What's All the Fuss About Randomness?

April 15, 2021


BUTKER
7
KELCE
87
HITCHENS
59
74
89
00:00
812
00:00
CAMERA
302
101
20

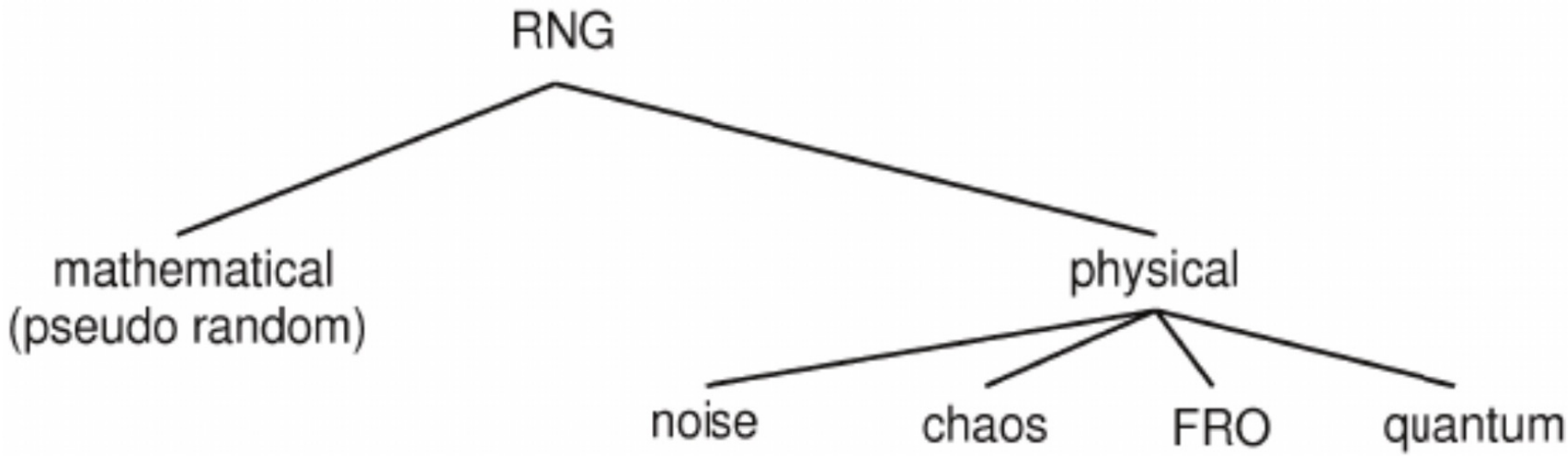
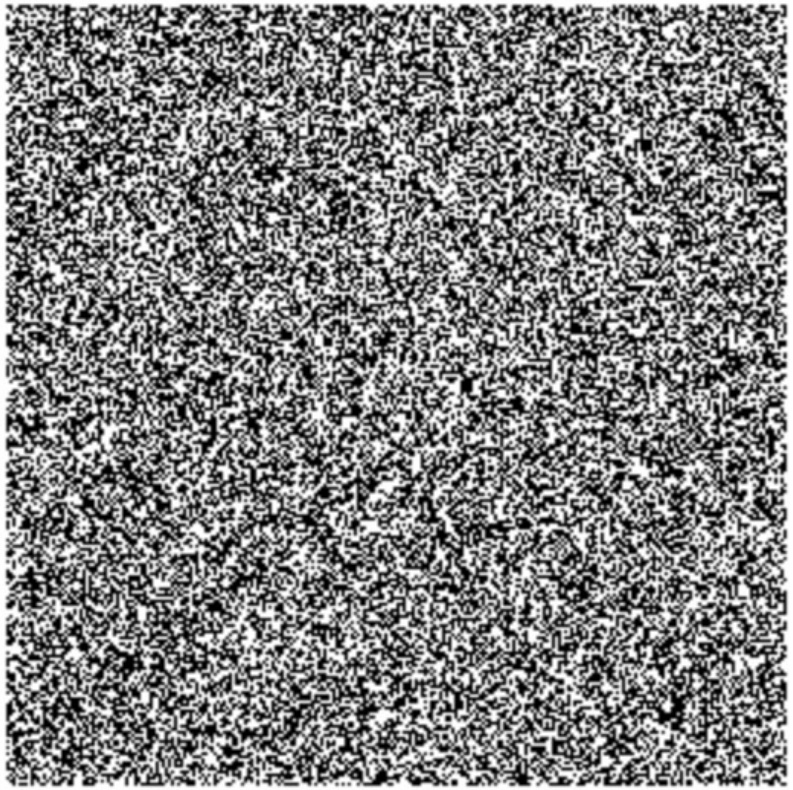
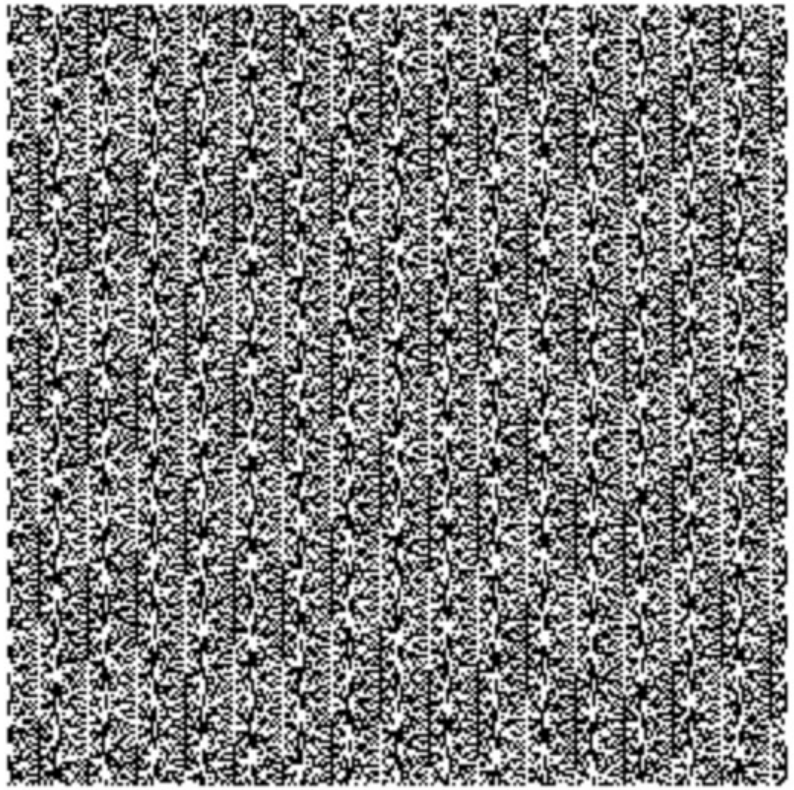


Figure 1: Classification of random number generators.

Visualization of Entropy



RANDOM.ORG



PHP rand() on Microsoft Windows

TRNG

-Uses an unpredictable physical means to generate numbers(like atmospheric noise)

VS

PRNG

- Uses methematical and deterministic algorithms(completely computer-generated)

“Nein Nines”

Matt Blaze's

EXHAUSTIVE SEARCH

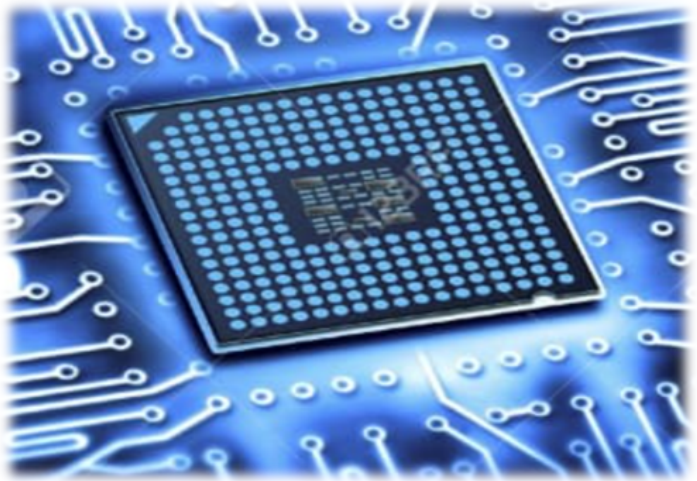
Science, Security, Curiosity

A Cryptologic Mystery

Did a broken random number generator in Cuba help expose a Russian espionage network?

Random Number Evolution

Classic Computer Mathematical Entropy



Centralized Bio-Mechanical Entropy using Lavarand at ***Cloudflare***

Centralized / Decentralized Bio-mechanical Entropy with visual analog source

Scientists Across the Globe Are Hunting for Pure Randomness

By Michael Dhar October 06, 2018

True Random Numbers Since 1998!

Home Games Numbers Lists & More Drawings Web Tools Statistics Testimonials Learn More Login

RANDOM.ORG

Search RANDOM.ORG [ ] Search

True Random Number Service

What's this fuss about *true* randomness?

Perhaps you have wondered how predictable machines like computers can generate randomness. In reality, most random numbers used in computer programs are *pseudo-random*, which means they are generated in a predictable fashion using a mathematical formula. This is fine for many purposes, but it may not be random in the way you expect if you're used to dice rolls and lottery drawings.

RANDOM.ORG offers *true* random numbers to anyone on the Internet. The randomness comes from atmospheric noise, which for many purposes is better than the pseudo-random number algorithms typically used in computer programs. People use RANDOM.ORG for holding drawings, lotteries and sweepstakes, to drive online games, for scientific applications and for art and music. The service has existed since 1998 and was built by Dr Mads Haahr of the School of Computer Science and Statistics at Trinity College, Dublin in Ireland. Today, RANDOM.ORG is operated by Randomness and Integrity Services Ltd.

True Random Number Generator

Min: 1

Max: 100

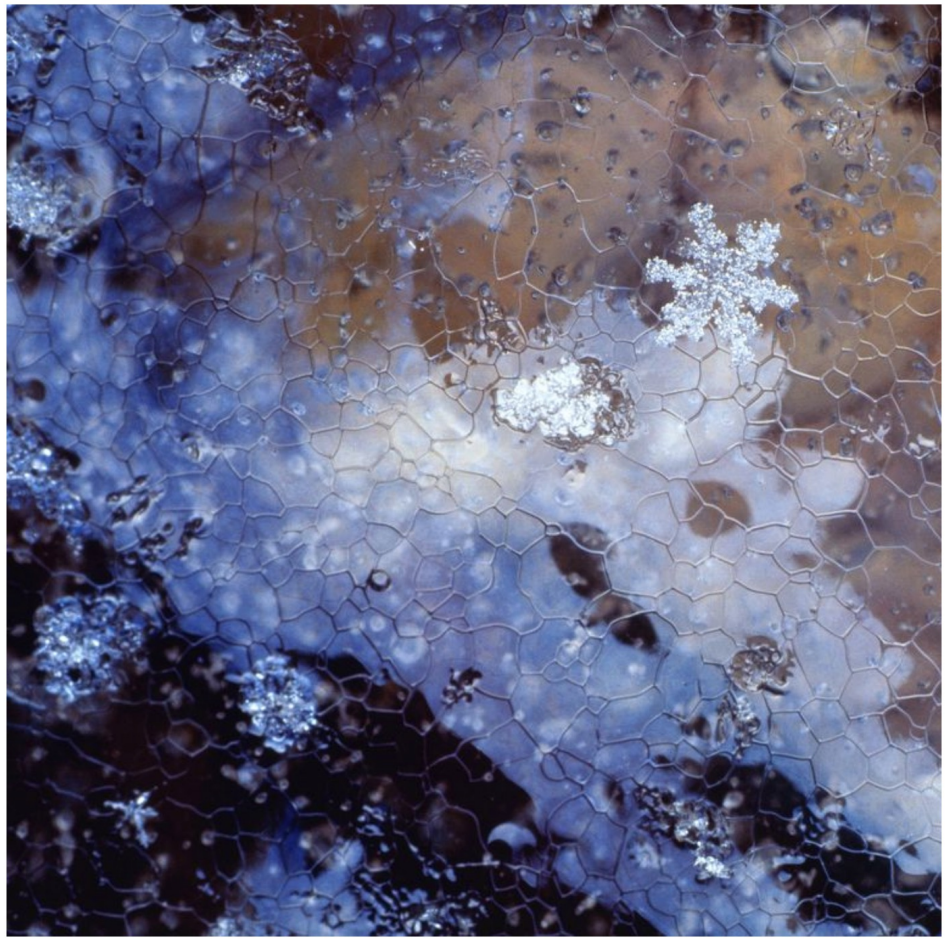
Generate

Result:

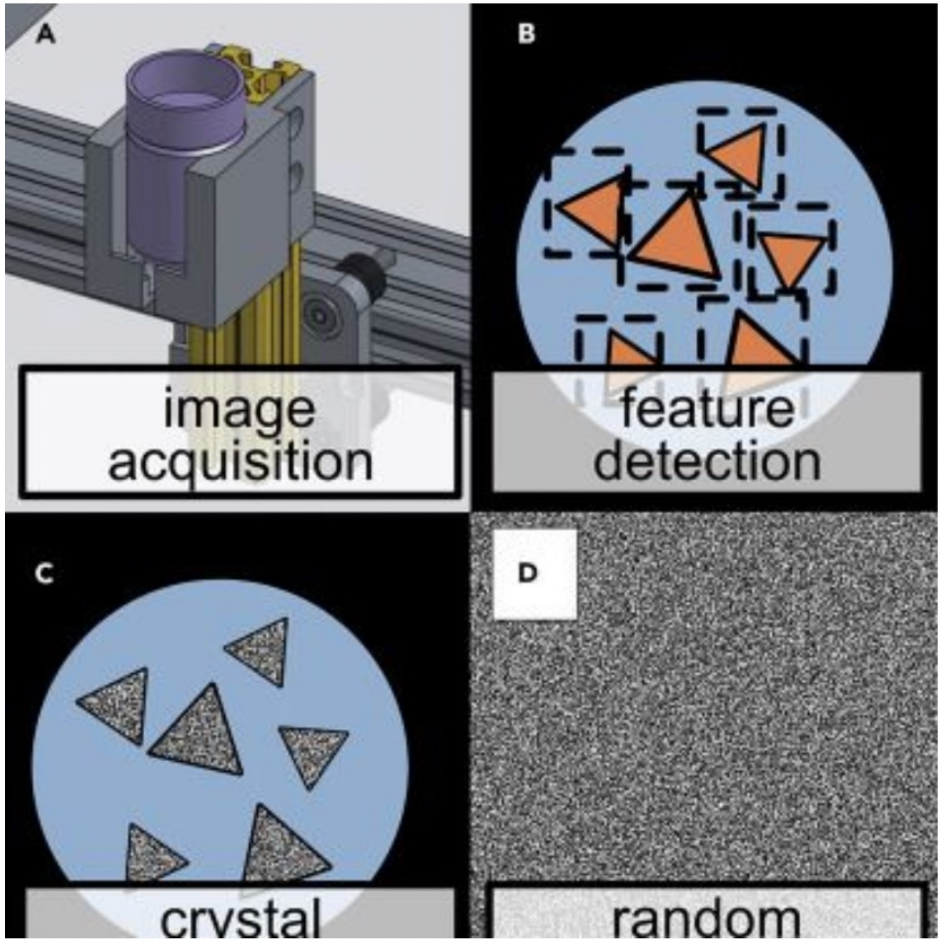
Powered by RANDOM.ORG

Mad Scientists and Crystal Formations

Computers, Meet Entropy

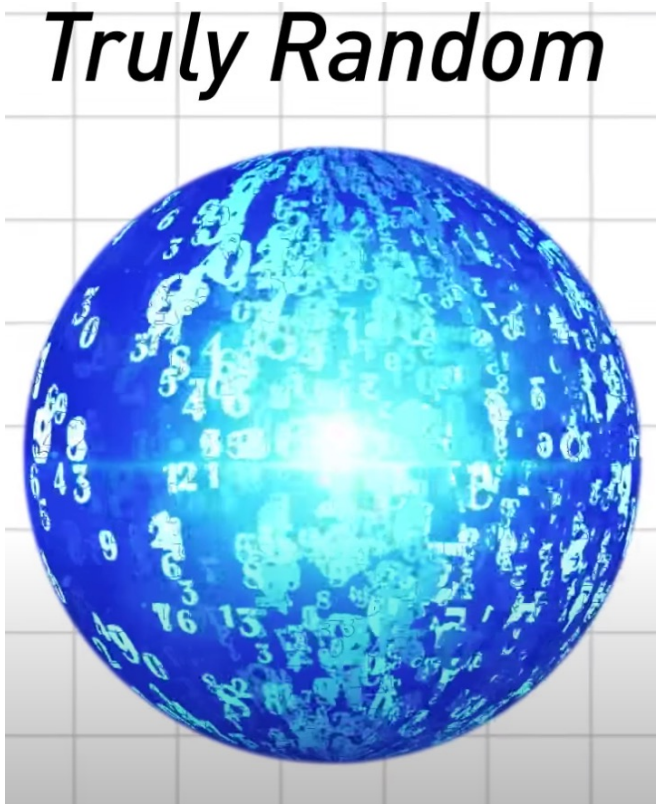


Automated Randomness



UNIVERSITY OF GLASGOW

Environmental Randomness

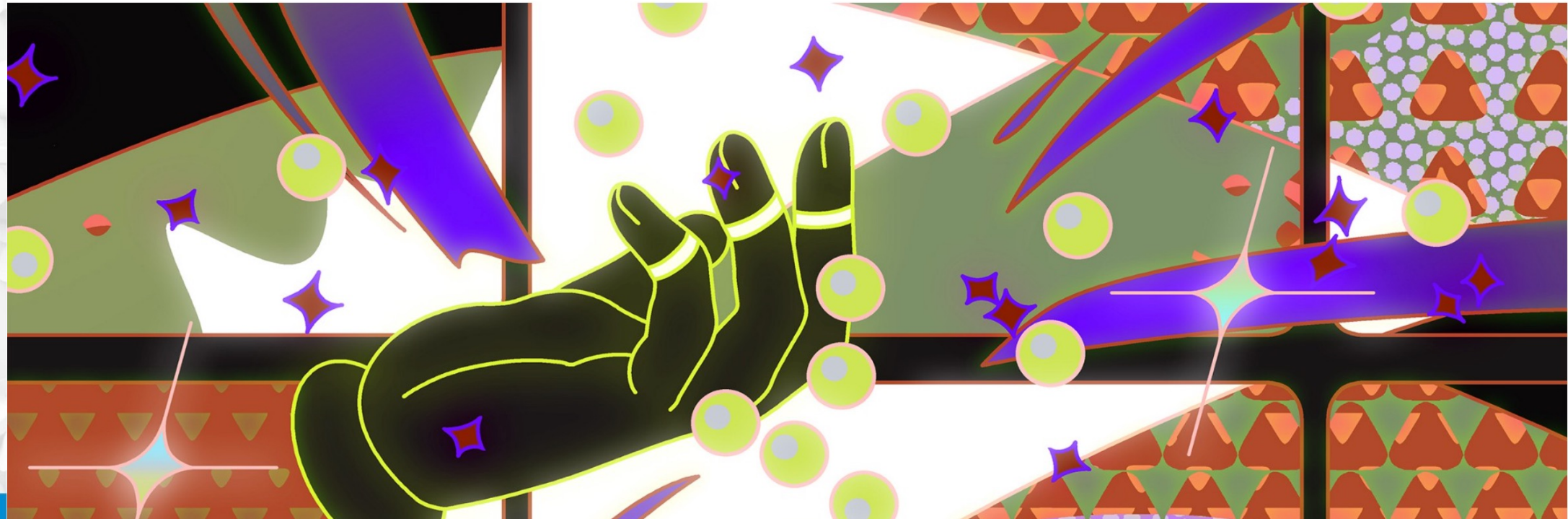


Random Resources

The League of Entropy Is Making Randomness Truly Random

Creating reliably random numbers isn't as easy as you think, but a new alliance of organizations and individuals is decentralizing randomness for more equitable and trustworthy applications

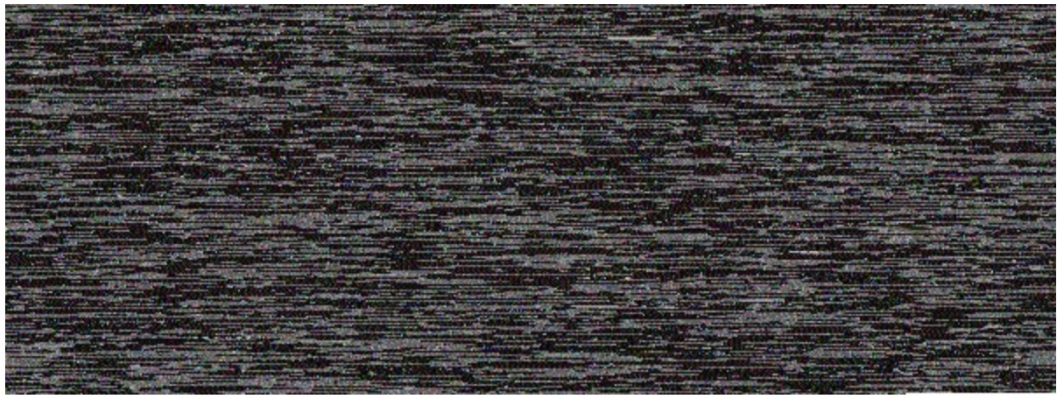
Rina Diane Caballar Aug 7, 2019 · 7 min read ★



Random Tweets?

Getting random Tweets

Twitter allows anyone to retrieve a small **random** sample of all public statuses being published in **real-time** using the *GET statuses/sample API*.



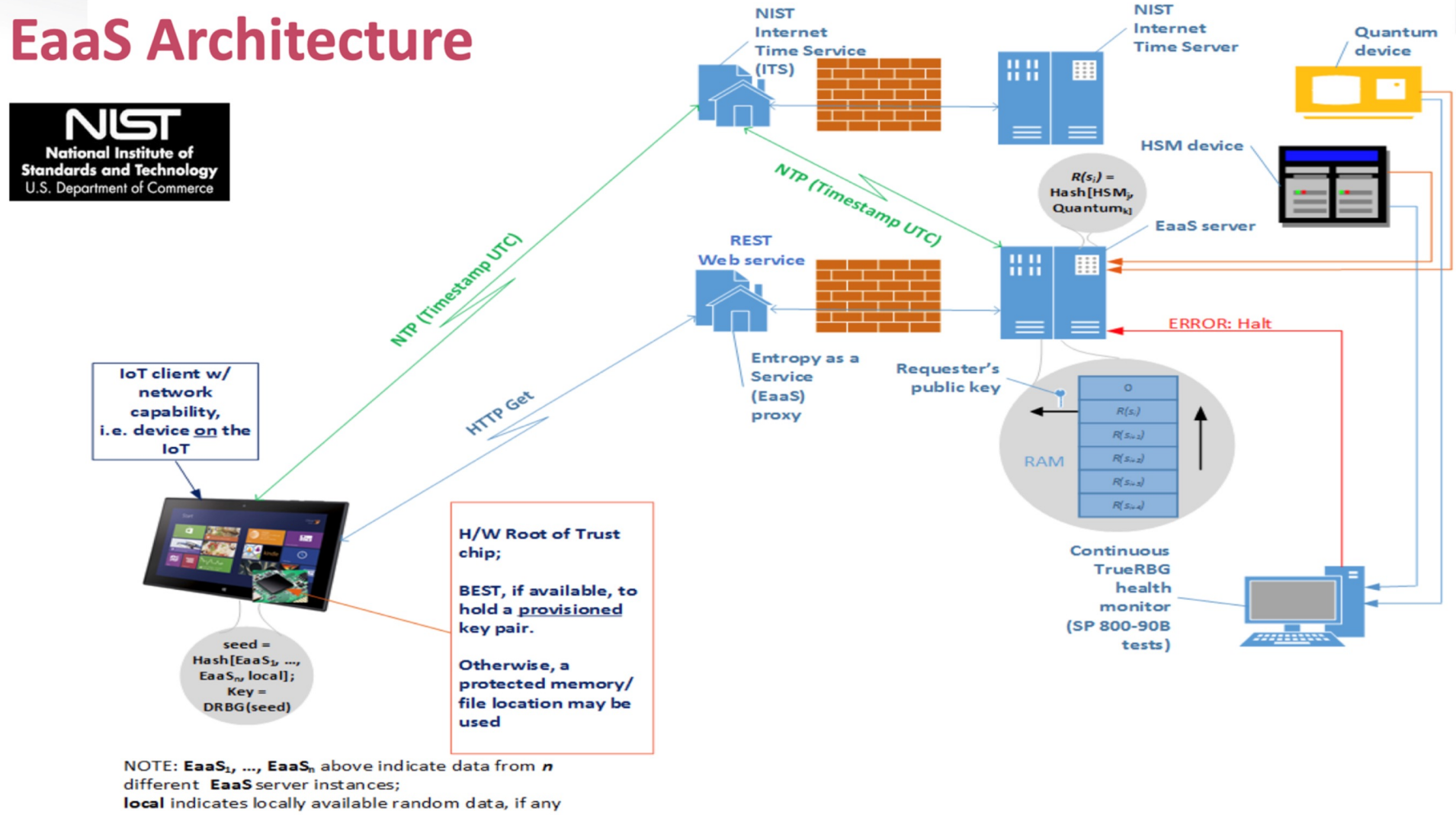
Twitter noise (concatenated UTF-8 encoded tweets)

Sampling 500KB of raw tweet data, entropy is around 6.5519 bits per byte (true random would reach 8) and the arithmetic mean value is 135.65 (random would be around 127.5). This is not perfect random but we're getting there!

⚠️ **The purpose of this article is to illustrate a joke & recreational RNG. Not something to be taken seriously.**

***tl;dr*: Do not use this for sensitive cryptographic operations.**

EaaS Architecture



NOTE: **EaaS$_1$, …, EaaS$_n$** above indicate data from ***n*** different **EaaS** server instances;
local indicates locally available random data, if any

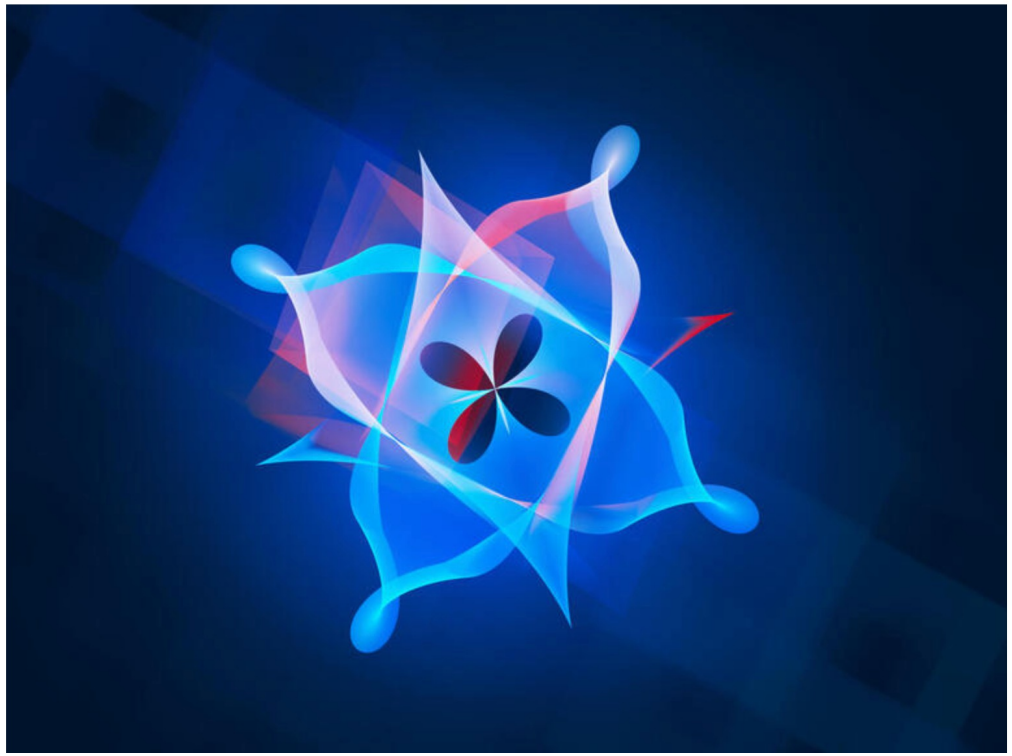
A. Vassilev and R. Staples. "Entropy-as-a-Service: Unlocking the Full Potential of Cryptography". *IEEE Computer*. September 2016.

Random Collaborations

IBM and Cambridge Quantum Computing announce random number generator service

by **Veronica Combs** in **Cloud**
on September 17, 2020, 10:01 AM PST

This cloud-based quantum computing service includes verification and is now available to members of the IBM Q Network.



Random Numbers in Your Pocket!

Latest News

LATEST NEWS PRESS RELEASES

ID Quantique and SK Telecom announce the world's first 5G smartphone equipped with a Quantum Random Number Generator (QRNG) chipset

ID Quantique announces that its newest Quantum Random Number Generator (QRNG) chip has been integrated in the new 5G smartphone 'Galaxy A Quantum'.

DISCOVER MORE

Investing in Randomness

Institute for Quantum Computing

IQC is a scientific research institute harnessing the quantum laws of nature to develop powerful new technologies.

Australian National University

DEPARTMENT OF QUANTUM SCIENCE
Research School of Physics
ANU College of Science

TRNG can Improve PRNG!

The Problem of Weak Entropy

	Our TLS Scan		Our SSH Scans	
Number of live hosts	12,828,613	(100.00%)	10,216,363	(100.00%)
... using repeated keys	7,770,232	(60.50%)	6,642,222	(65.00%)
... using vulnerable repeated keys	714,243	(5.57%)	981,166	(9.60%)
... using default certificates or default keys	670,391	(5.23%)		
... using low-entropy repeated keys	43,852	(0.34%)		
... using RSA keys we could factor	64,081	(0.50%)	2,459	(0.03%)
... using DSA keys we could compromise			105,728	(1.03%)
... using Debian weak keys	4,147	(0.03%)	53,141	(0.52%)
... using 512-bit RSA keys	123,038	(0.96%)	8,459	(0.08%)
... identified as a vulnerable device model	985,031	(7.68%)	1,070,522	(10.48%)
... model using low-entropy repeated keys	314,640	(2.45%)		

Improving Encryption with True Randomness

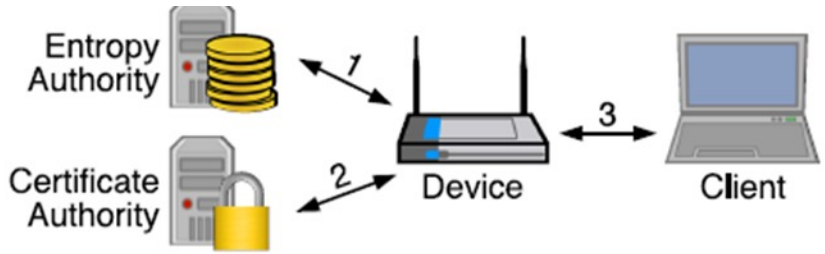
Ensuring High-Quality Randomness in Cryptographic Key Generation

Henry Corrigan-Gibbs*
Stanford University
henrycg@stanford.edu

Wendy Mu
Stanford University
wmu@cs.stanford.edu

Dan Boneh
Stanford University
dabo@cs.stanford.edu

Bryan Ford
Yale University
bryan.ford@yale.edu



A man had a dream…


The United States of America

The Director of the United States Patent and Trademark Office

Has received an application for a patent for a new and useful invention. The title and description of the invention are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the invention shall be granted under the law.

Therefore, this

United States Patent

Grants to the person(s) having title to this patent the right to exclude others from making, using, offering for sale, or selling the invention throughout the United States of America or importing the invention into the United States of America for the term set forth below, subject to the payment of maintenance fees as provided by law.

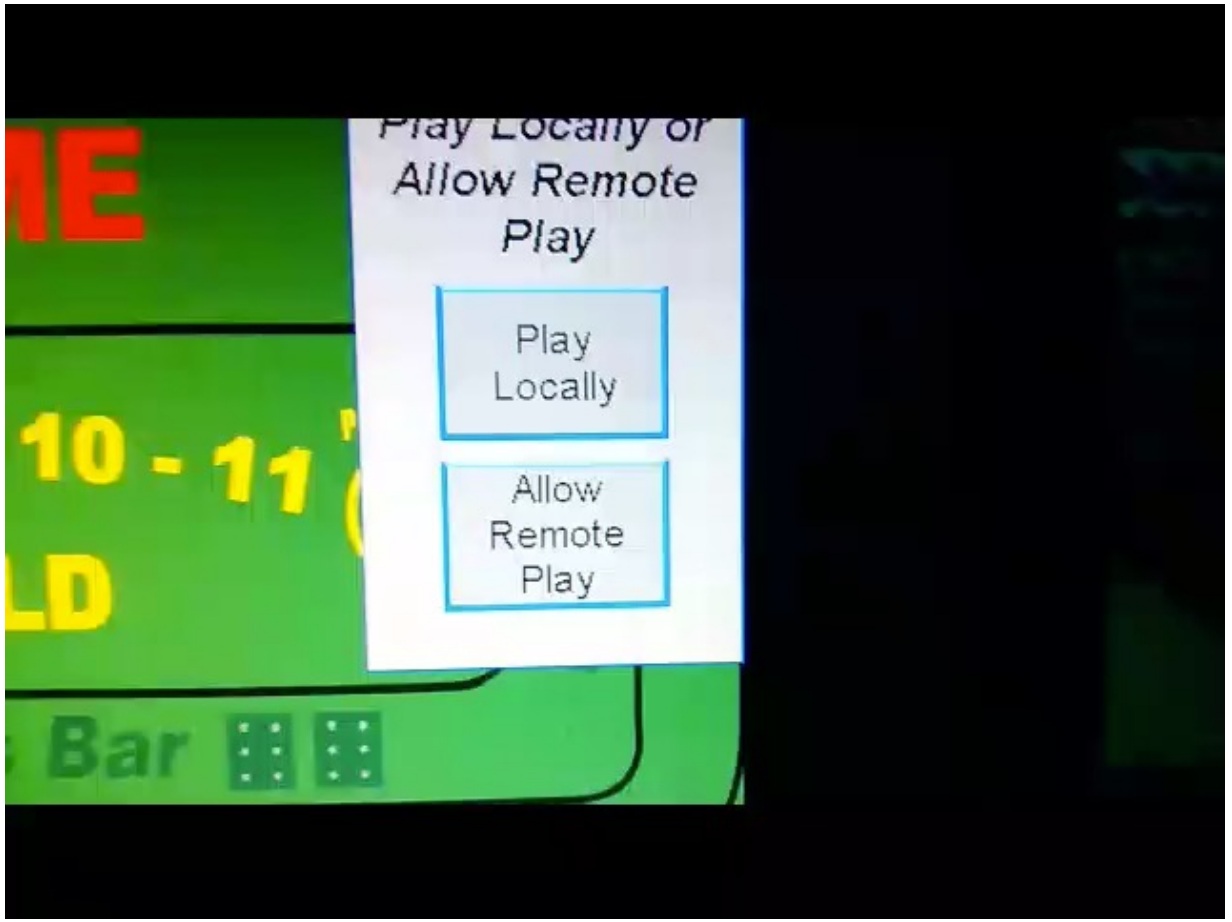
If this application was filed prior to June 8, 1995, the term of this patent is the longer of seventeen years from the date of grant of this patent or twenty years from the earliest effective U.S. filing date of the application, subject to any statutory extension.

If this application was filed on or after June 8, 1995, the term of this patent is twenty years from the U.S. filing date, subject to any statutory extension. If the application contains a specific reference to an earlier filed application or applications under 35 U.S.C. 120, 121 or 365(c), the term of the patent is twenty years from the date on which the earliest application was filed, subject to any statutory extensions.

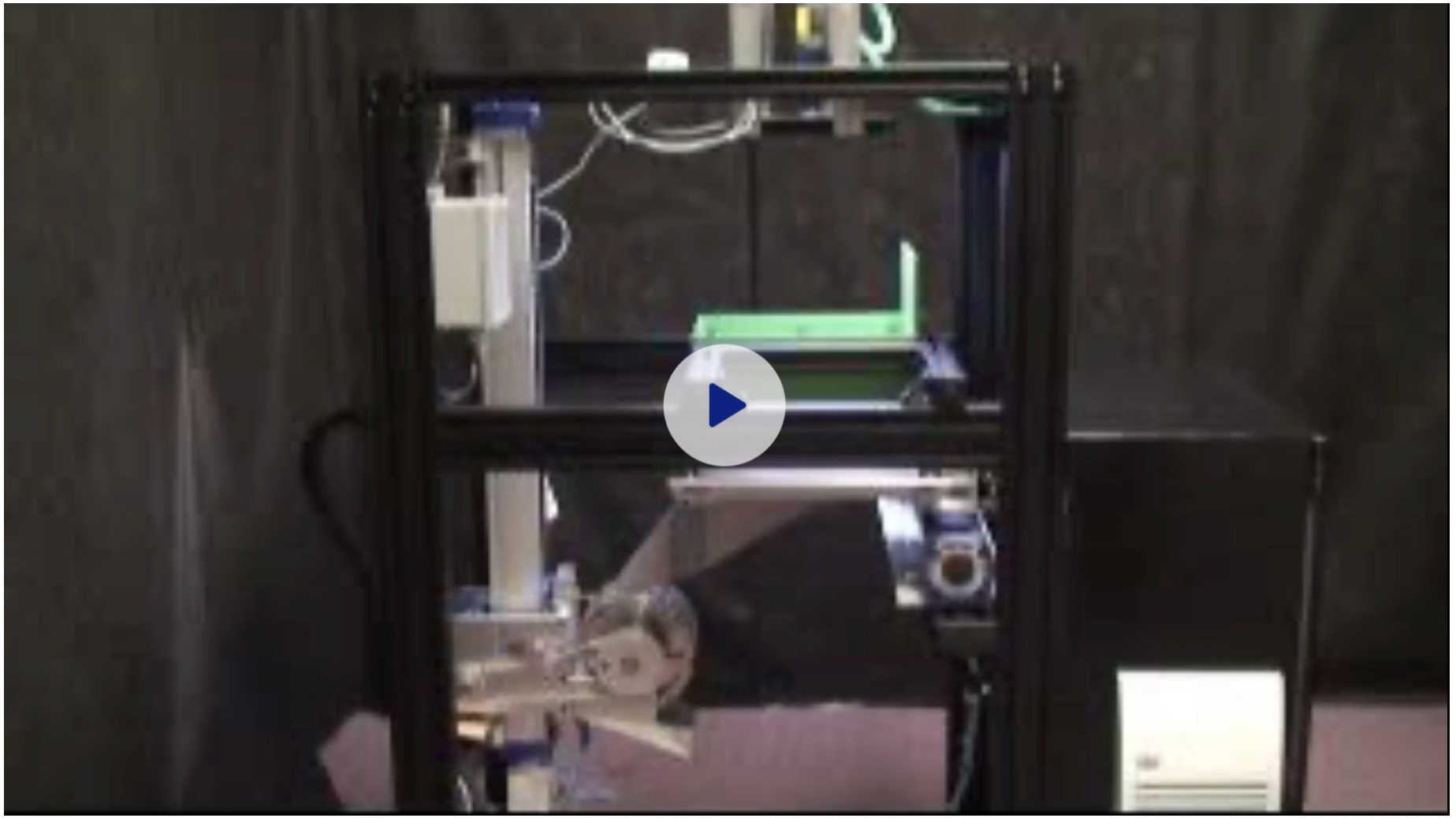
Director of the United States Patent and Trademark Office

Attest

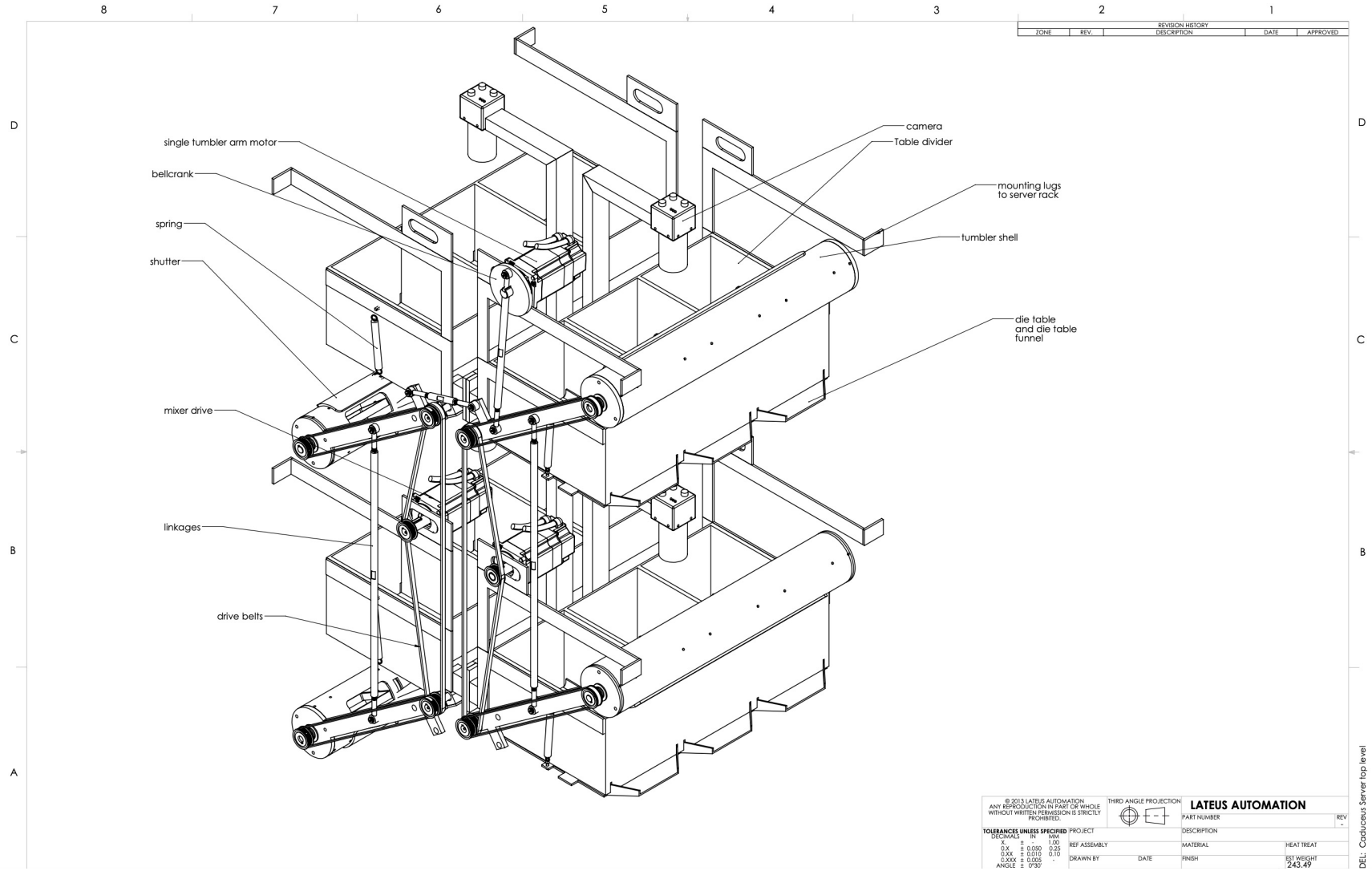
iPhone & the DiceMaster



Athena the Dice Robot...



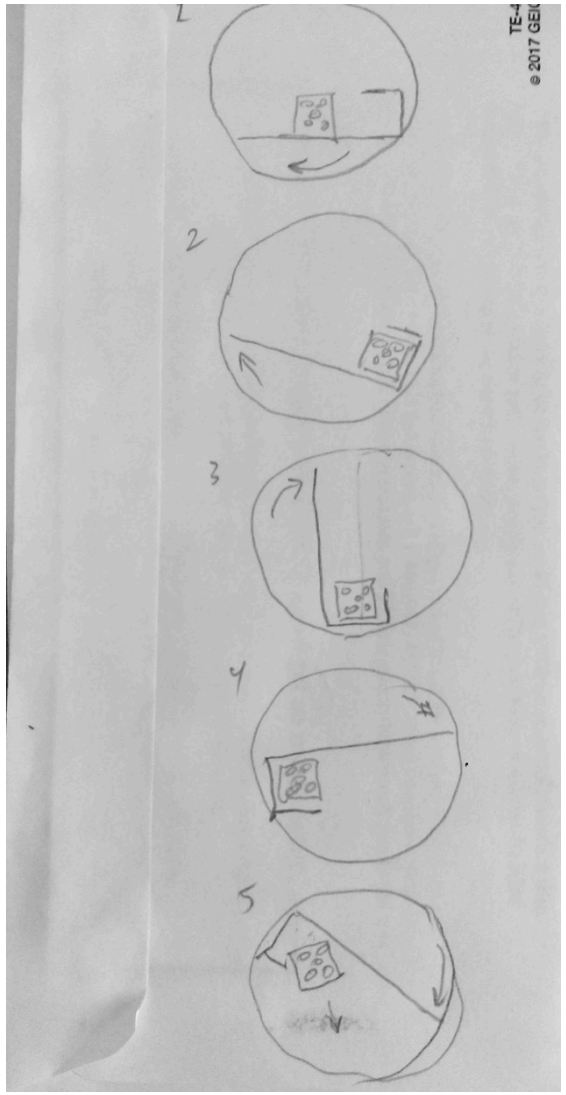
Caduceus Concept of Chaos...



Stinger Lego Mindstorms

Stinger II Server Model

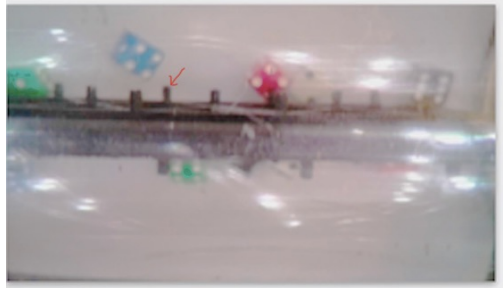
If At First You Fail, Keep Rolling…



2228469.jpg

2228538.jpg

Blue die hits bottom-row peg (red arrow).

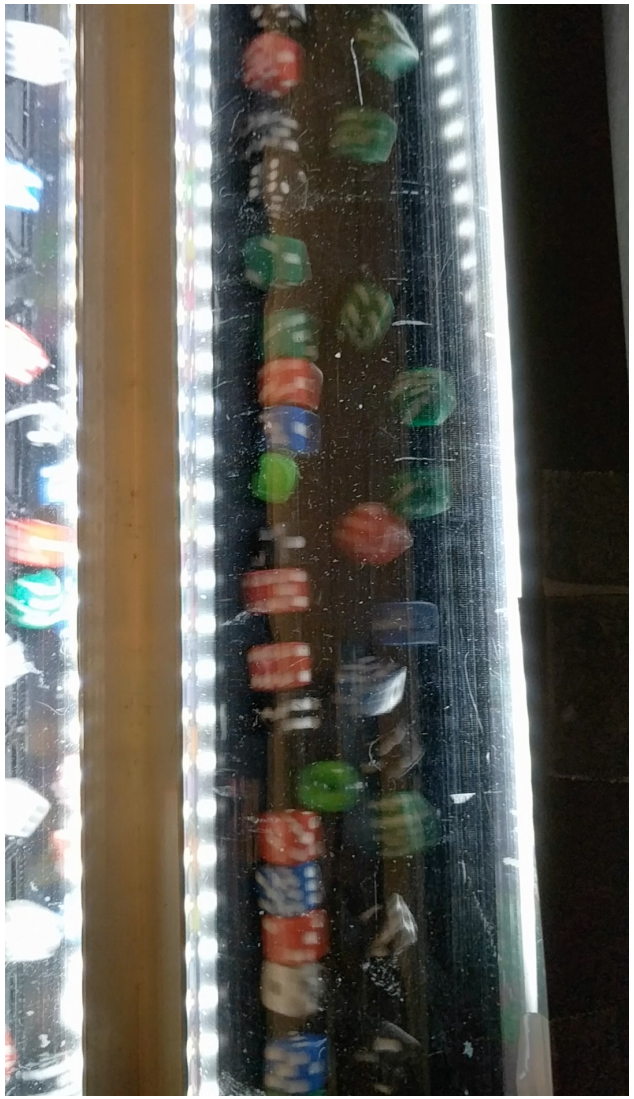


2347429.jpg

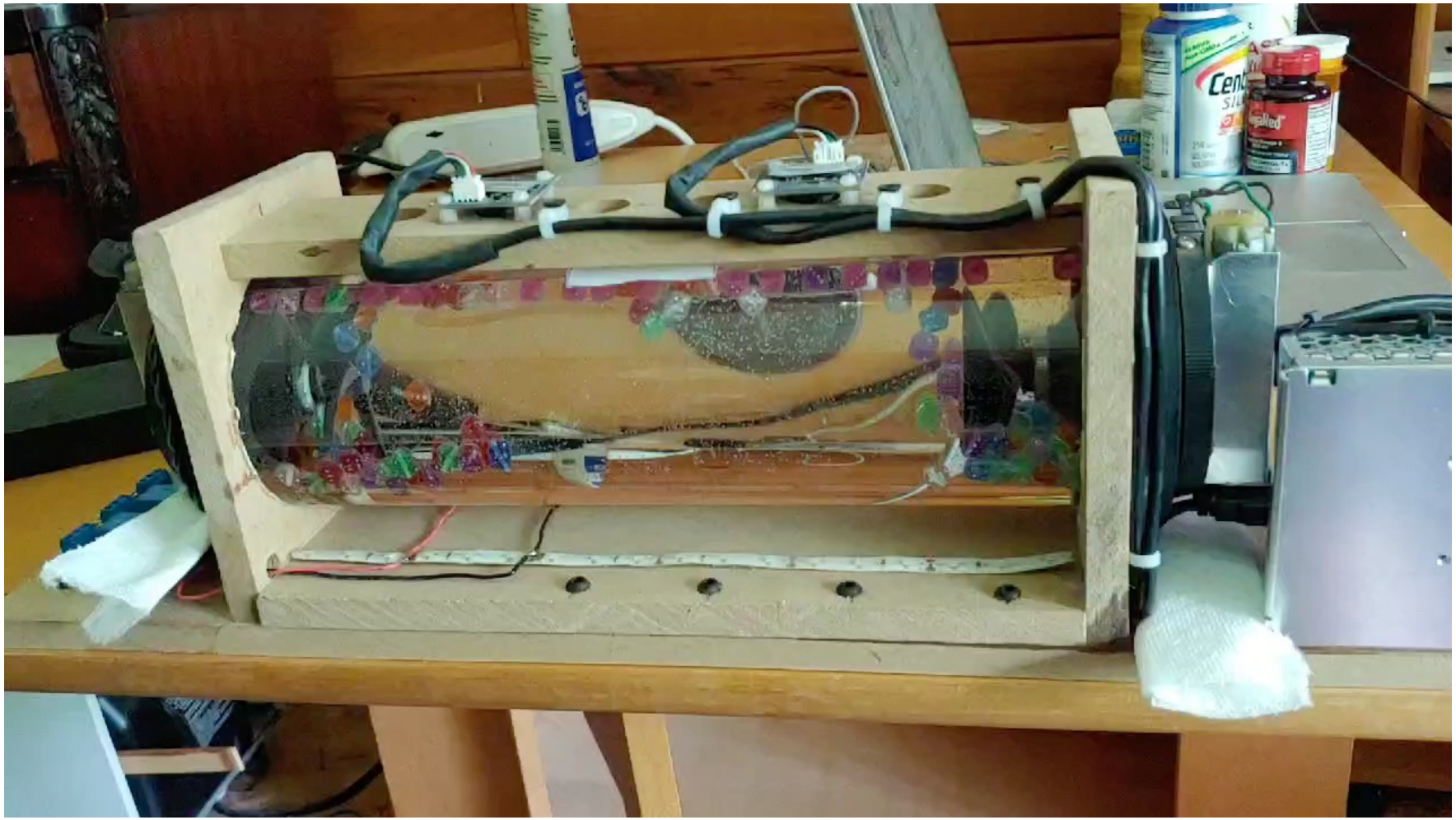
2347497.jpg

Black die bounces right off low peg (arrow)_

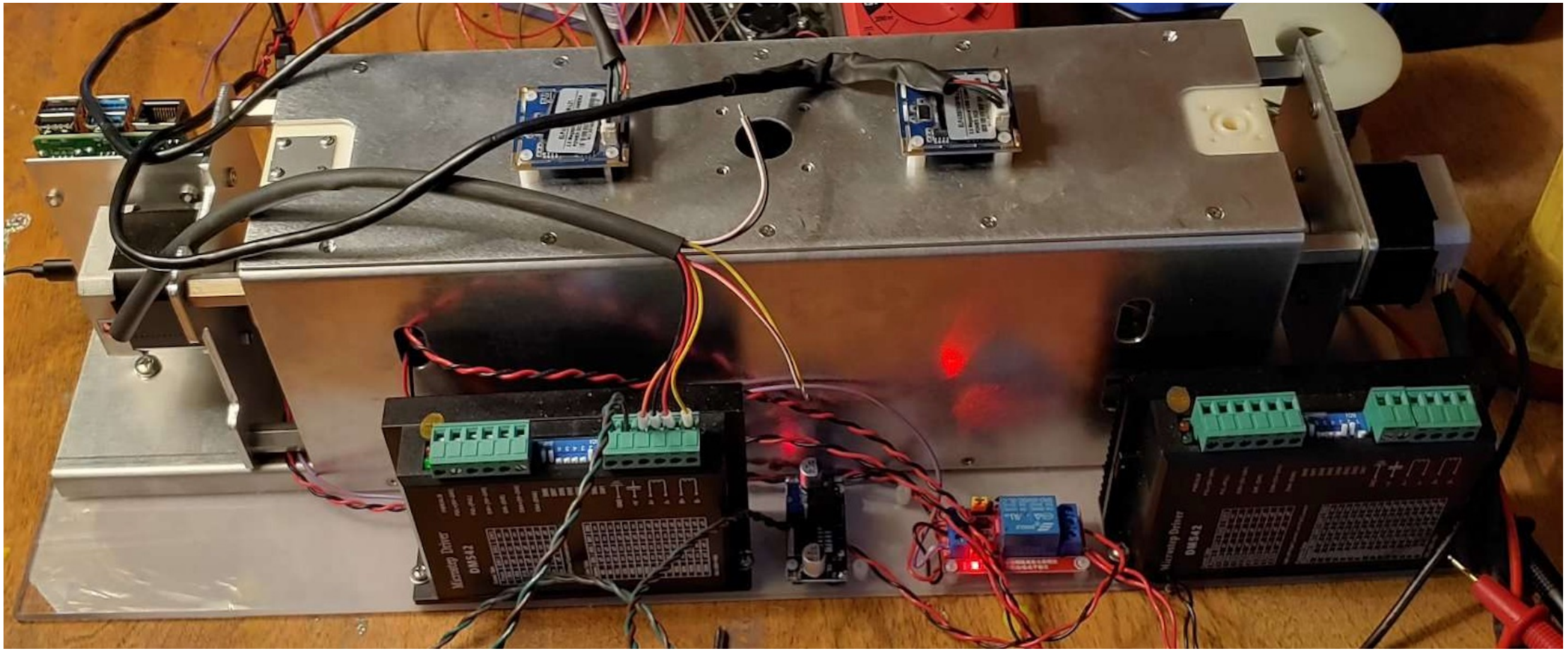
2347568.jpg



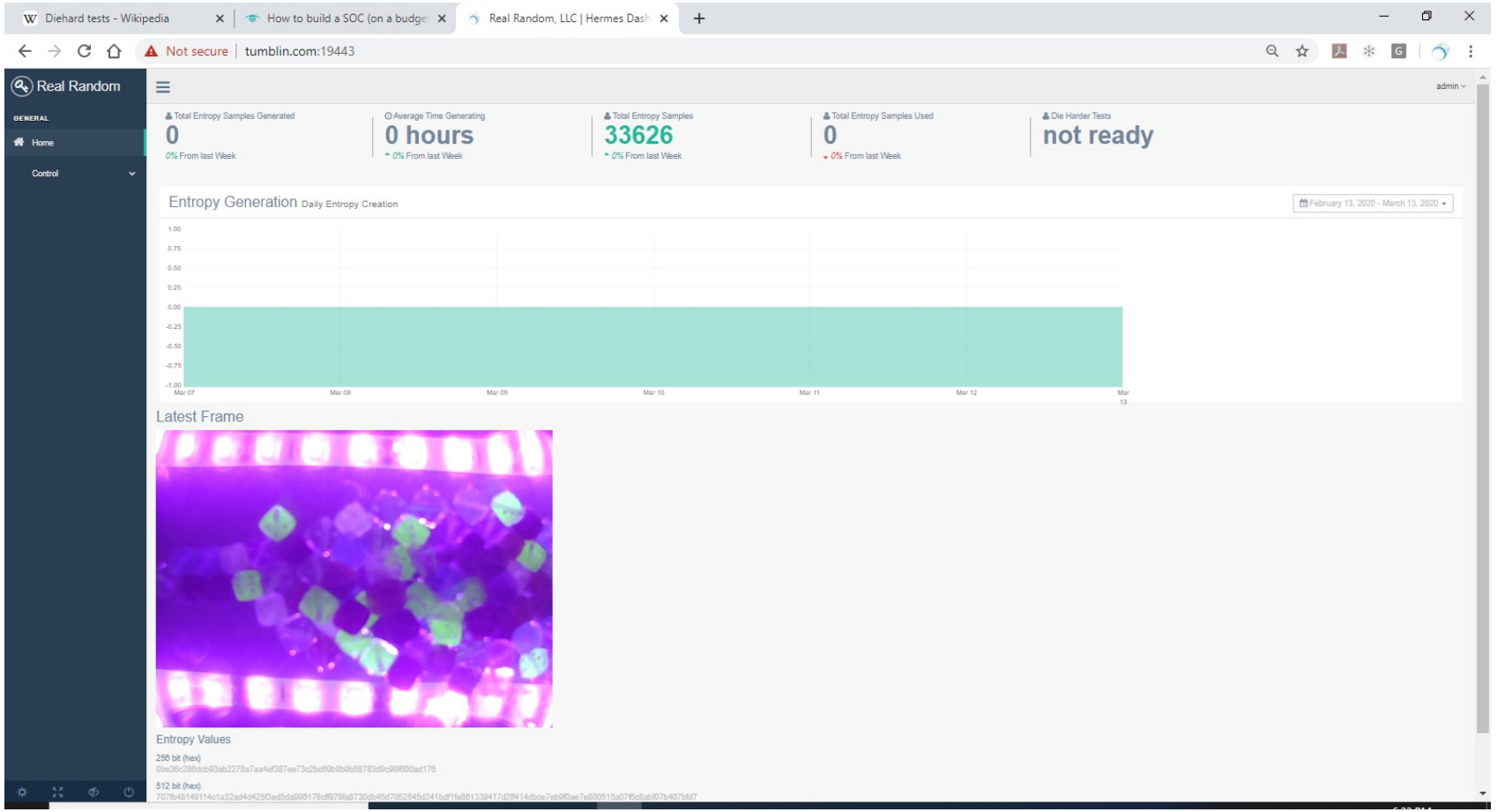
Hermes Prototype Bench Model



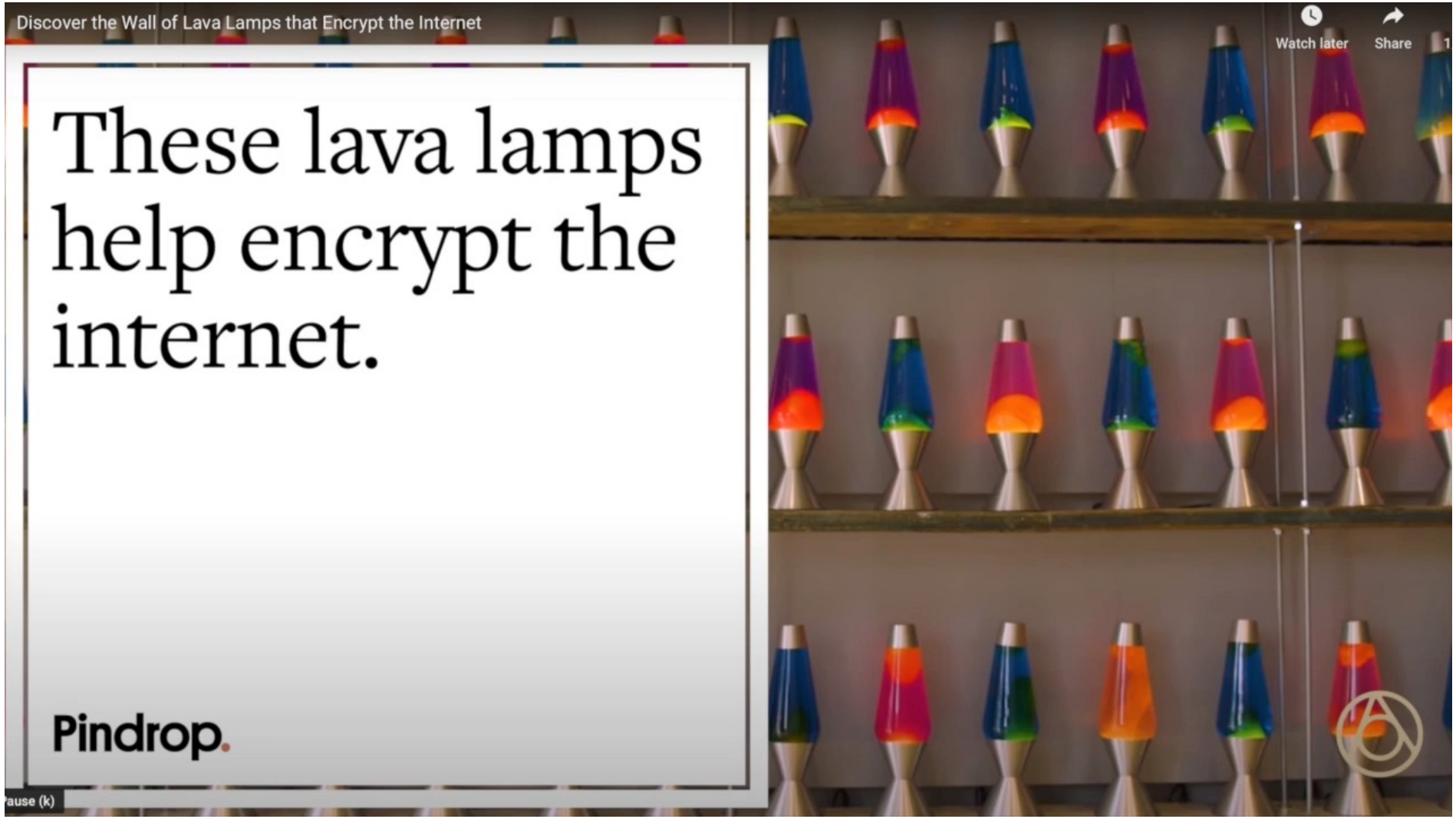
Patent Pending Hardware RNG



Remote Access Dashboard



Cloudflare but Scalable



Utility Patent Filed March 2020

ELECTROMECHANICAL APPARATUS, SYSTEM, AND METHOD FOR GENERATING TRUE RANDOM NUMBERS

TECHNICAL DATA FIELD

[0001] This application relates generally to random number generators, including but not limited to generating true random numbers using an electromechanical apparatus, for cryptographic applications.

Utility Patent Filing April 2021

SYSTEM AND METHOD FOR SECURE END-TO-END ELECTRONIC COMMUNICATION USING A PRIVATELY SHARED TABLE OF ENTROPY

TECHNICAL DATA FIELD

[0001] This application relates generally to secure communication, including but not limited to secure communication using a privately shared table of entropy that includes true random numbers.

The Entropy Authority Solution