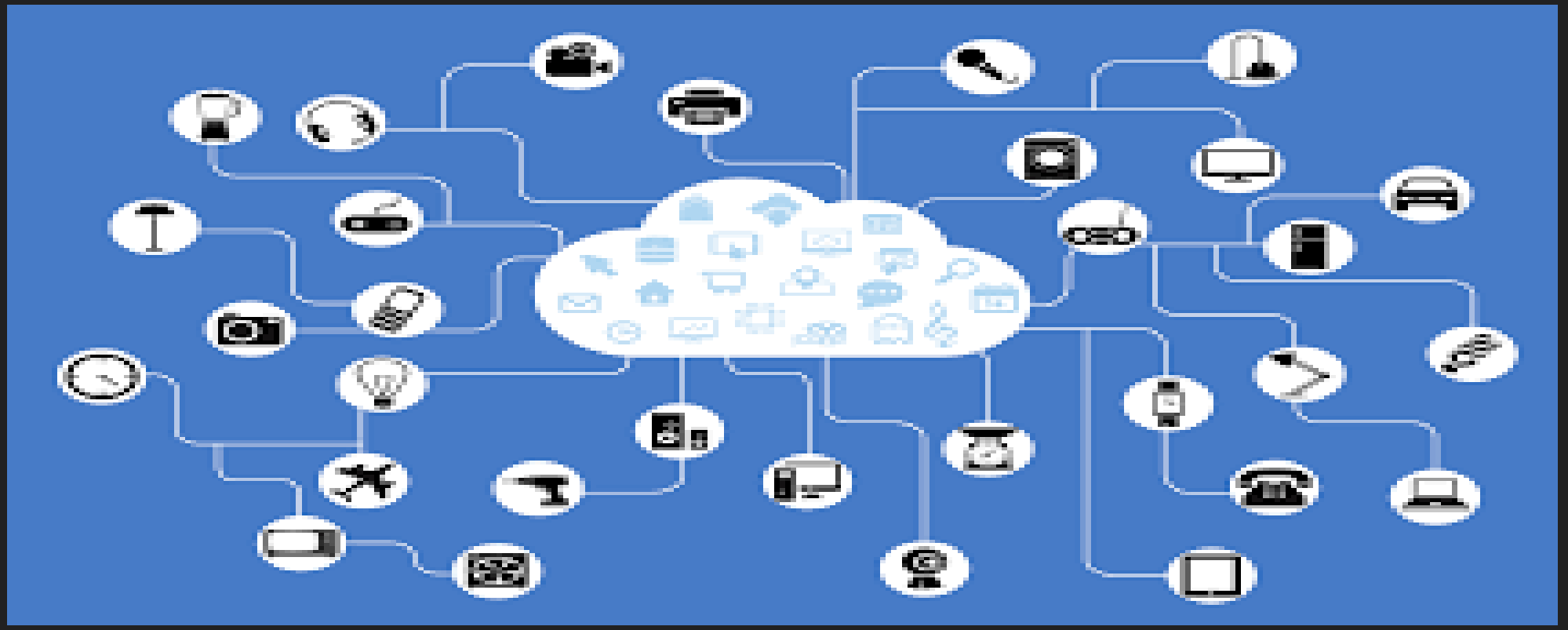
QA / Testing challenges

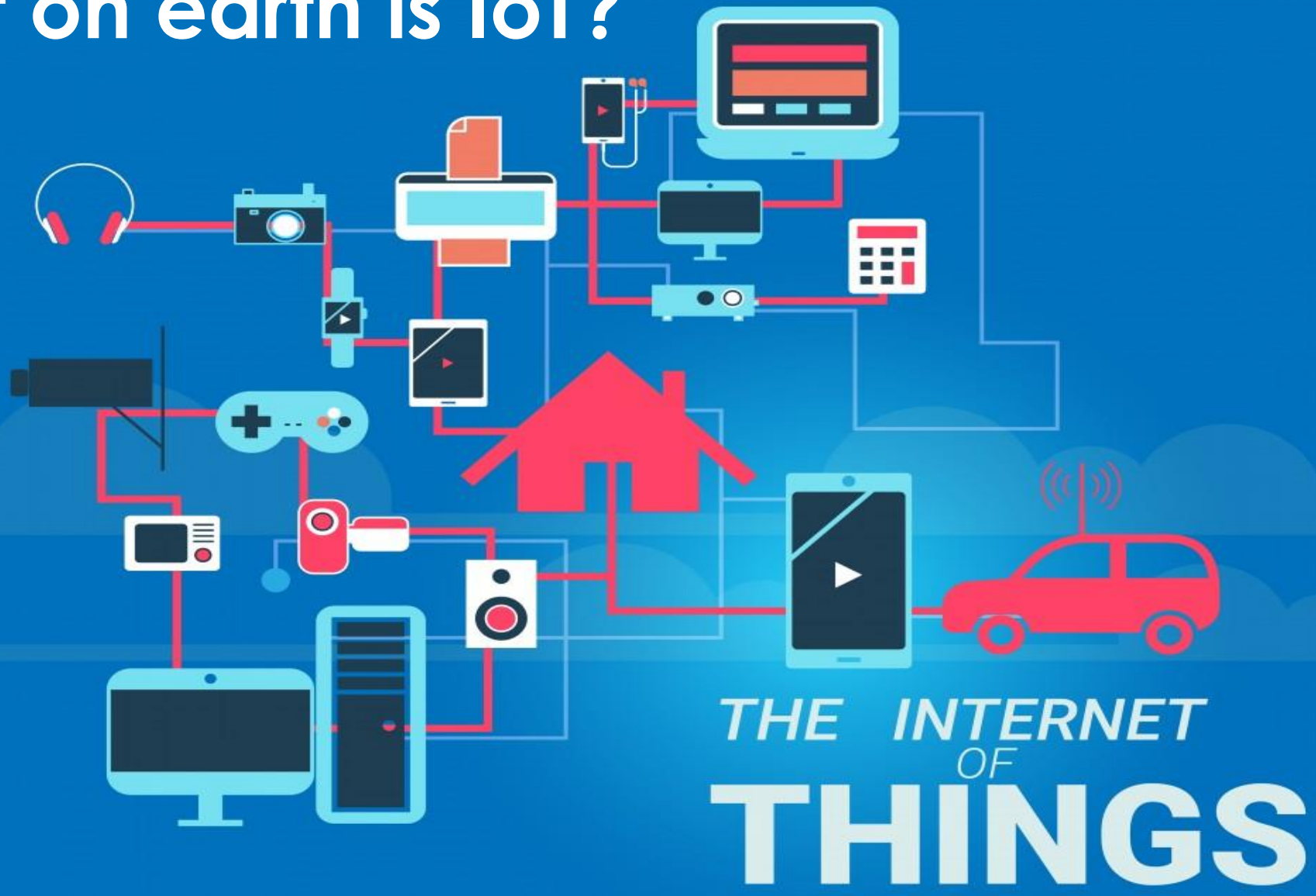
Driverless cars?

QA Challenges with IoT Systems



Bede Ngaruko
LinkedIn
@bedengaruko

What on earth is IoT?



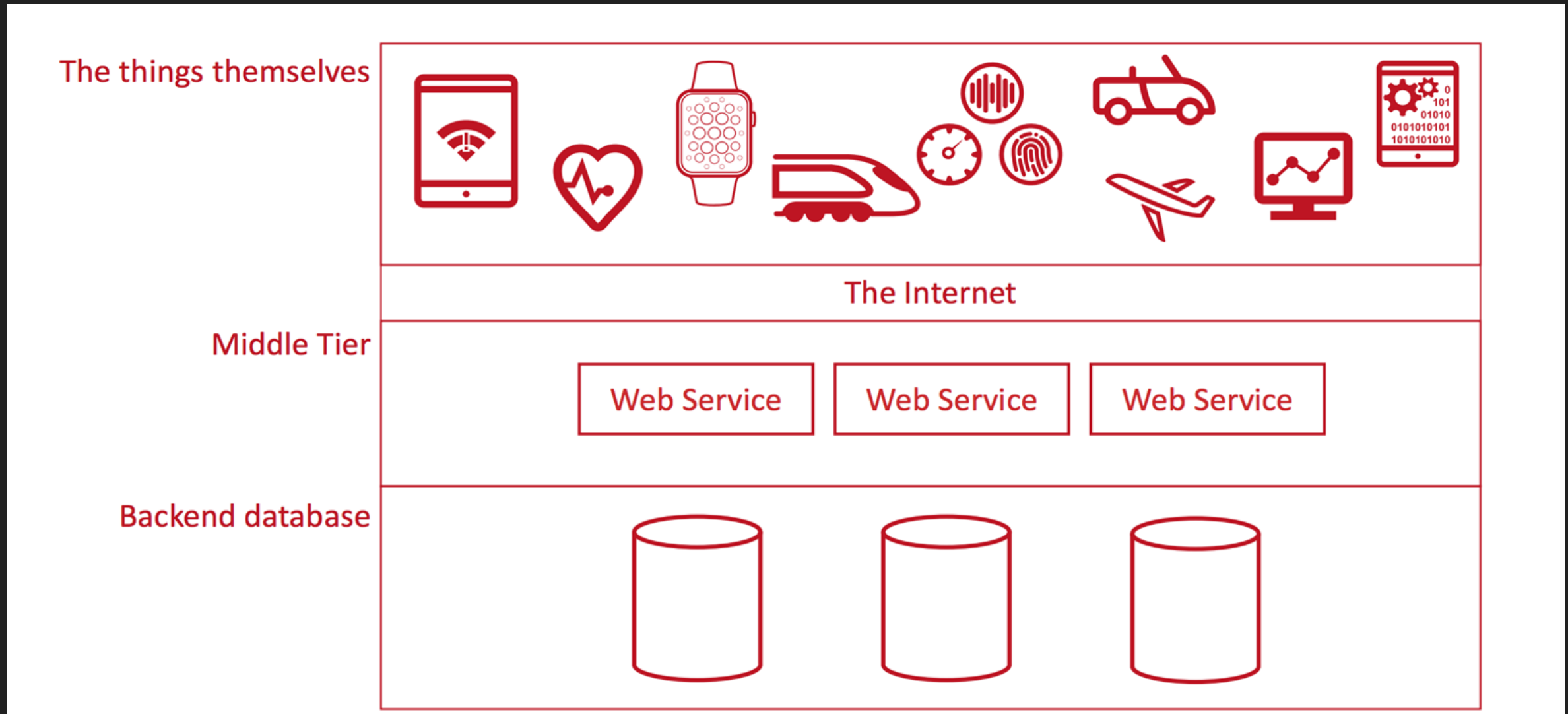
Not good at definitions, but … here goes

- Interconnected physical devices, vehicles, buildings, etc.
- Smart devices
- Embedded Electronics
- Software
- Sensors and Actuators
- Networks connectivity
- Collect data and exchange data

The ‘things’: 20 billion devices by 2020

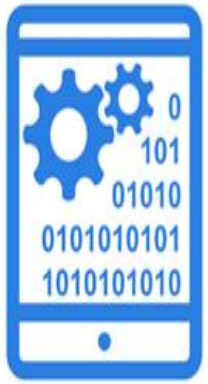
- Wearables
- Smart phones
- Tablets
- Sensors
- Health devices
- Cars
- Planes
- Collecting data
- Real time

Typical IoT architecture

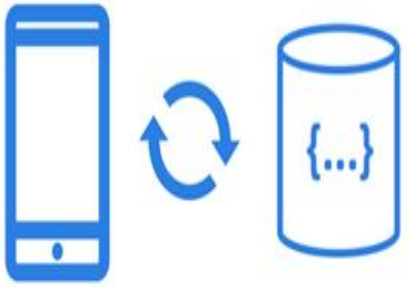


Typical Use Cases

On-device data management

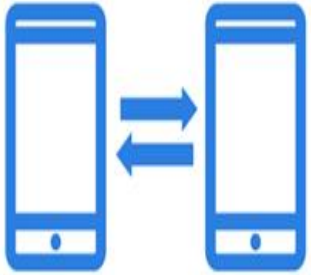


Data transport between device and backend



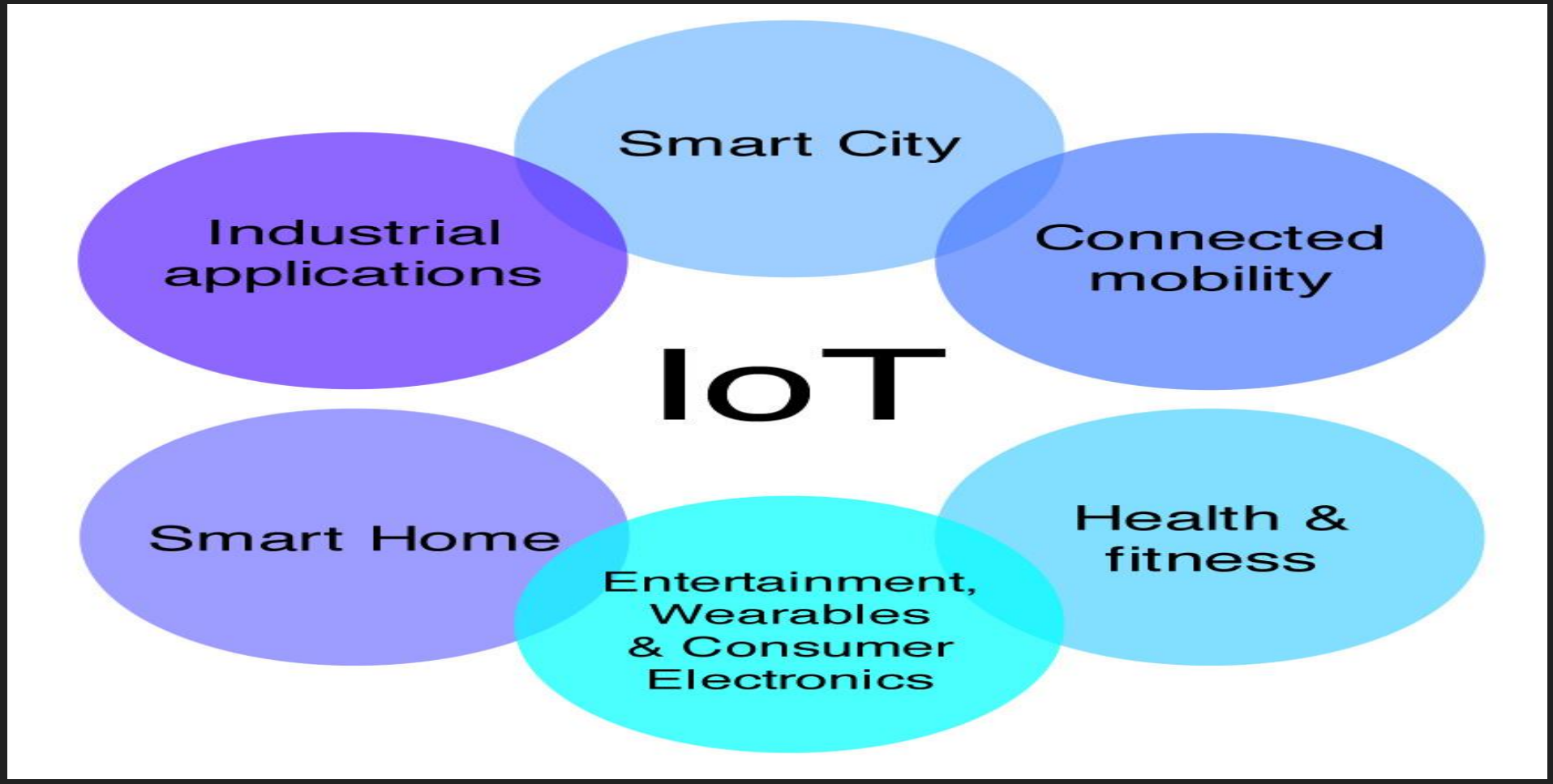
Management of streaming data

Data sharing between devices

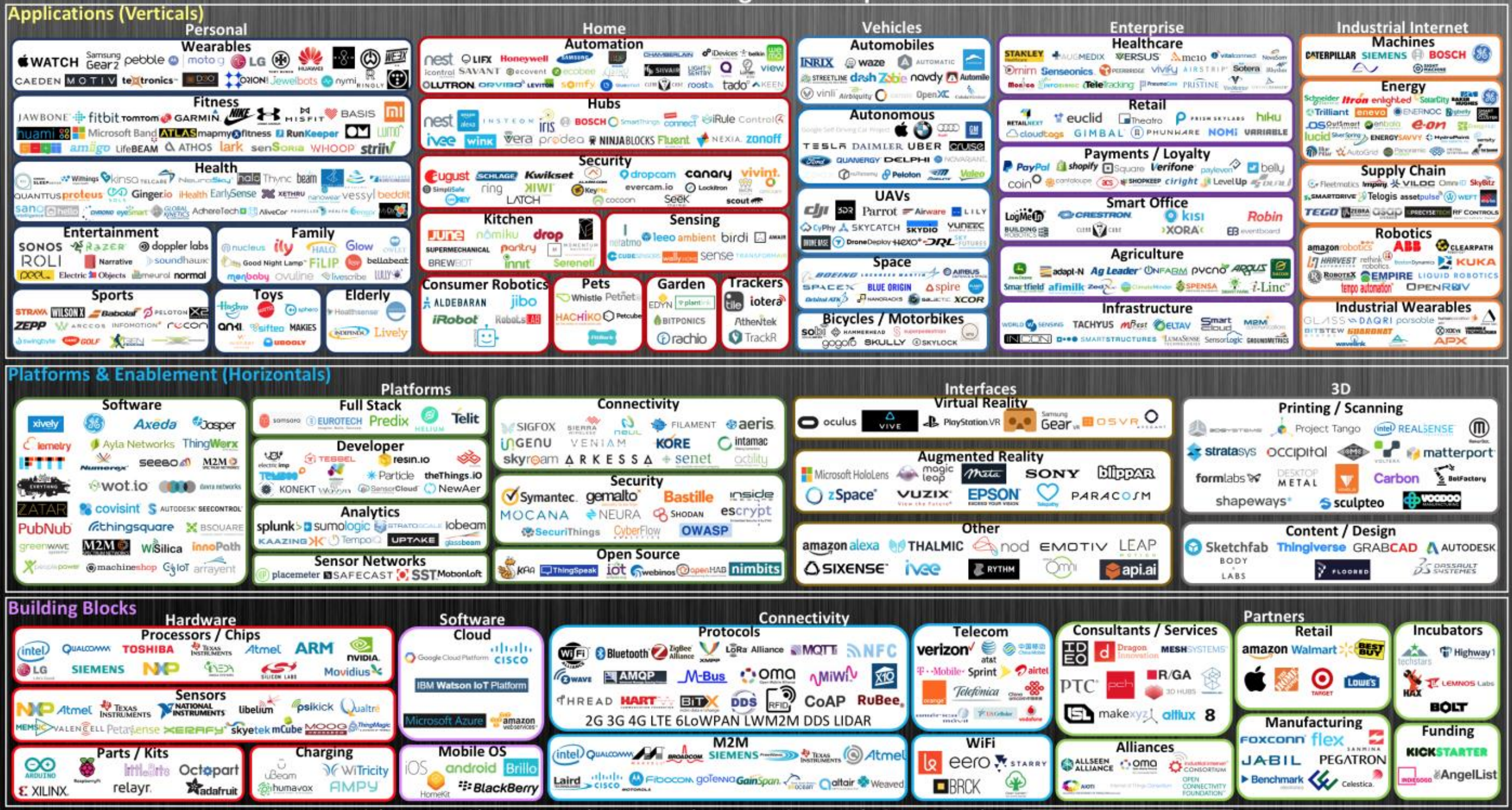


Offline-enabled apps and devices

Typical IoT Applications



Internet of Things Landscape 2016



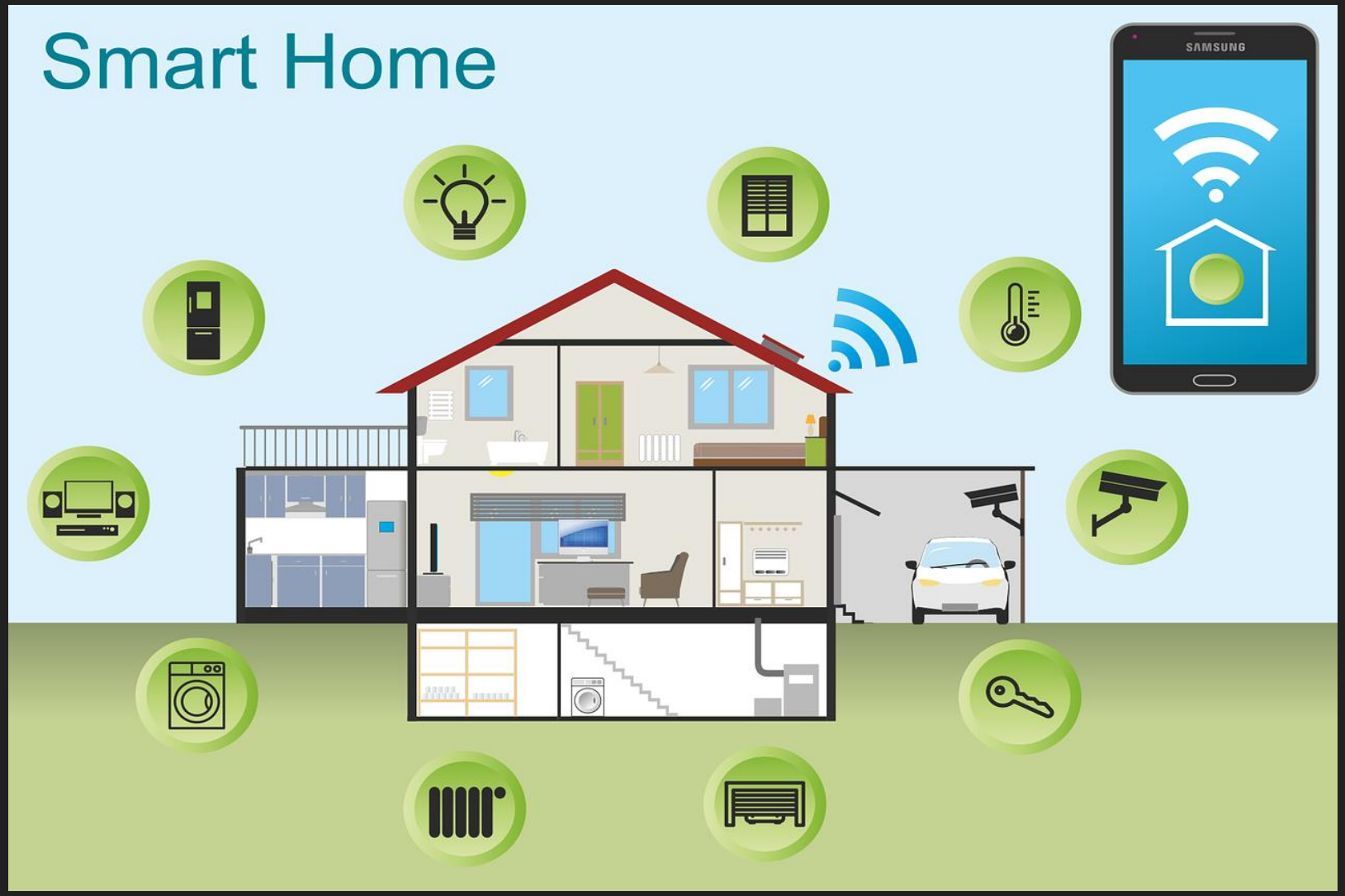
© Matt Turck (@mattturck), David Rogg (@davidjrogg) & FirstMark Capital (@firstmarkcap)

FIRSTMARK

Drones will fly life-saving blood supplies to clinics in Rwanda

Challenge: The things

- Hardware
- Car
- Air-conditioning unit
- Refrigerated truck
- Home security systems
- Etc.



Sensors

- Temperature
- Humidity
- Gyro
- GPS
- Motion
- Etc.

Actuators / Effectors

Embedded Systems / Firmware

Challenge: no UI (I freak out!)

```
josh@blackbox:~$ telnet en.wikipedia.org 80
Trying 208.80.152.2...
Connected to rr.pmtpa.wikimedia.org.
Escape character is '^]'.
GET /wiki/Main_Page http/1.1
Host: en.wikipedia.org
```

Request

```
HTTP/1.0 200 OK
Date: Thu, 03 Jul 2008 11:12:06 GMT
Server: Apache
X-Powered-By: PHP/5.2.5
Cache-Control: private, s-maxage=0, max-age=0, must-revalidate
Content-Language: en
Vary: Accept-Encoding,Cookie
X-Vary-Options: Accept-Encoding;list-contains=gzip,Cookie;string-contains=enwikiToken;string-contains=enwikiLoggedOut;string-contains=enwiki_session;
string-contains=centralauth_Token;string-contains=centralauth_Session;string-contains=centralauth_LoggedOut
Last-Modified: Thu, 03 Jul 2008 10:44:34 GMT
Content-Length: 54218
Content-Type: text/html; charset=utf-8
X-Cache: HIT from sq39.wikimedia.org
X-Cache-Lookup: HIT from sq39.wikimedia.org:3128
Age: 3
X-Cache: HIT from sq38.wikimedia.org
X-Cache-Lookup: HIT from sq38.wikimedia.org:80
Via: 1.0 sq39.wikimedia.org:3128 (squid/2.6.STABLE18), 1.0 sq38.wikimedia.org:80 (squid/2.6.STABLE18)
Connection: close
```

Response headers

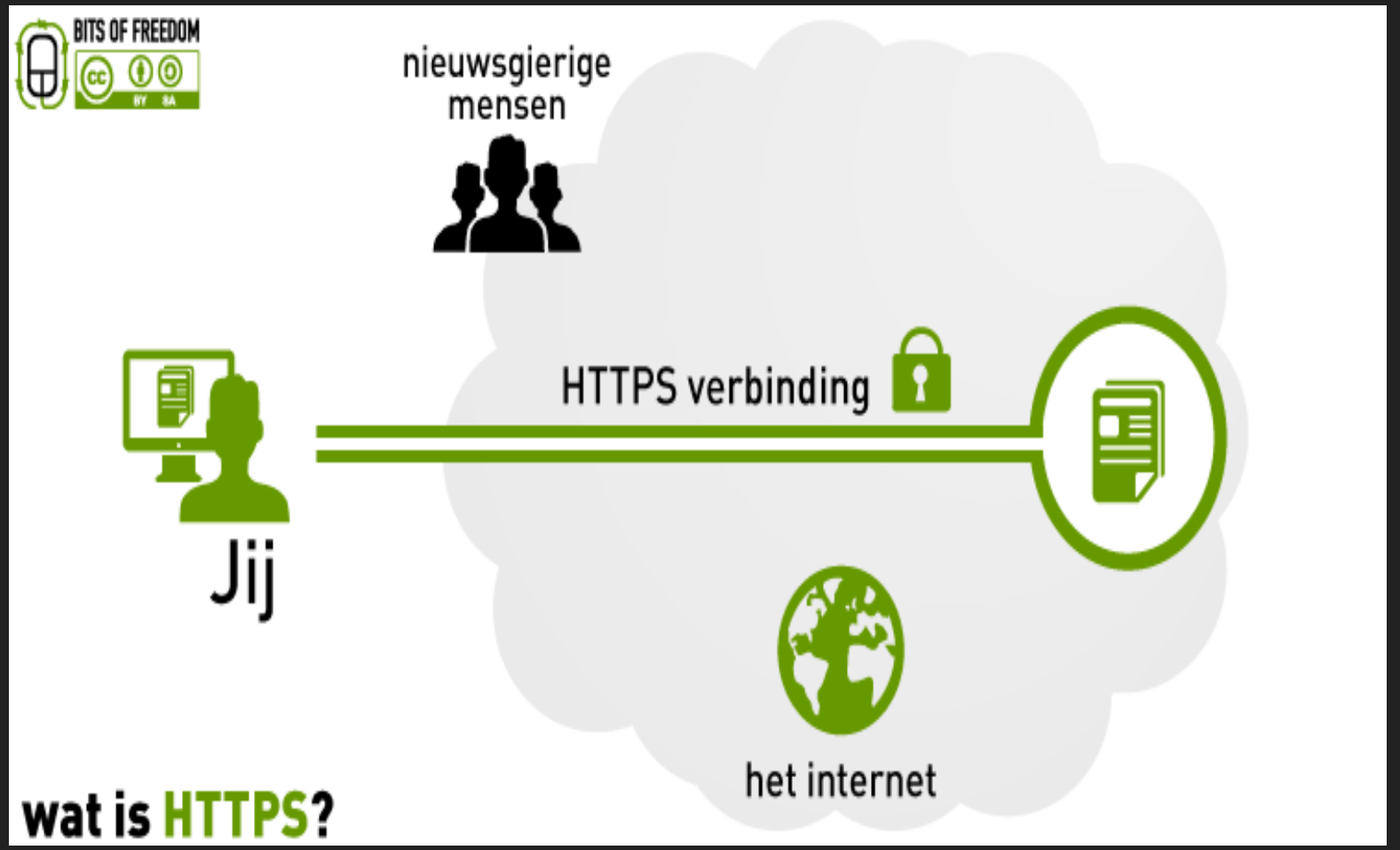
```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml" xml:lang="en" lang="en" dir="ltr">
        <head>
                <meta http-equiv="Content-Type" content="text/html; charset=utf-8" />
                        <meta name="keywords" content="Main Page,1778,1844,1863,1938,1980 Summer Olympics,2008,2008 Guizhou riot,2008 Jerusal
...
... This content has been removed to save space
...
"Non-profit organization">nonprofit</a> <a href="http://en.wikipedia.org/wiki/Charitable_organization" title="Charitable organization">charity</a>.<b
r /></li>
                        <li id="privacy"><a href="http://wikimediafoundation.org/wiki/Privacy_policy" title="wikimedia:Privacy policy">Privac
y policy</a></li>
                        <li id="about"><a href="/wiki/Wikipedia:About" title="Wikipedia:About">About Wikipedia</a></li>
                        <li id="disclaimer"><a href="/wiki/Wikipedia:General_disclaimer" title="Wikipedia:General disclaimer">Disclaimers</a>
</li>
                </ul>
        </div>
</div>

        <script type="text/javascript">if (window.runOnloadHook) runOnloadHook();</script>
<!-- Served by srv93 in 0.050 secs. --></body></html>
Connection closed by foreign host.
josh@blackbox:~$
```

Response body

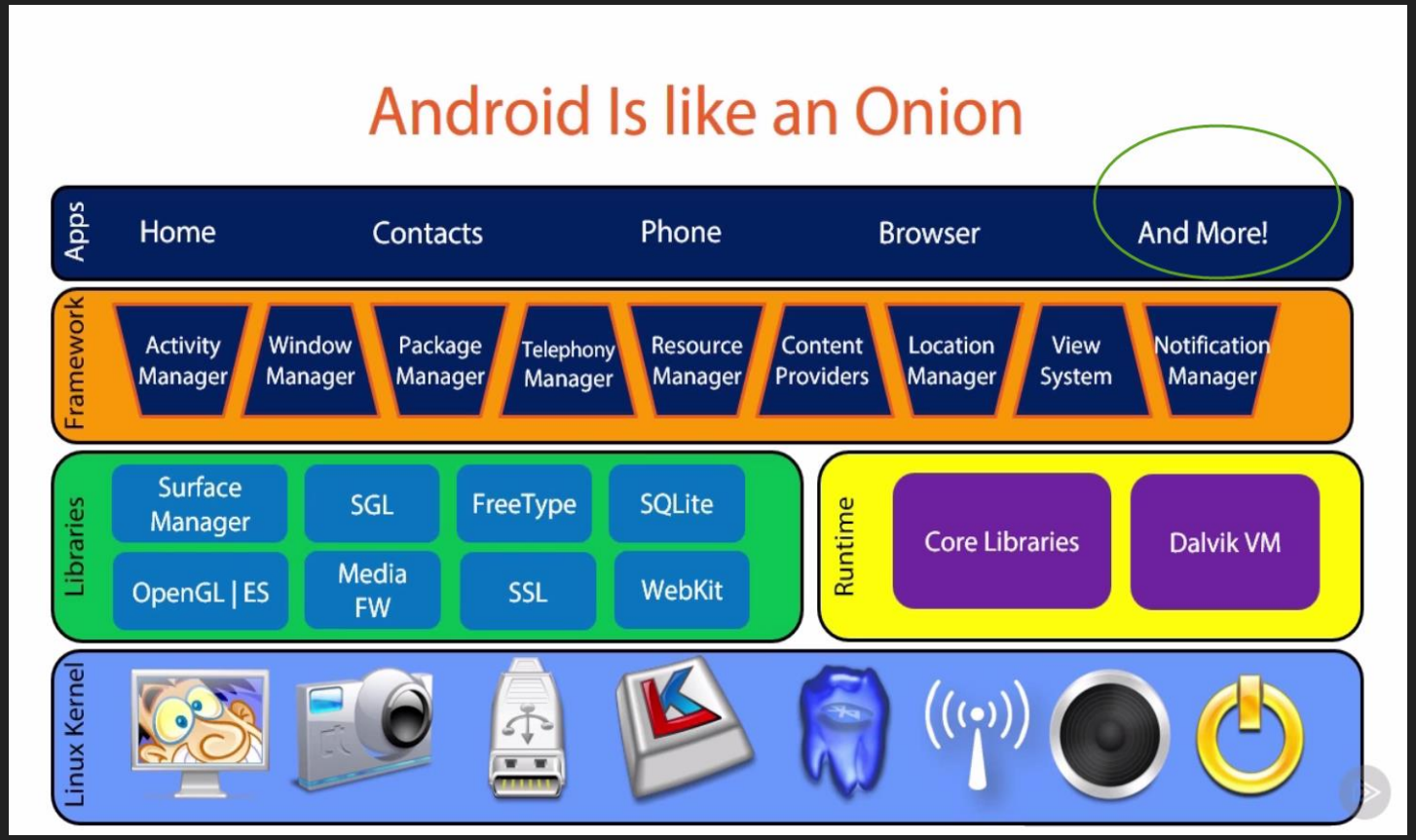
API Testing

- No UI?
- Testers or Devs
- Web servers,
- Http, SSL/TLS
- Web APIs, REST
- JSON, Xml
- Authentication
- Network protocols

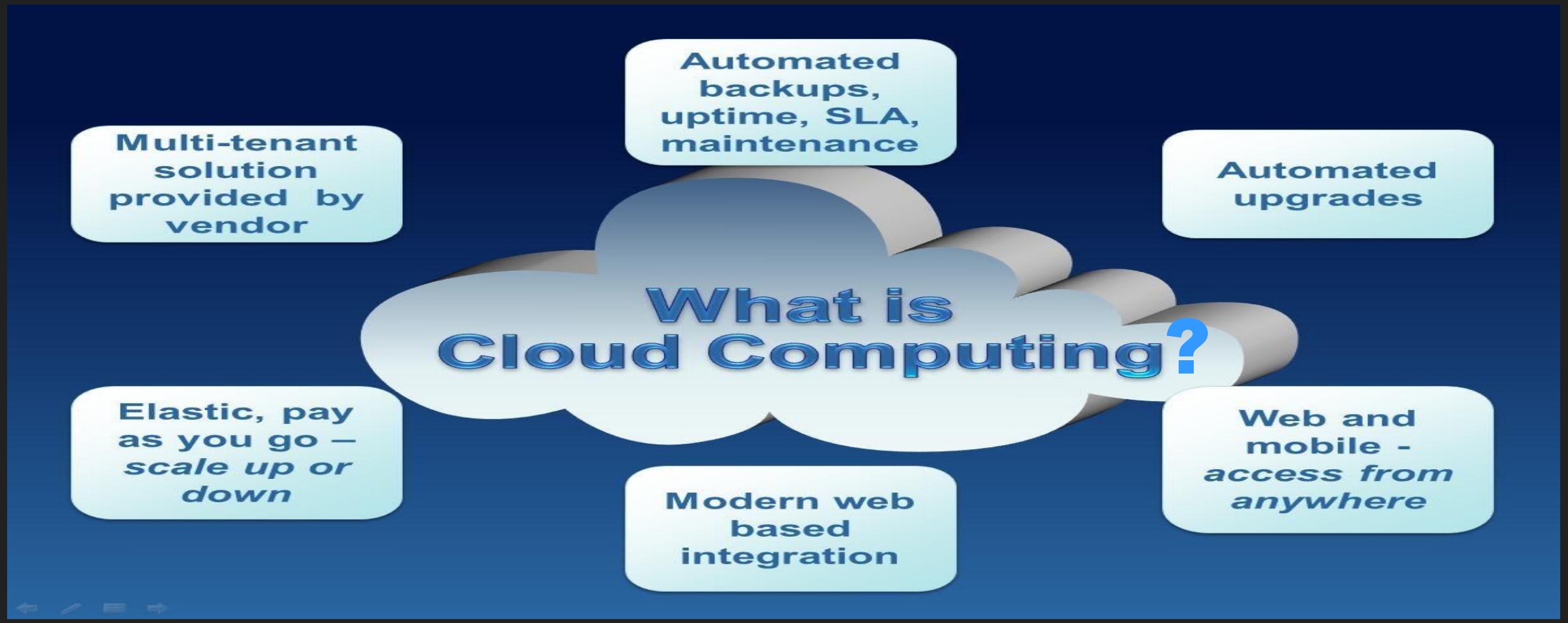


Mobile devices

- Things have short range comms (Bluetooth, Zigbee, Intranet)
- Mobile as gateway
- Fragmented market
- Lots of configs



The Cloud


Automated backups, uptime, SLA, maintenance
Multi-tenant solution provided by vendor
Automated upgrades
What is Cloud Computing?
Elastic, pay as you go – scale up or down
Web and mobile - access from anywhere
Modern web based integration

Third party libraries: the hack culture

Added dimensions in IoT

- Security
- Availability
- Reliability
- Safety
- Resilience
- Compliance

Security

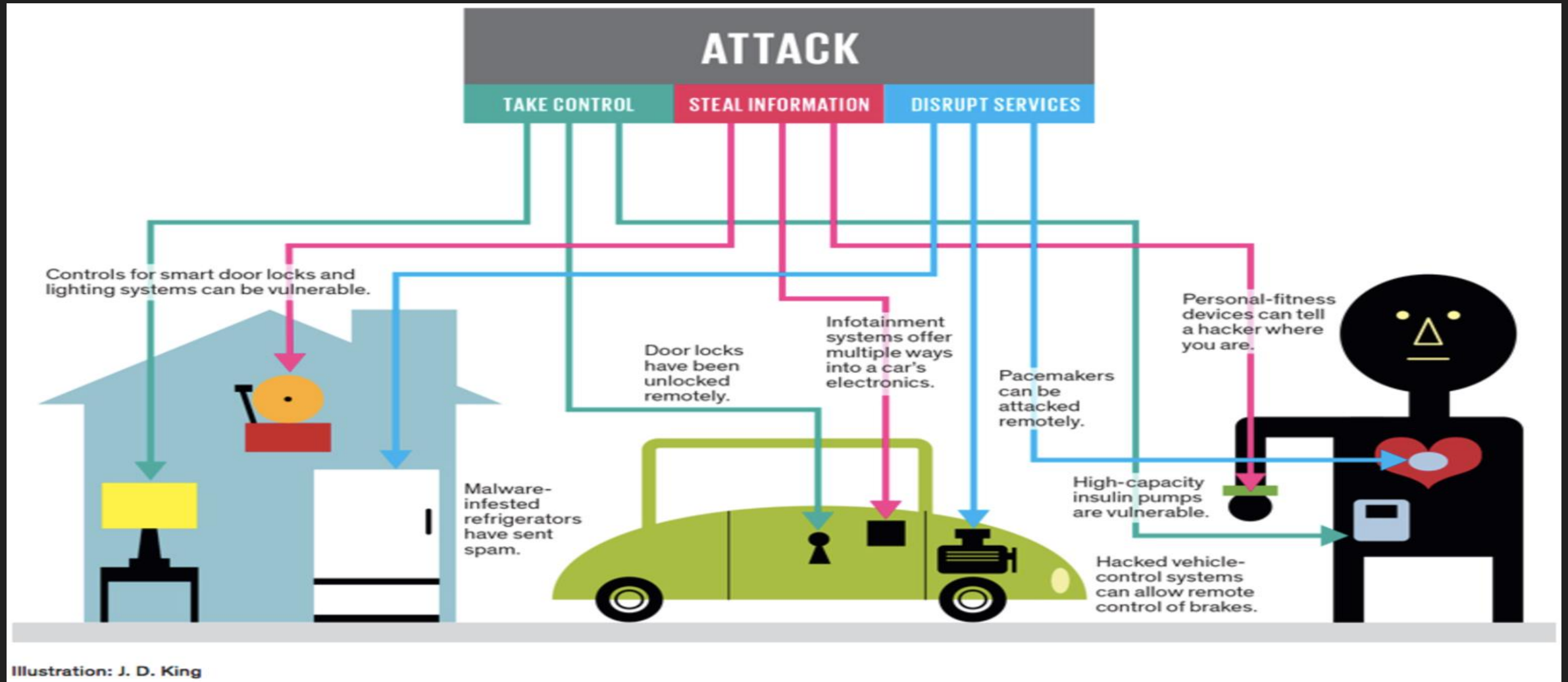


Illustration: J. D. King

Availability and Reliability

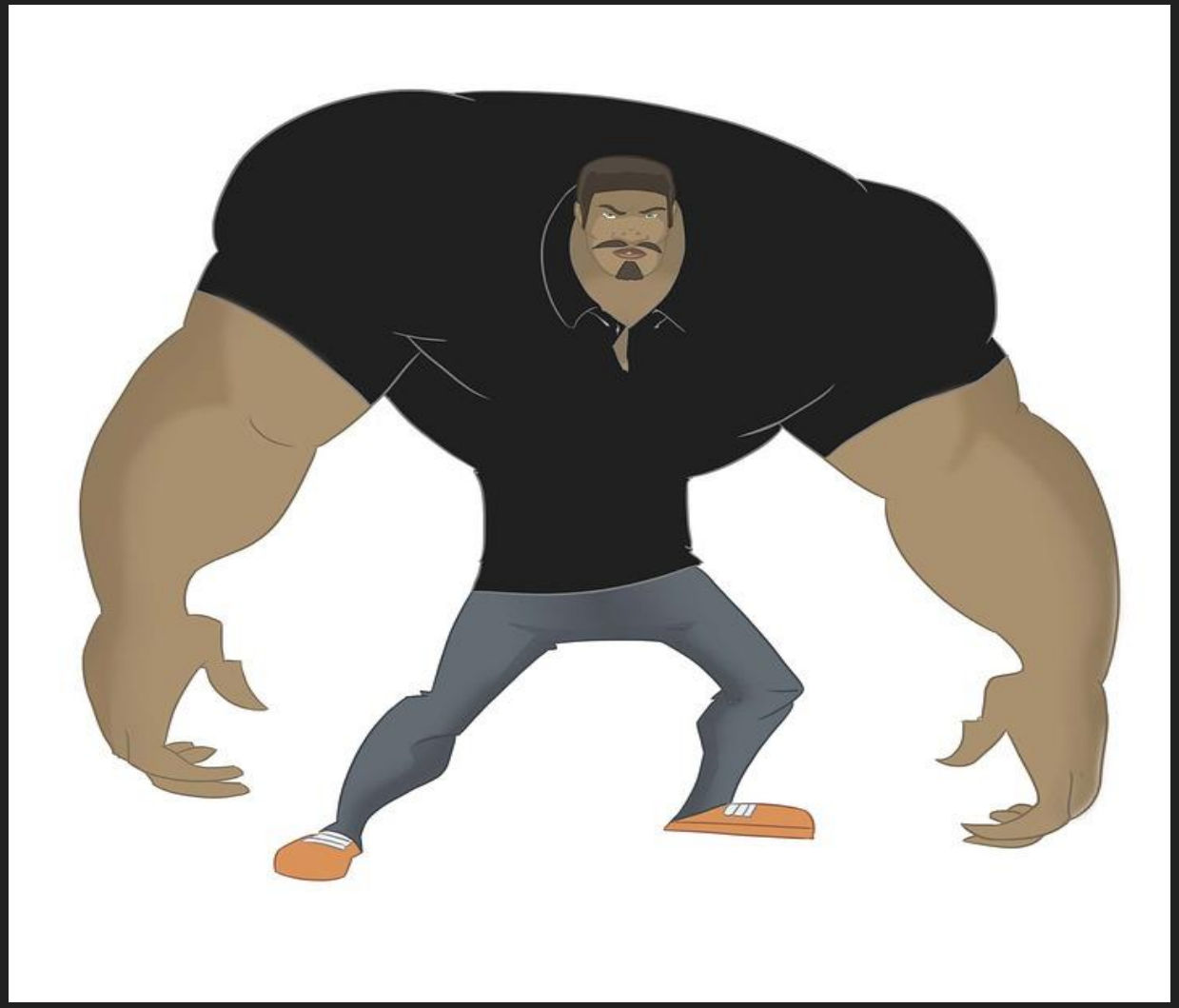
- Remote
- Moving
- Low battery
- Rely on wireless

Safety

- Irresponsible operators
- Decoupling the fate of the driver/pilot from that of the passengers
- Unattended devices and machinery
- Missing human judgement in critical circumstances

Resilience

- Physical environments
- Noise & Interferences
- Frequently on and off
- Pinged frequently



So what do we do?

Traditional structured testing

- GUI
- Web
- Integration

Testing ‘in the wild’

- Drive the truck
- Fly the drone
- Go to sea
- Physical ‘things’

Service virtualisation

Security / Penetration testing

- Start with the easy stuff
- Password strength
- Cookies expiry
- SQL injection
- Ultimately QA includes Security

User Experience!

Remember how Glade (a rival brand from SC Johnson) used to have the jingle that went,“Plug it in, plug it in”? That is not the case with connected devices. The new theme song should go something like, “Plug it in, plug it in. And then go through a 50-step process that we will now explain to you in painstaking detail, and you will still have to call that 15-year-old kid who hooks up your TV and shows you how to add people on Snapchat.”

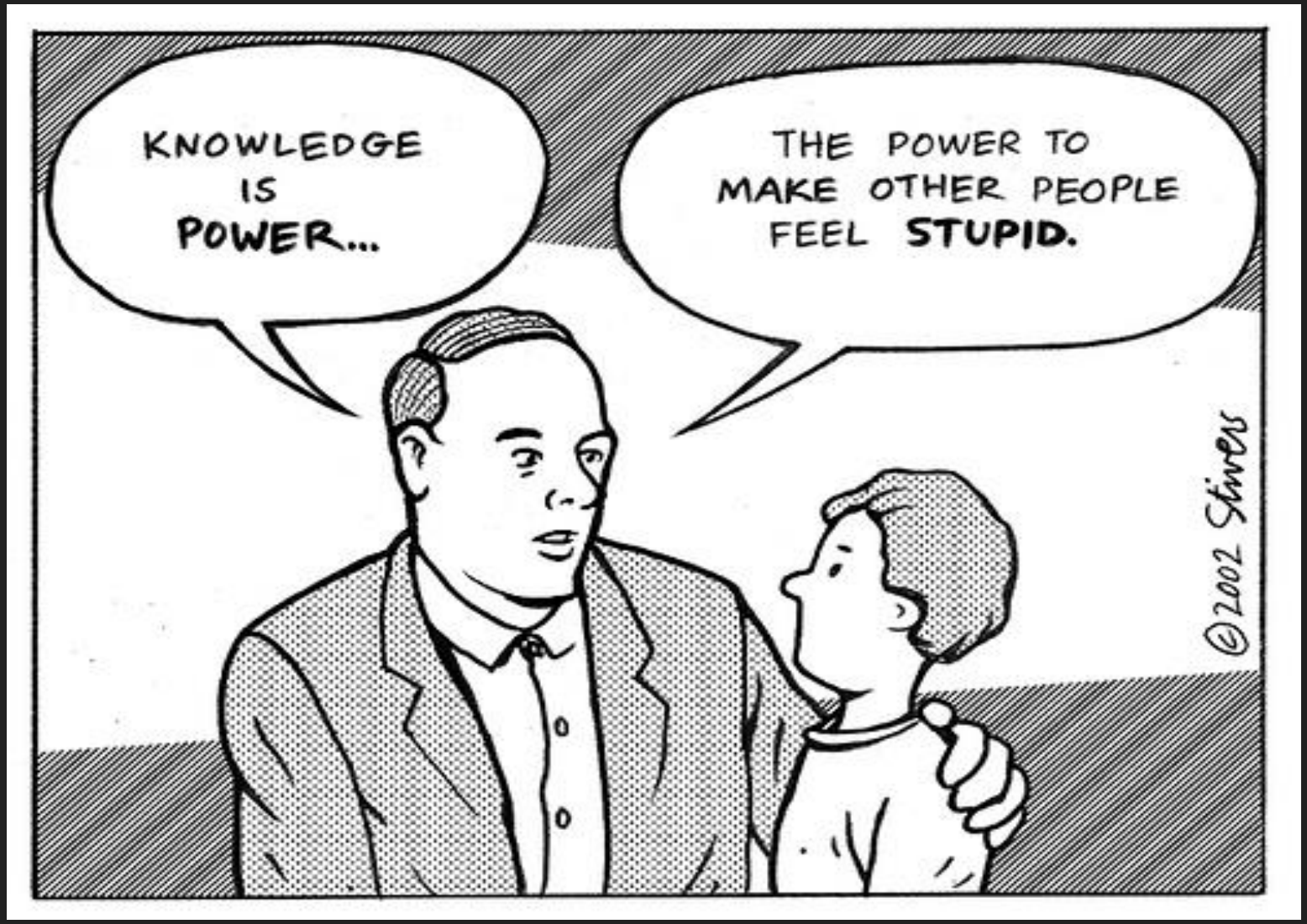
David Berkowitz

“The entire setup process felt absurd. First, I needed to find and download the Febreze Connect app on my iPhone – for my air freshener. Next, I had to connect to a custom WiFi network, requiring me to look up my home network’s password – for my air freshener. Then, I had to wait for a firmware update (really) – for my air freshener. Finally, to differentiate multiple devices should I ever buy a case of them, I had to come up with a name – for my air freshener (mine goes by the name Feberky). The user experience will need to improve, especially for lower-cost devices, so that they are truly plug-and-play.”

David Berkowitz

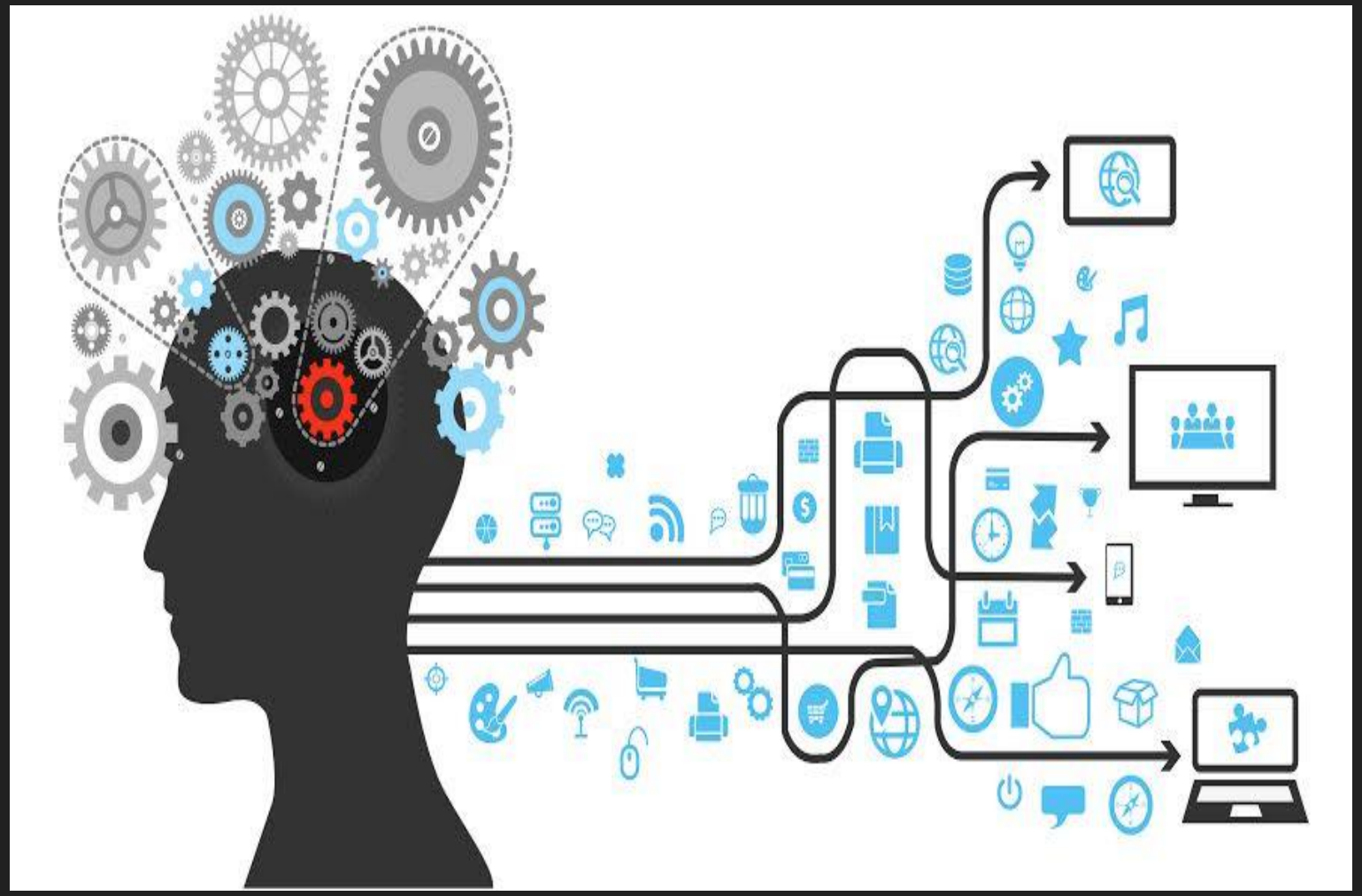
So what now?

- Upskill
- Hardware/Firmware
- Basic Electronics
- Wireless technologies
- Networks
- Web technologies
- Work with devs
- Cloud platforms
- Security testing



Back to the future...

- IoT collects Data
- Big data
- Analytics
- Machine Learning
- Artificial Intelligence
- Bots
- Oh my!



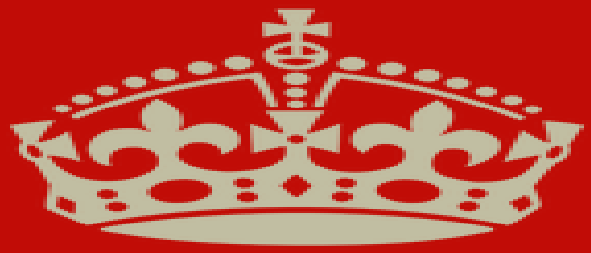
A word on automation

- Hard to test end to end
- Combination of Desktop, Web, Mobile and Hardware testing
- We are all familiar with Desktop, Web, Mobile
- Hardware integration test tools such as LabView
- Service Virtualisation
- Testing APIs: Vendor UI based such as SoapUI or http client proxy such as Postman or better yet http client APIs and libraries such as RestSharp (.Net) and Rest Assured (Java)
- In-house, custom-built test rigs or test jigs

Conclusion

- IoT here to stay and expected to grow
- Blend existing strategies with innovative ones
- Testers to upskill
- Increase cooperation with devs/devOps/IT staff
- Include security/penetration testing in test plans

But……



KEEP CALM WE WILL SURVIVE

Questions, Queries & Comments ….