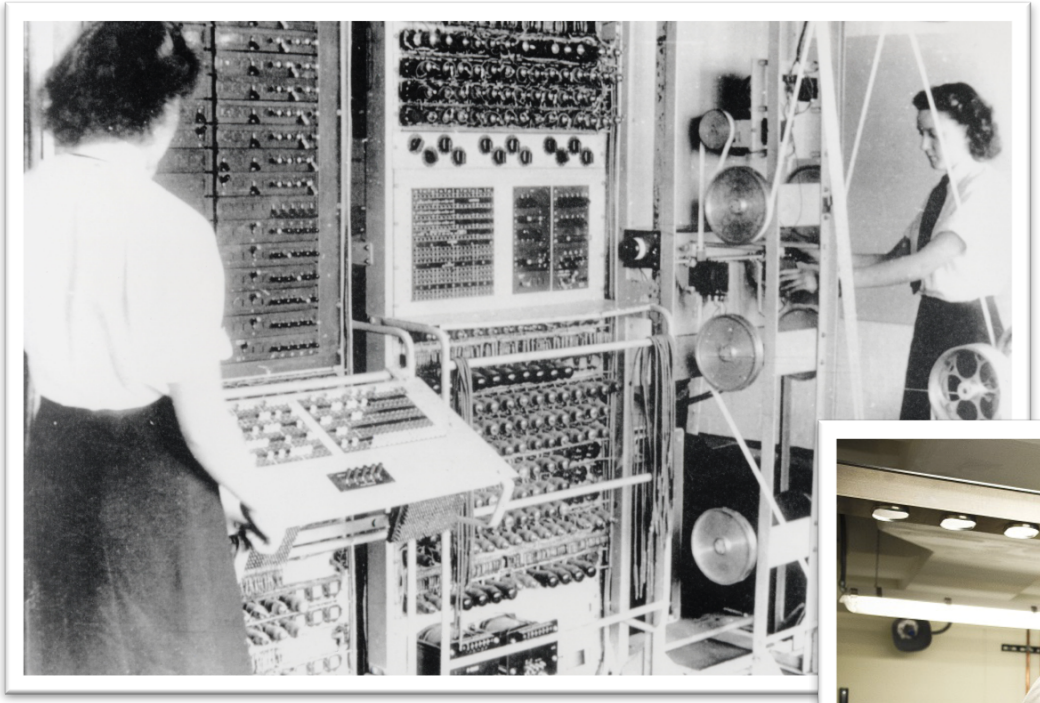
Quantum key distribution

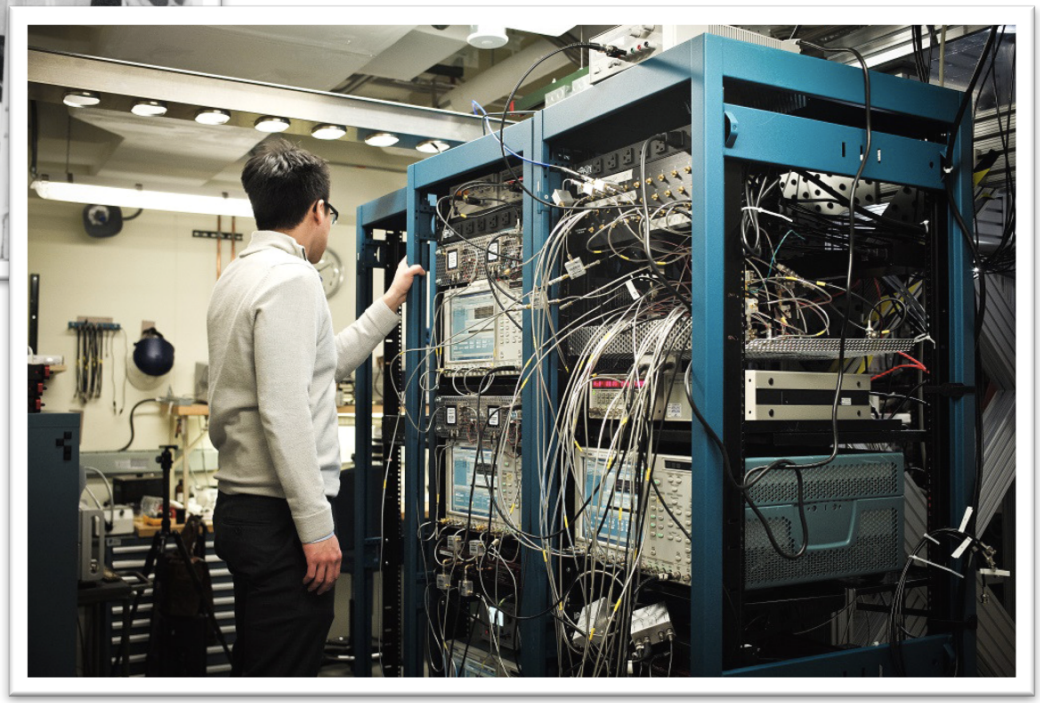
Quantum Information Theory

Better sensors, including gravity detectors

Quantum key distribution

Quantum computers



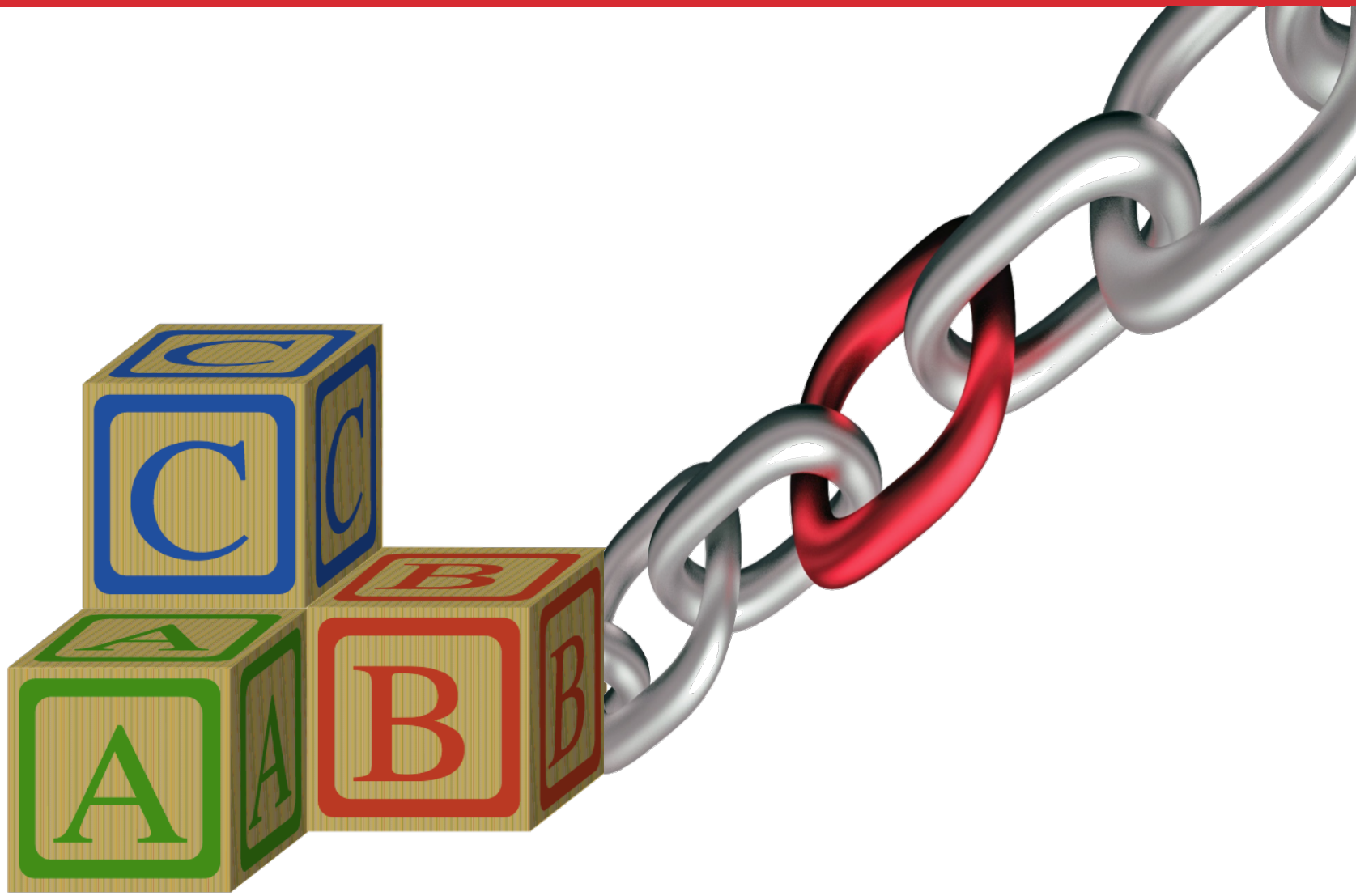


Conclusion:

>15 years away from general use

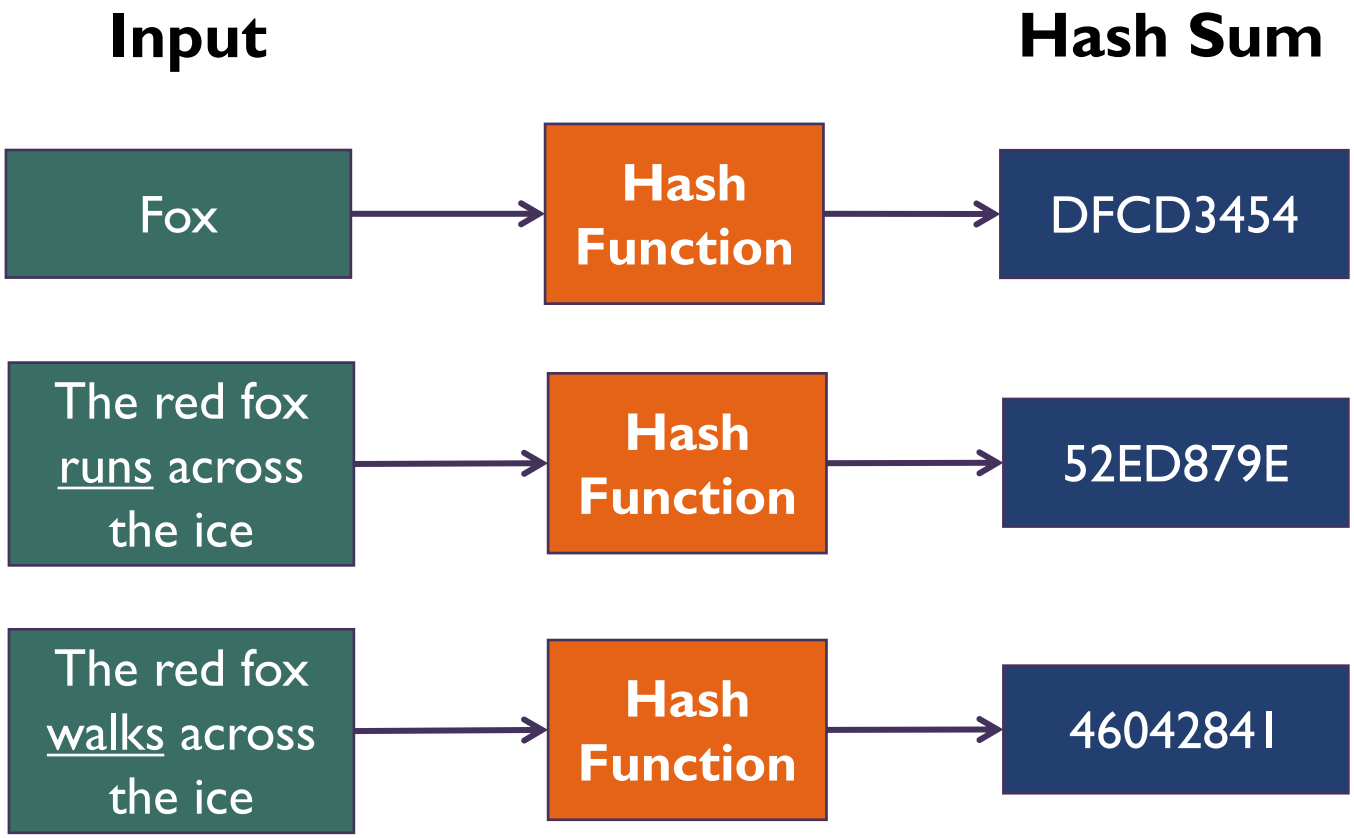
Slide concept by **the Honorable Zachary J. Lemnios**

Image sources: https://en.wikipedia.org/wiki/Computer#/media/File:Colossus.jpg
http://icdn8.digitaltrends.com/image/quantum-computer-ibm-5-1012x675.jpg



Chain image created by http://mbakakeeda.com

Blockchain

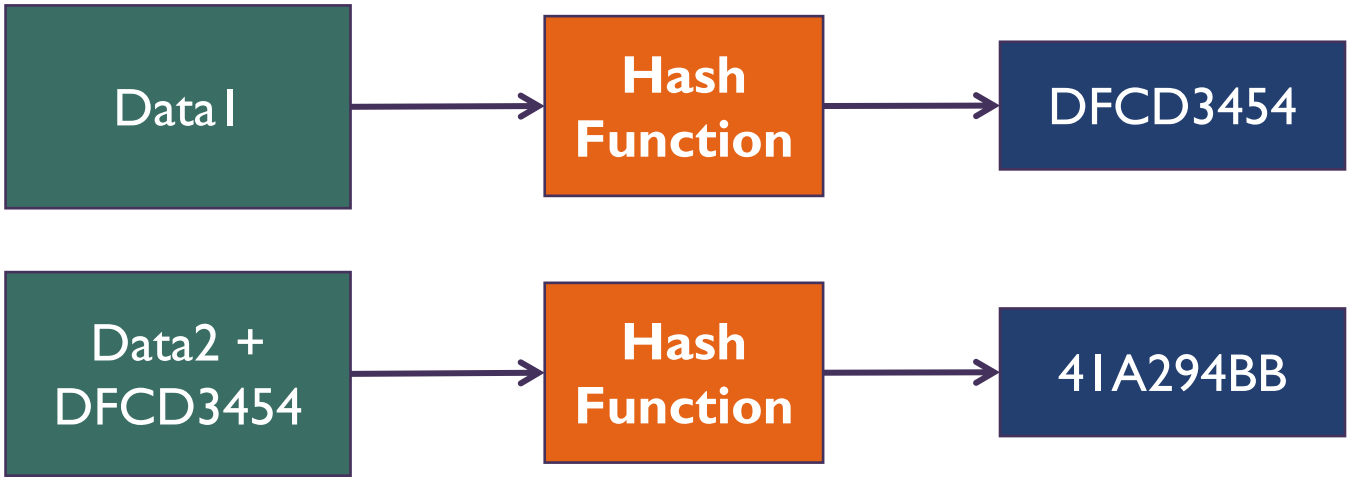

Input
Hash Sum
Fox
Hash Function
DFCD3454
The red fox runs across the ice
Hash Function
52ED879E
The red fox walks across the ice
Hash Function
46042841

Blockchain

1. Blockchain is a digital (distributed) database of records called blocks.
2. Each block has the data recorded, a timestamp, and a link to the previous block.
3. Each block has a hash sum. The link to the previous block includes its hash sum, so each block is linked numerically.

Blockchain

1. Blockchain is a digital (distributed) database of records called blocks.
2. Each block has the data recorded, a timestamp, and a link to the previous block.
3. Each block has a hash sum. The link to the previous block includes its hash sum, so each block is linked numerically.



Blockchain

1. **Secure**
   - Not possible to alter a record without changing a hash sum.

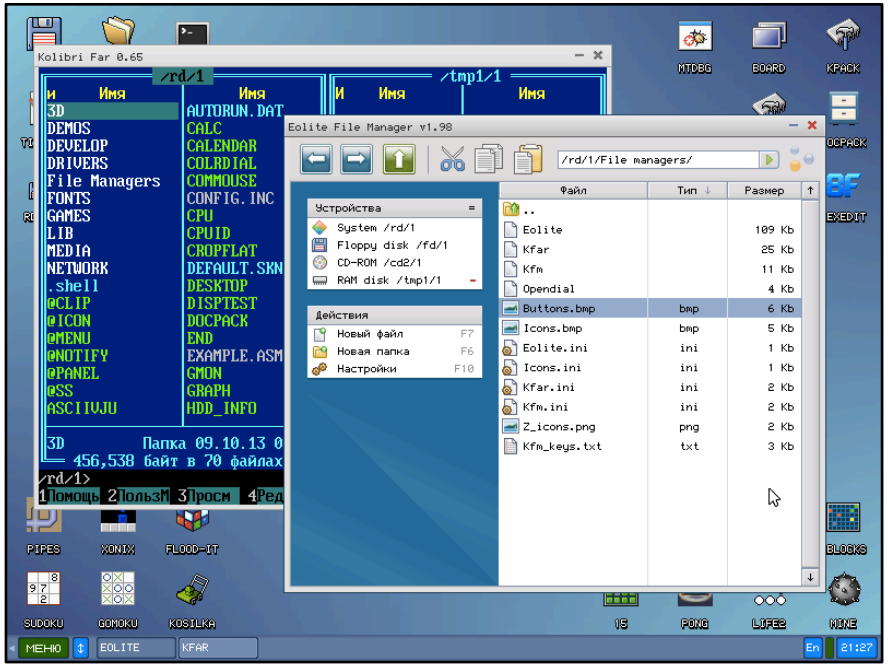
2. **Can be distributed**
   - Multiple parties can keep their own record, creates trust

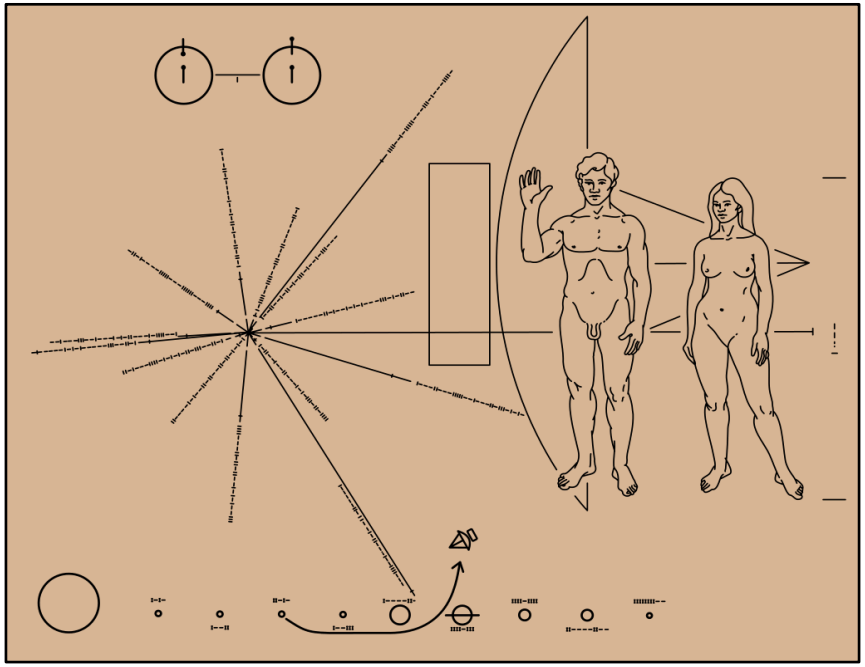
3. **Public or private**
   - Flexible for open, trusted, and closed environments

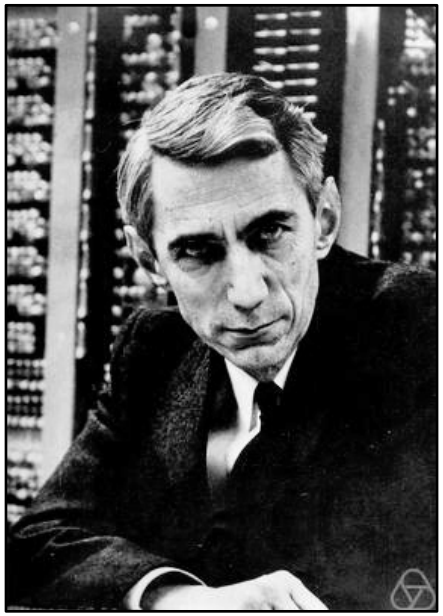
4. **A basis for trusted information**

Simple Blockchain Applications

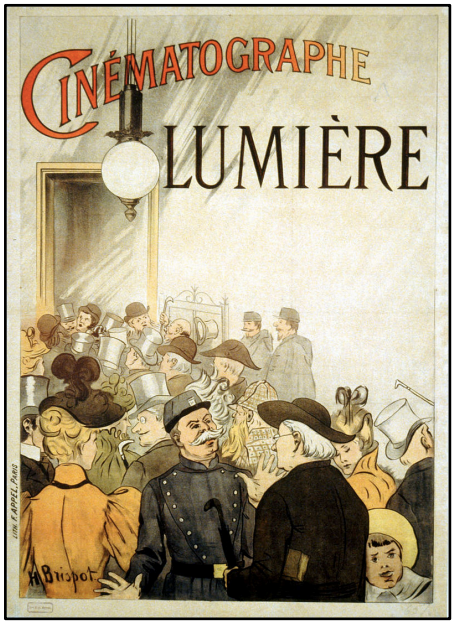
1. Access logging
2. Machine to machine transactions
3. Record of equipment changes, calibrations, repairs, warranty
4. Software licensing certificates
5. Student, faculty, researcher records


Kolibri Far 0.65
/rd/1
/tmp1/1
Имя
3D
DEMOS
DEVELOP
DRIVERS
File Managers
FONTS
GAMES
LIB
MEDIA
NETWORK
.shell
@CLIP
@ICON
@MENU
@NOTIFY
@PANEL
@SS
ASCIIVJU
AUTORUN.DAT
CALC
CALENDAR
COLRDIAL
COMMOUSE
CONFIG.INC
CPU
CPUID
CROPFLAT
DEFAULT.SKN
DESKTOP
DISPTEST
DOCPACK
END
EXAMPLE.ASM
GMON
GRAPH
HDD_INFO
3D Папка 09.10.13 0
456,538 байт в 70 файлах
/rd/1>
1Помощь 2Польз 3Просм 4Ред
Eolite File Manager v1.98
/rd/1/File managers/
Устройства
System /rd/1
Floppy disk /fd/1
CD-ROM /cd2/1
RAM disk /tmp1/1
Действия
Новый файл F7
Новая папка F6
Настройки F10
Файл
Тип
Размер
Eolite 109 Kb
Kfar 25 Kb
Kfm 11 Kb
Opendial 4 Kb
Buttons.bmp bmp 6 Kb
Icons.bmp bmp 5 Kb
Eolite.ini ini 1 Kb
Icons.ini ini 1 Kb
Kfar.ini ini 2 Kb
Kfm.ini ini 2 Kb
Z_icons.png png 2 Kb
Kfm_keys.txt txt 3 Kb
MTDBG
BOARD
KPACK
DOCPACK
EXEDIT
PIPES
XONIX
FLOOD-IT
BLOCKS
SUDOKU
GOMOKU
KOSILKA
15
PONG
LIFE2
MINE
МЕНЮ
EOLITE
KFAR
En
21:27





amazon.com
gift card
$50


CINÉMATOGRAPHE
LUMIÈRE

DNA as Storage

DNA Storage

> Mikhail Neiman credited with idea of DNA storage, 1964-65

1. DNA storage works today, uses artificial DNA
2. Higher density that hard drive storage
3. 200+ PB per gram of DNA
4. Can re-use today's error correction methods
5. Cost will decrease with DNA technology advances

Previous slide per Columbia University & the New York Genome Center, 2017

DNA Storage Limitations

1. Slow access rate. DNA must be sequenced first to read
2. Currently expensive. Thousands $ to synthesize, read
3. Currently needs special storage environment

Conclusion:

5 - 10 years away from first application of (very) long-term storage use.

Now what?

canarie

canarie.ca | @canarie_inc

mark.wolff@canarie.ca