Migratory Trash Clouds

Low-cost Computing with Flying Garbage

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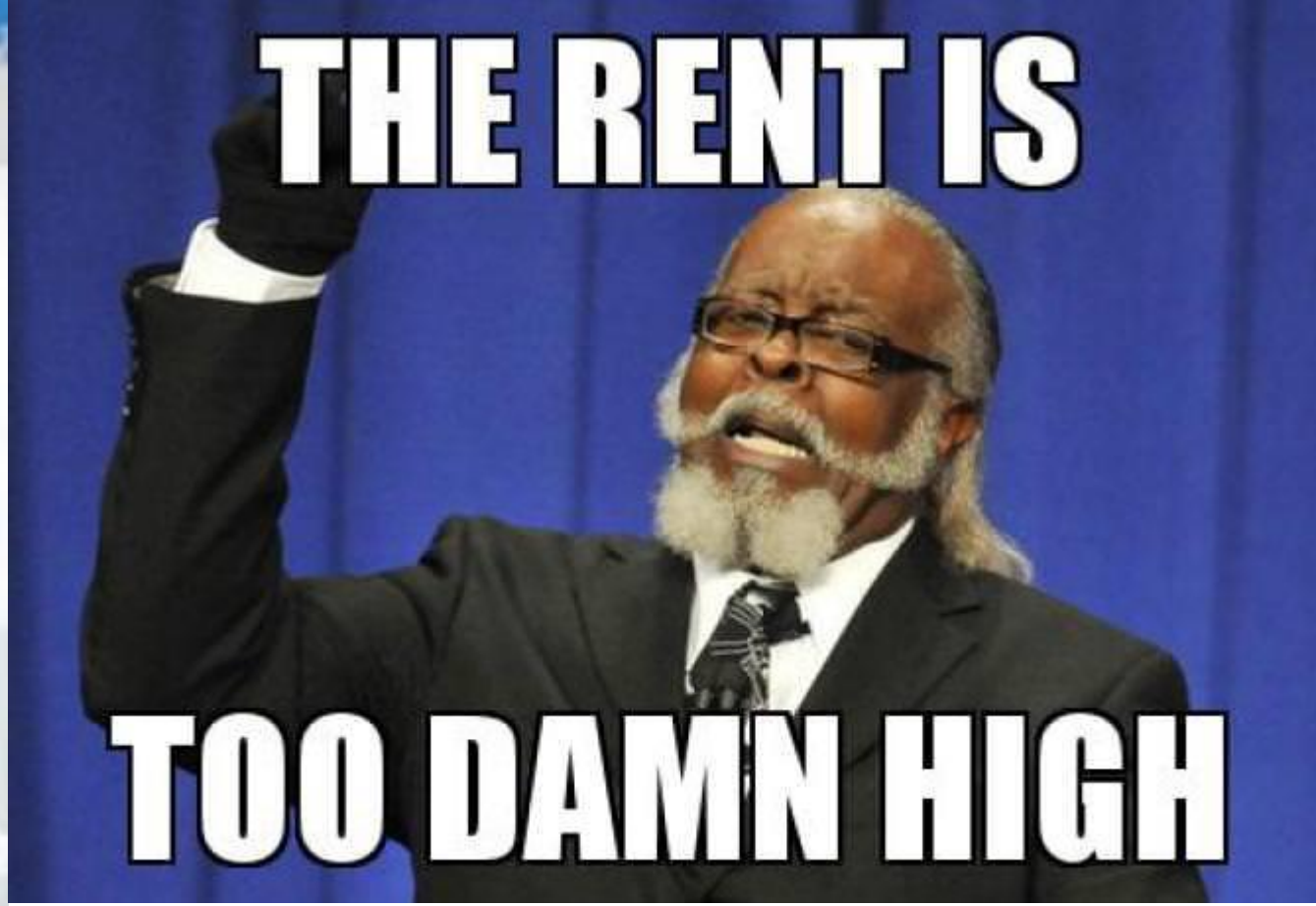
Shop for cost of GPUs

NVIDIA Tesla V100 GPU 16GB
HBM2 Volta CUDA PCIe for…
$8,495.00
Bibuni
Free shipping

Computers are expensive!

Cloud cycles are (often) cheaper

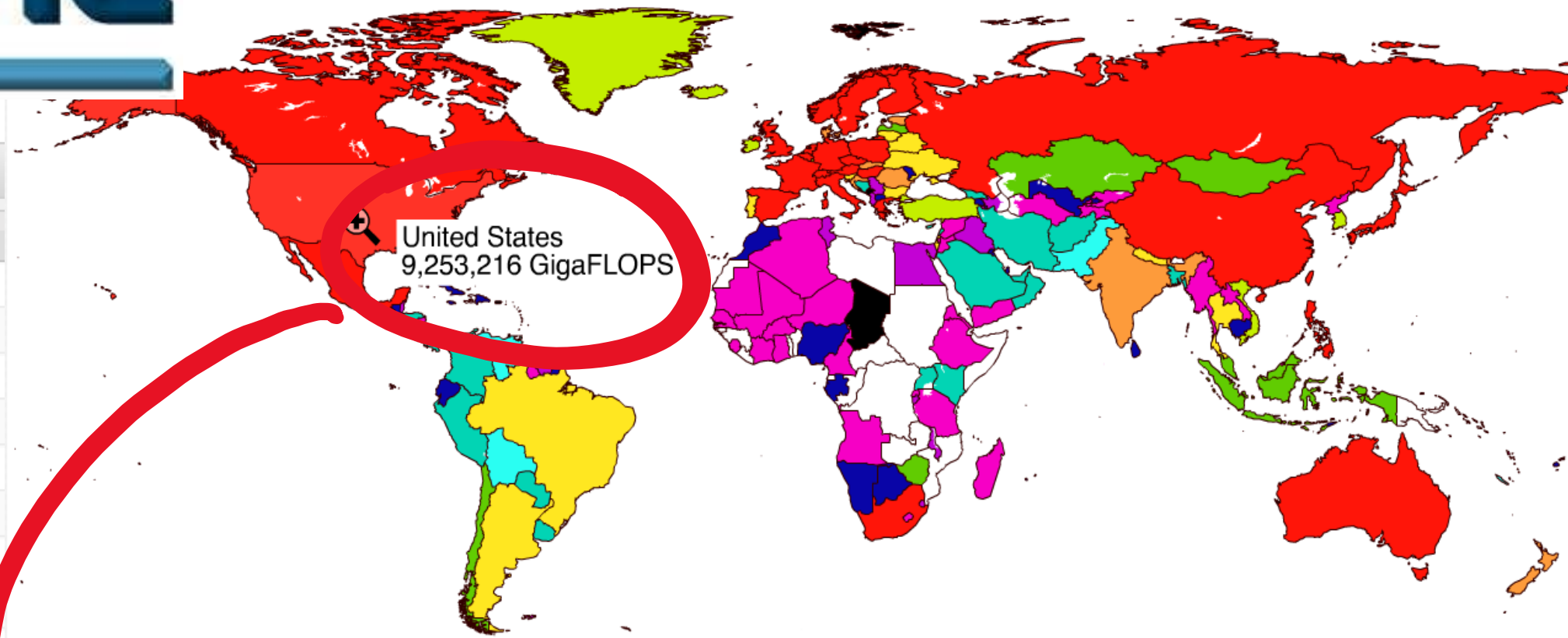


Break even @
~ 0.5 compute years

BOINC

Projects

Project	Users
SETI@Home	1725655
Rosetta@Home	1274950
World Community Grid	539805
Einstein@Home	461945
PrimeGrid	344704
CPDN@Home	299725
MilkyWay@Home	218711
MalariaControl Project	205925
SixTrack	160572
BBC Climate Change ...	120553
Asteroids@Home	115057
SIMAP	82875



9 PetaFLOPS!!!

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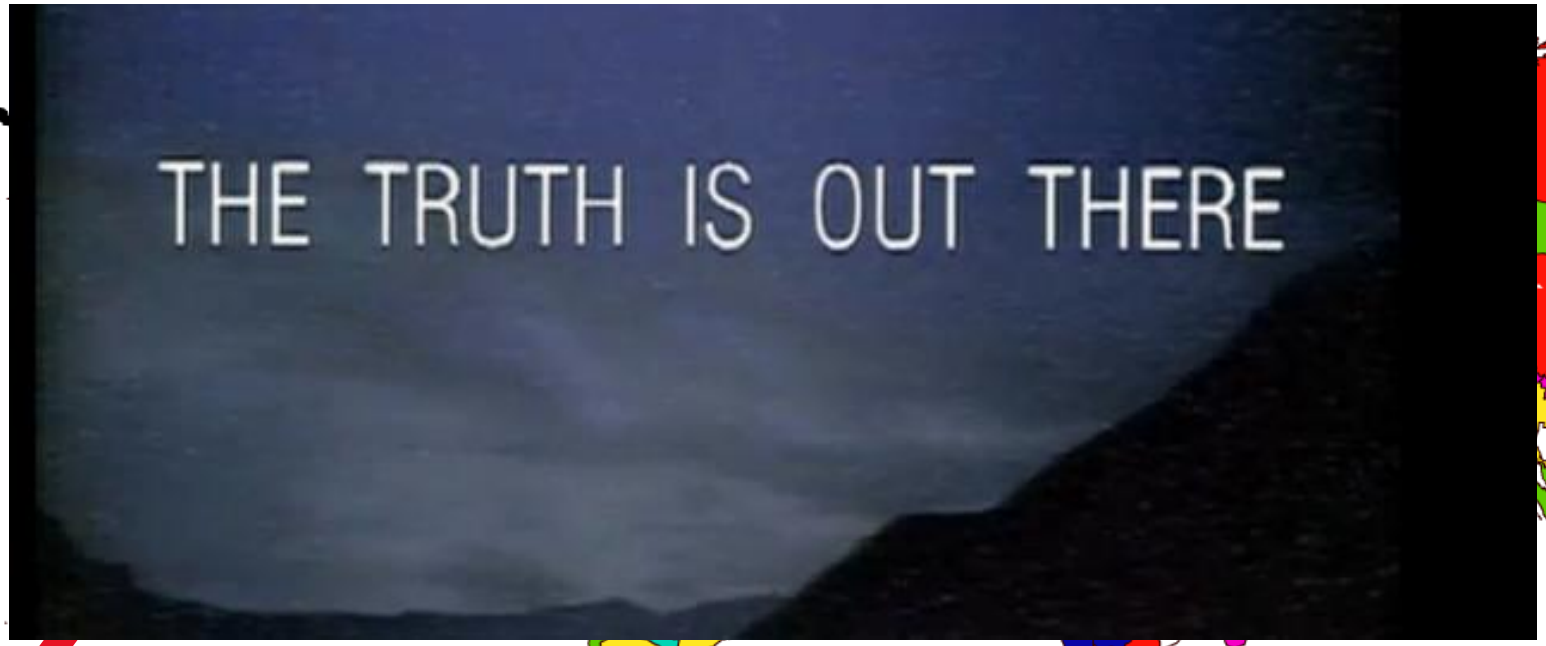
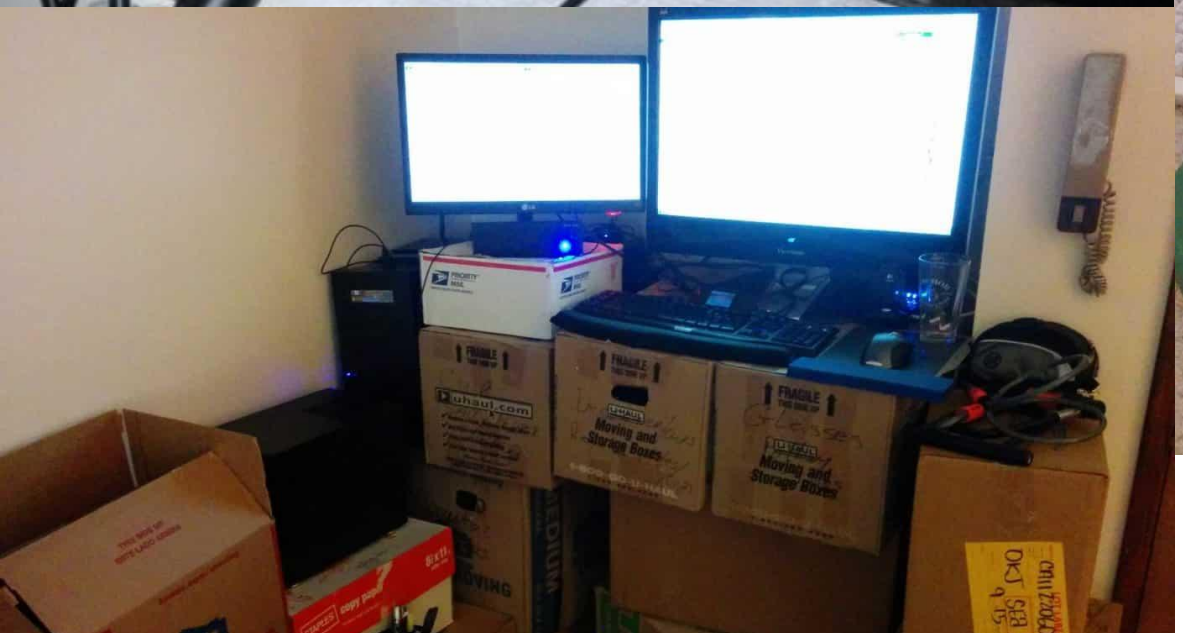


→ 9 PetaFLOPS!!!


FRAGILE
Moving and Storage Boxes

Volunteer tester

> I just did a power consumption calculation and found that running SETI@Home on
> my desktop computer 24/7 is costing me $50 - $75 per month. I use it for other
> tasks perhaps five hours per day. That's a lot more energy than I thought it
> would be using.

Opportunity:
Trash Clouds

WIRED

Apple Sold a Bonkers Number of iPhones Over the Holidays

But nobody expected sales quite as high as Apple achieved in its first fiscal quarter of 2015.

Apple sold a whopping 74.4 million iPhones over the 90 day period ending December 27th. On average, that translates to over 34,000 iPhones sold every hour, every day of the quarter. Analysts expected numbers around 65 million, and the previous record, 51 million iPhone sales in the first quarter of last year, seems paltry by comparison.

SHARE

SHARE

TWEET

"Junk" Phones

Galaxy S6

4 ARM Cortex A57 @ 2.1 GHz
4 ARM Cortex A53 @ 1.5 GHz
3GB RAM, 64GB Off-chip Flash
10 GFLOPS @ 2 Watts per phone

74.4M Phones = 740 PFLOPS of trash in Q4 alone!

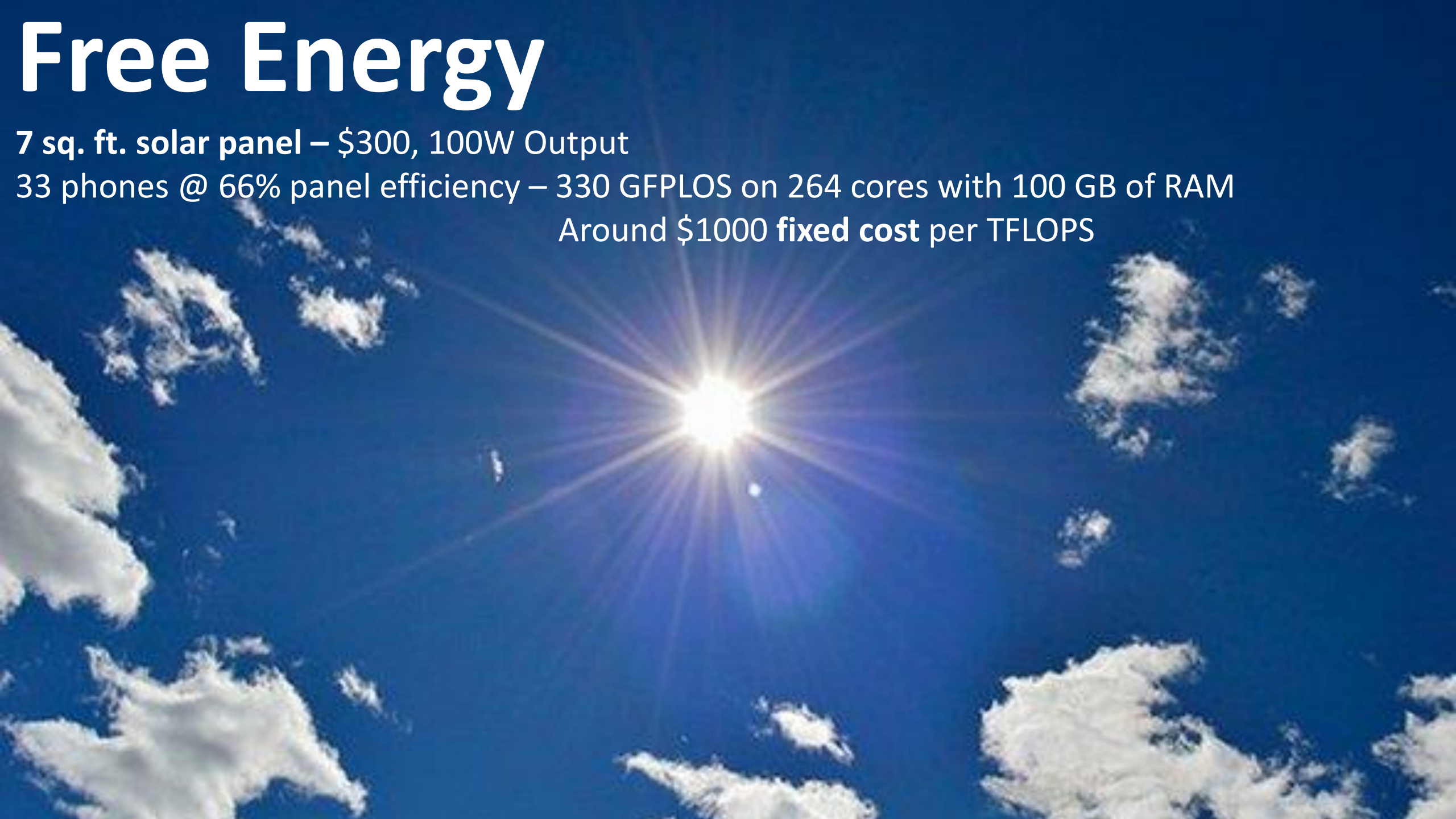
(as similarly observed by Shahrad et al, HotCloud '17)

Free Energy

7 sq. ft. solar panel – $300, 100W Output

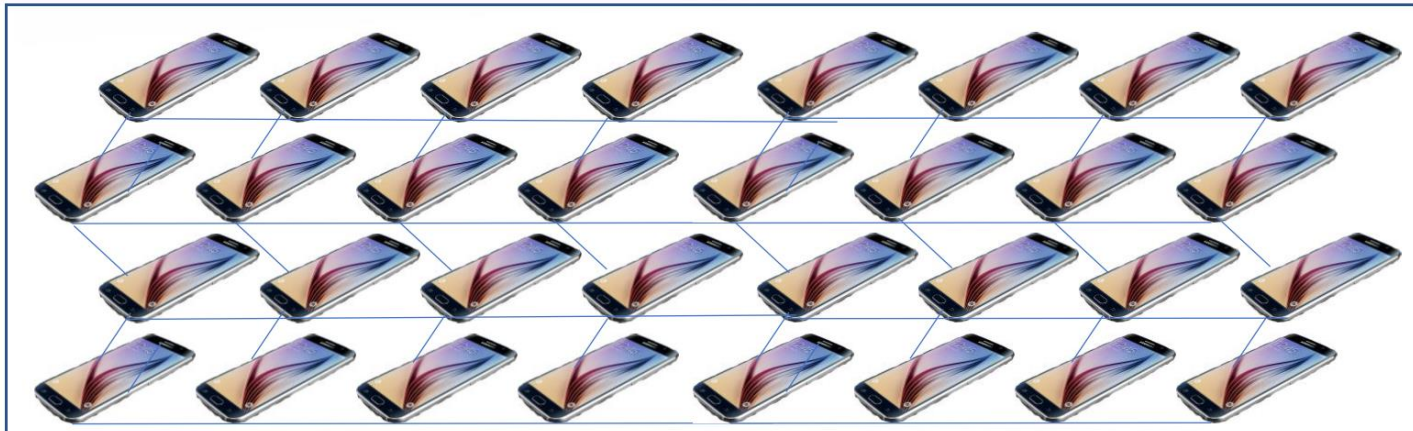
33 phones @ 66% panel efficiency – 330 GFPLOS on 264 cores with 100 GB of RAM

Around $1000 **fixed cost** per TFLOPS



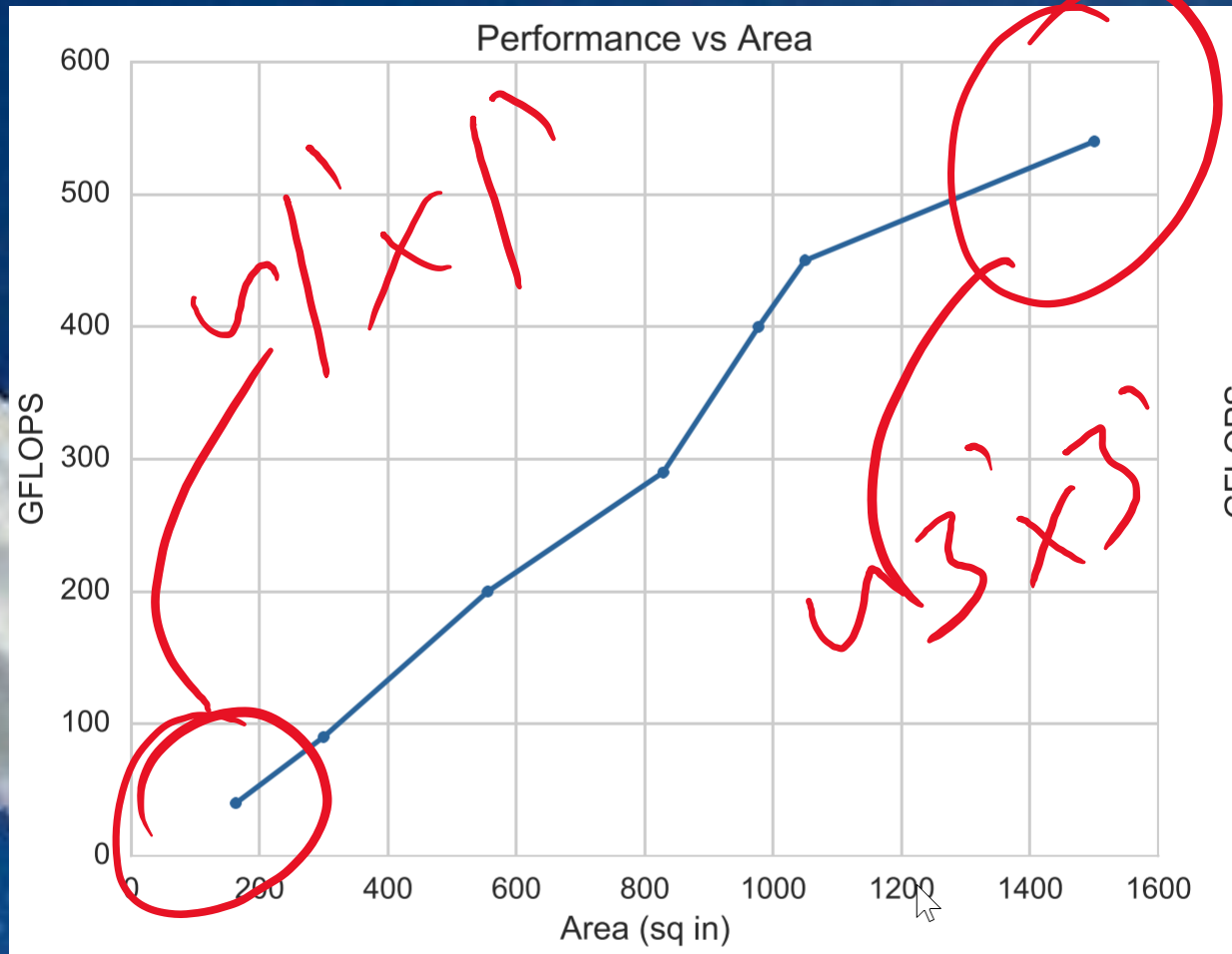
Energy Harvesting and Voltage Conversion

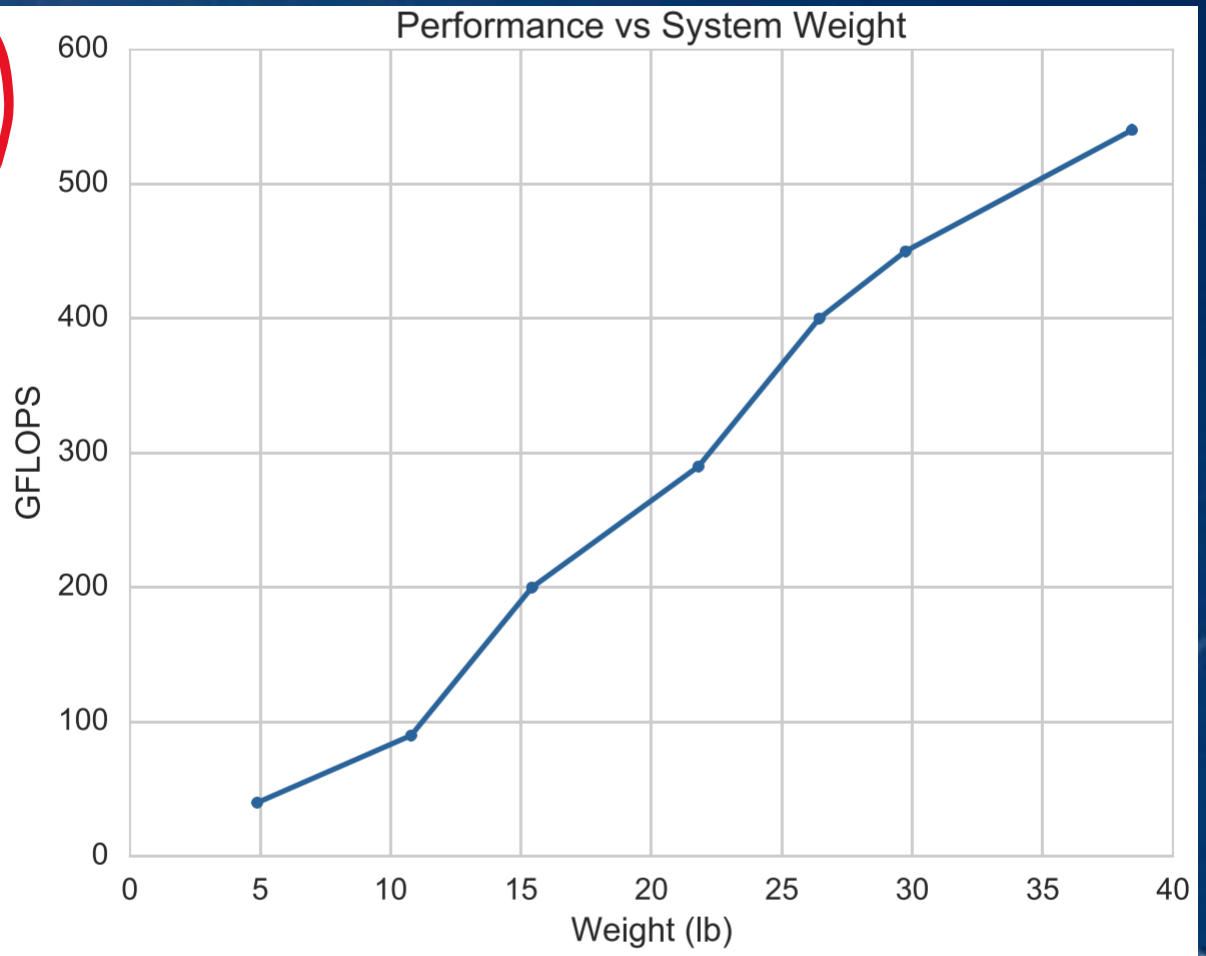
Repurposed Hardware



Wireless Communication

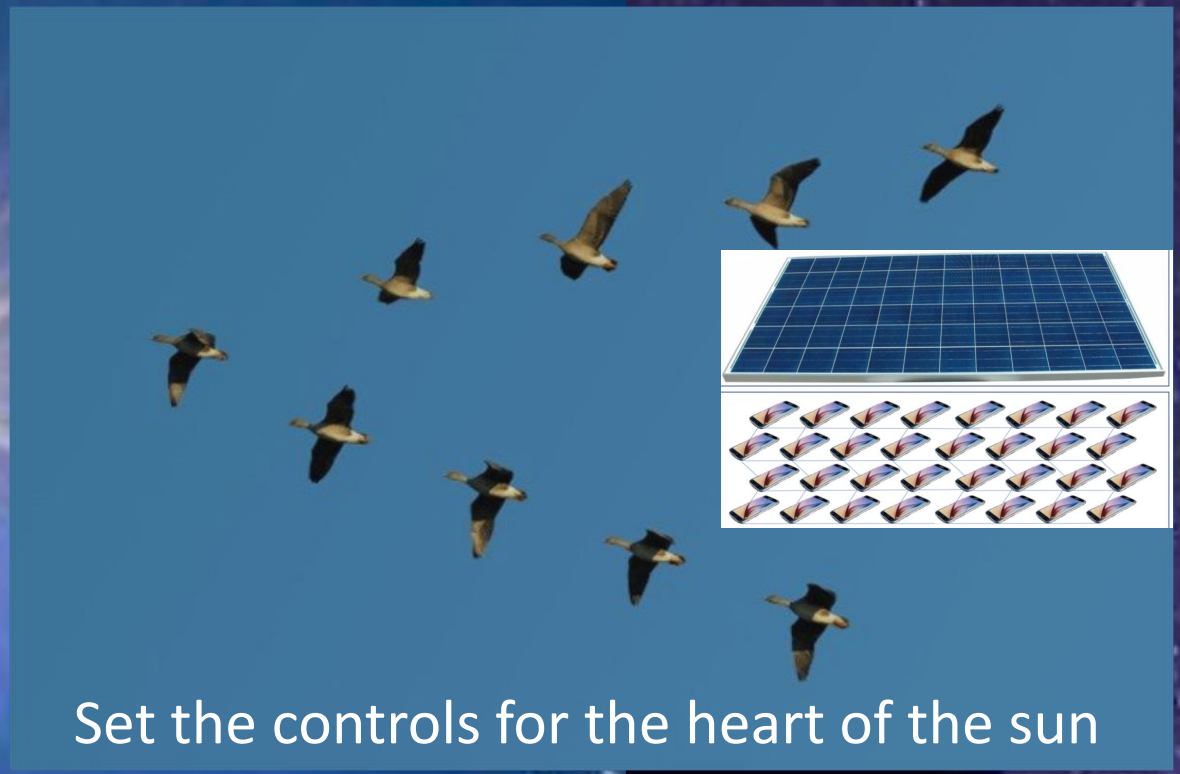
LoRa™


Performance vs Area
GFLOPS
Area (sq in)
0
100
200
300
400
500
600
0
200
400
600
800
1000
1200
1400
1600
1x1
3x3

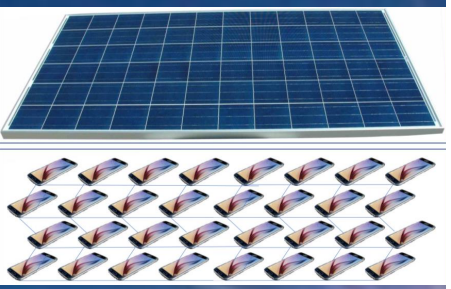

Performance vs System Weight
GFLOPS
Weight (lb)
0
100
200
300
400
500
600
0
5
10
15
20
25
30
35
40


Intermittent energy
Intermittent computing

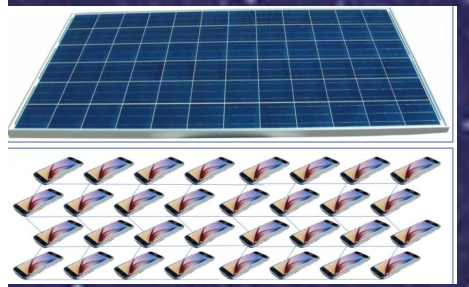
Migrate toward power source

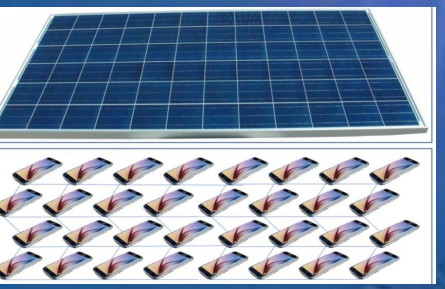


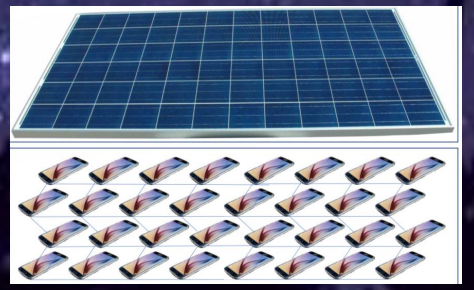
Migrate toward power source



Job + Data







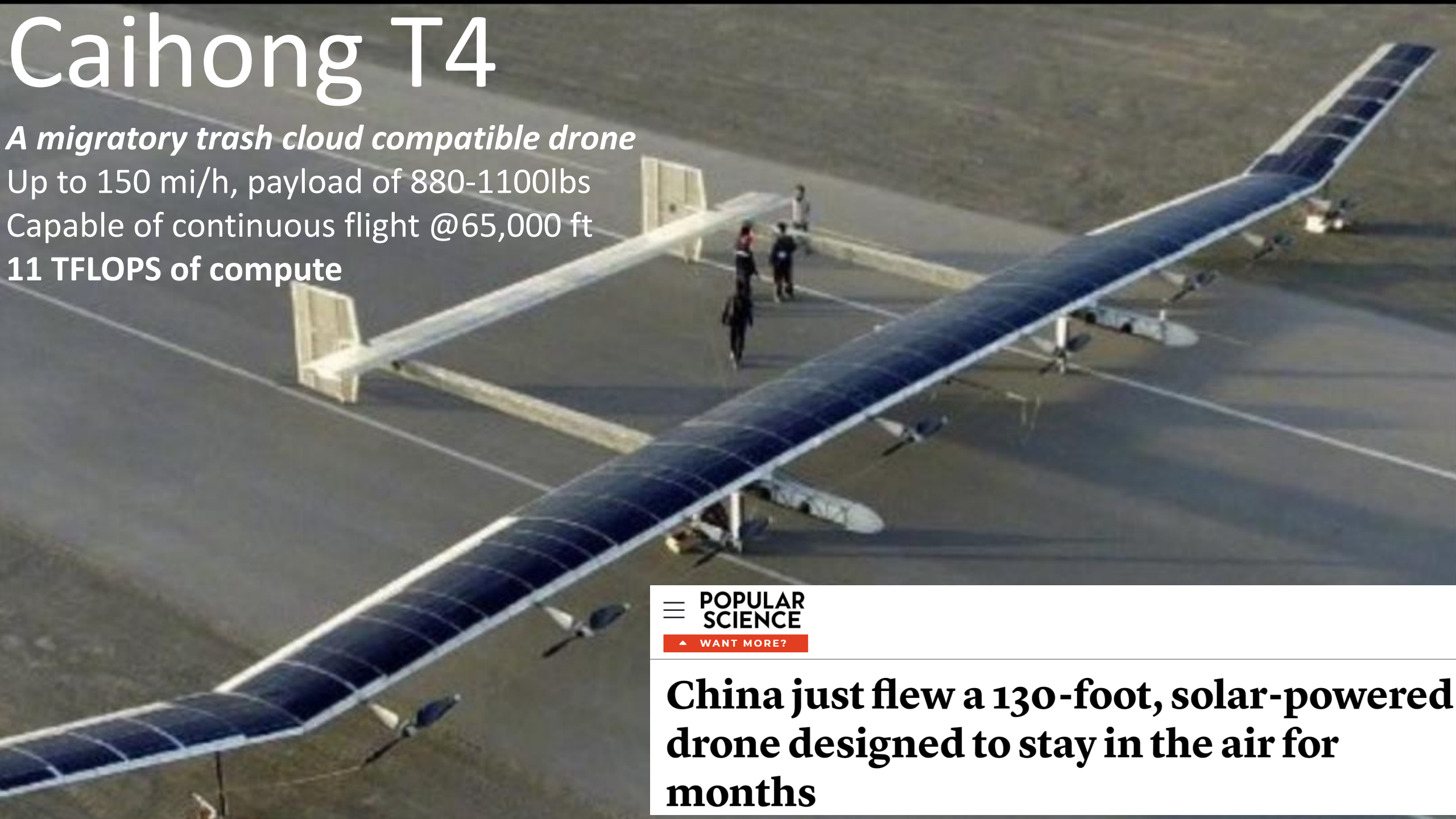
Caihong T4

A migratory trash cloud compatible drone

Up to 150 mi/h, payload of 880-1100lbs

Capable of continuous flight @65,000 ft

11 TFLOPS of compute



POPULAR SCIENCE

WANT MORE?

China just flew a 130-foot, solar-powered drone designed to stay in the air for months


Continuous
Migration
@ ~3000 mi


~~Station wagon~~ Drone
full of hard drives