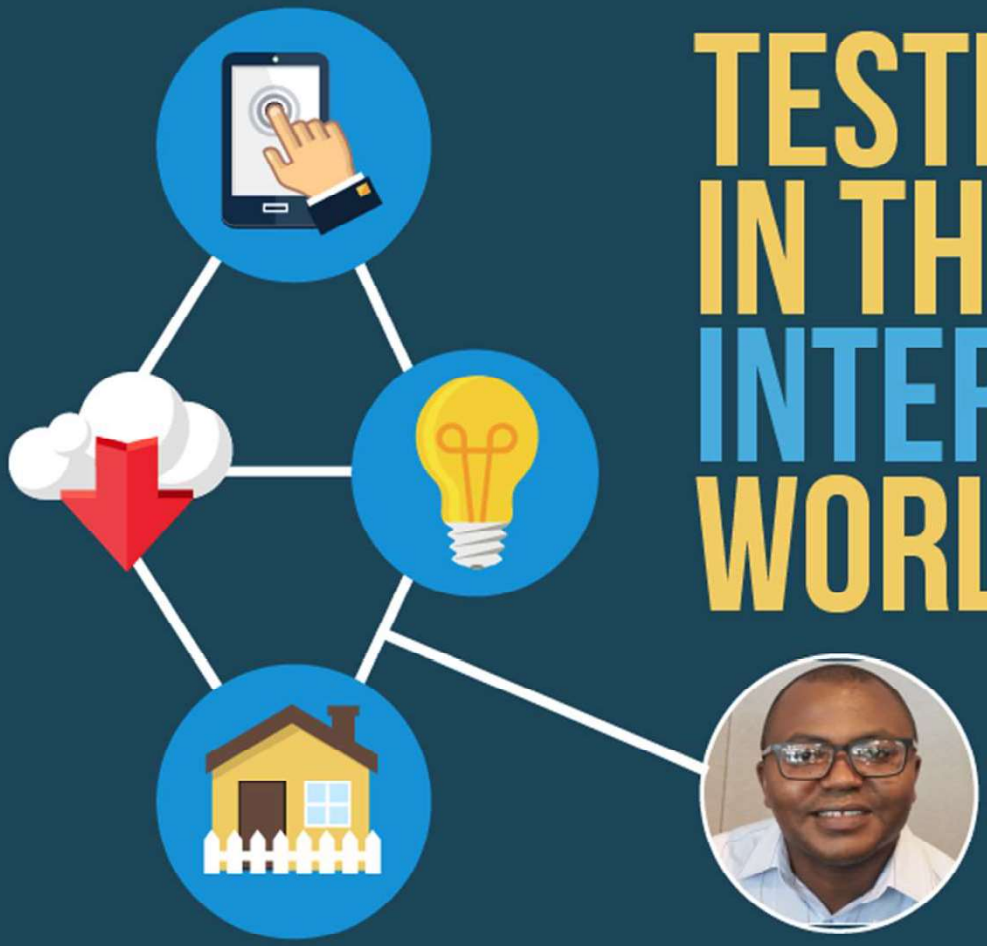
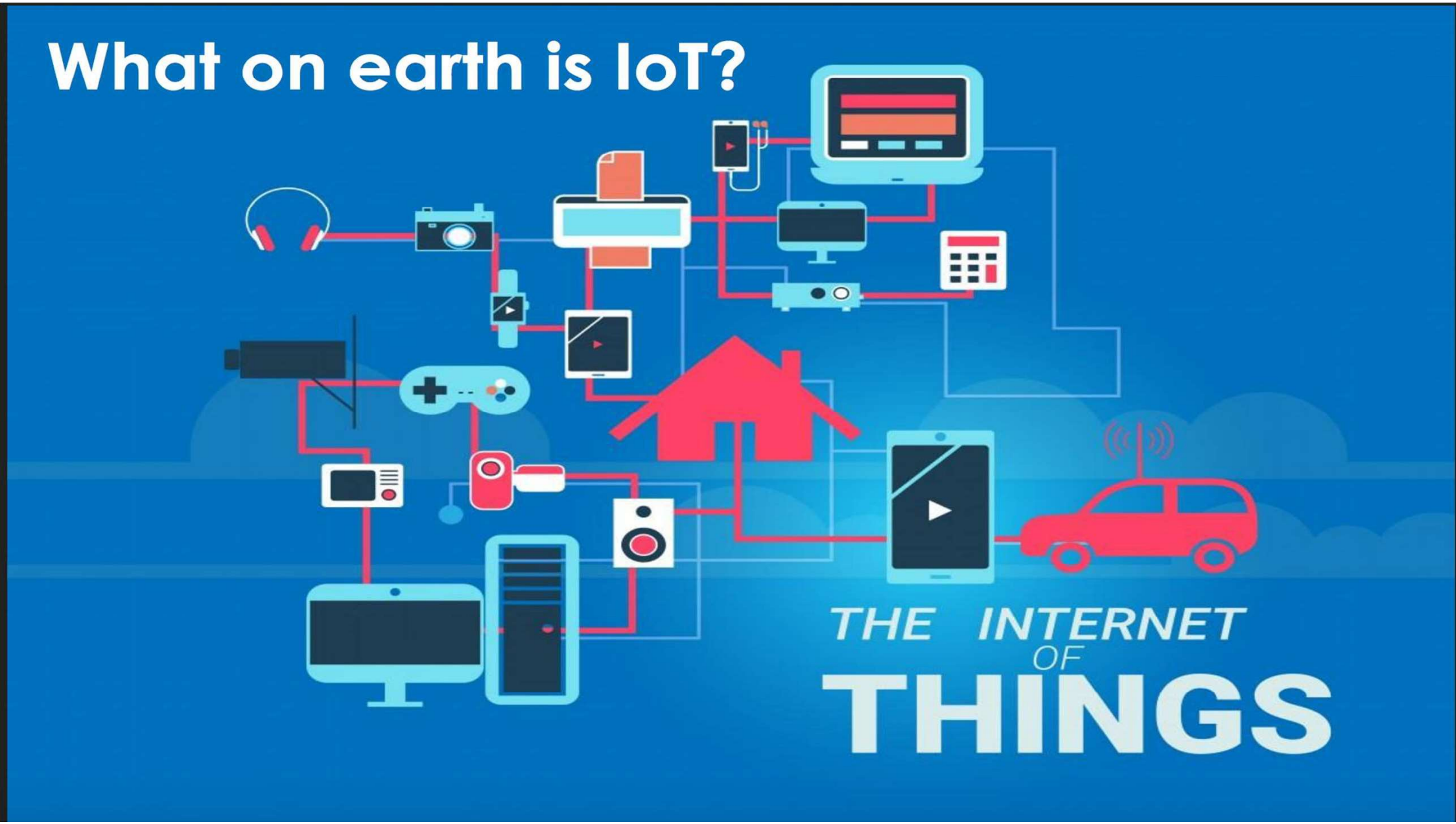


TESTING CHALLENGES IN THE HIGHLY INTERCONNECTED WORLD OF IOT

@bedengaruko

Driverless cars?

What on earth is IoT?

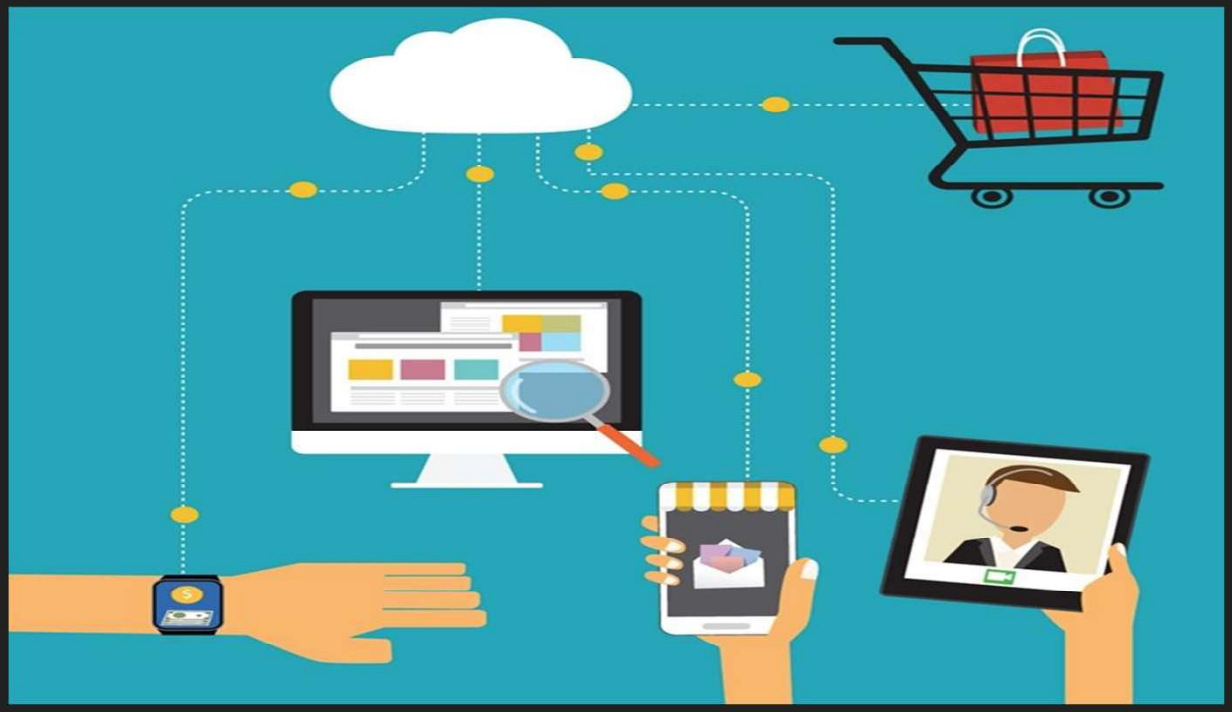


Not good at definitions, but..here goes

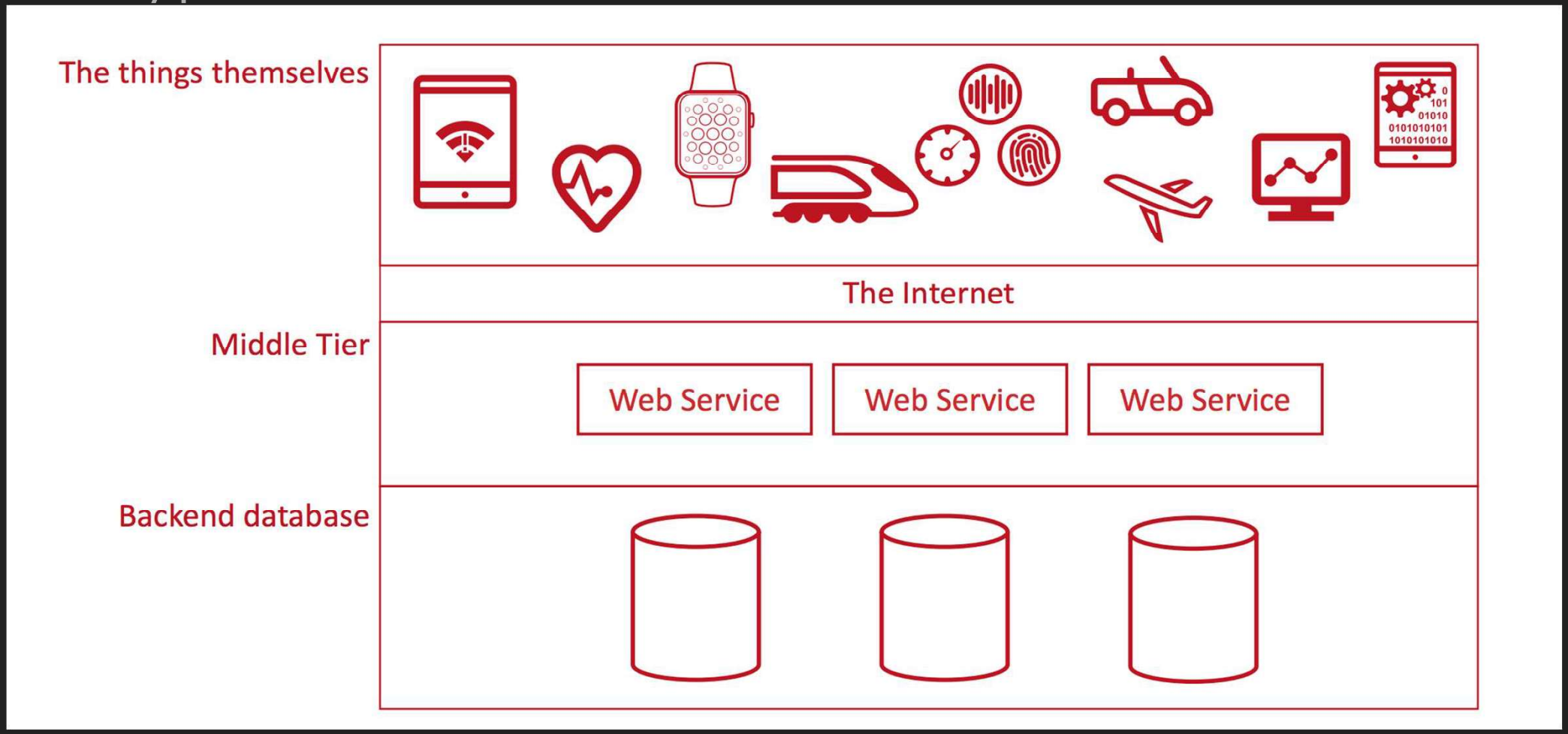
- Interconnected physical devices, vehicles, buildings, etc.
- Smart devices
- Embedded Electronics
- Software
- Sensors and Actuators
- Networks connectivity
- Collect data and exchange data

The ‘things’: 26 billion devices by 2020

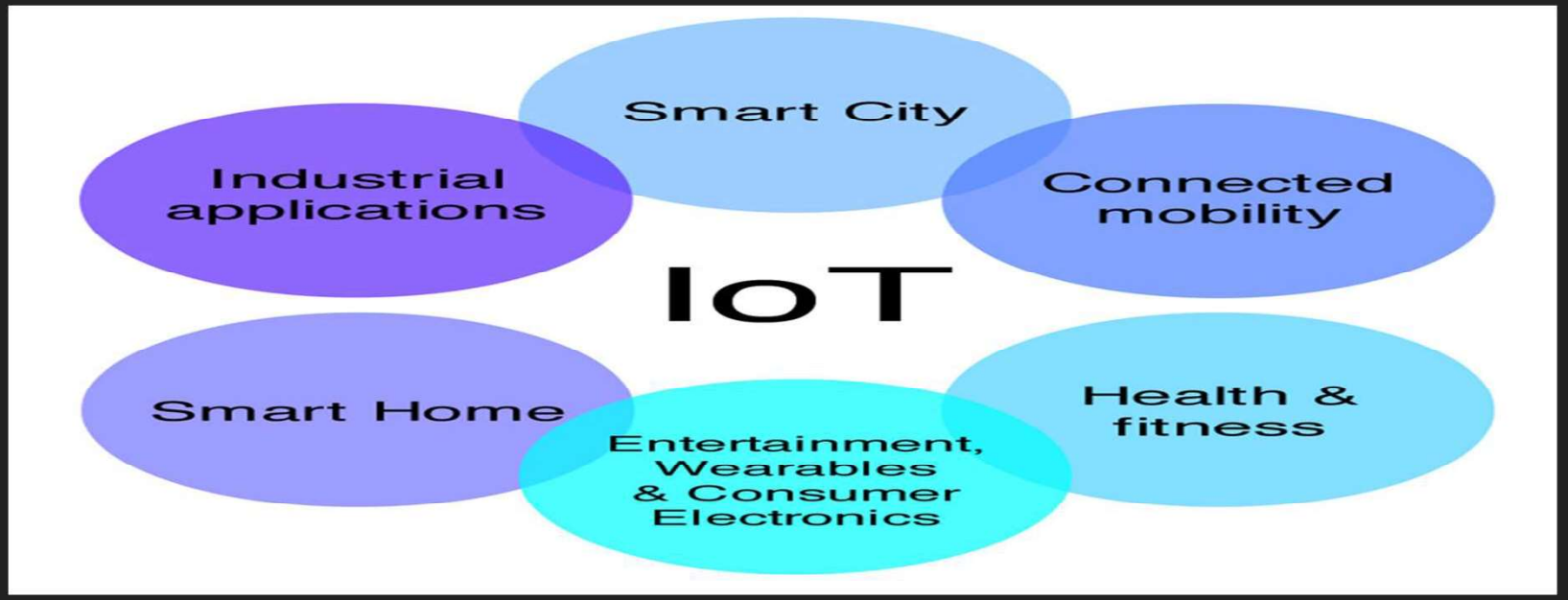
- Wearables
- Smart phones
- Tablets
- Sensors
- Health devices
- Cars
- Planes
- Collecting data
- Real time

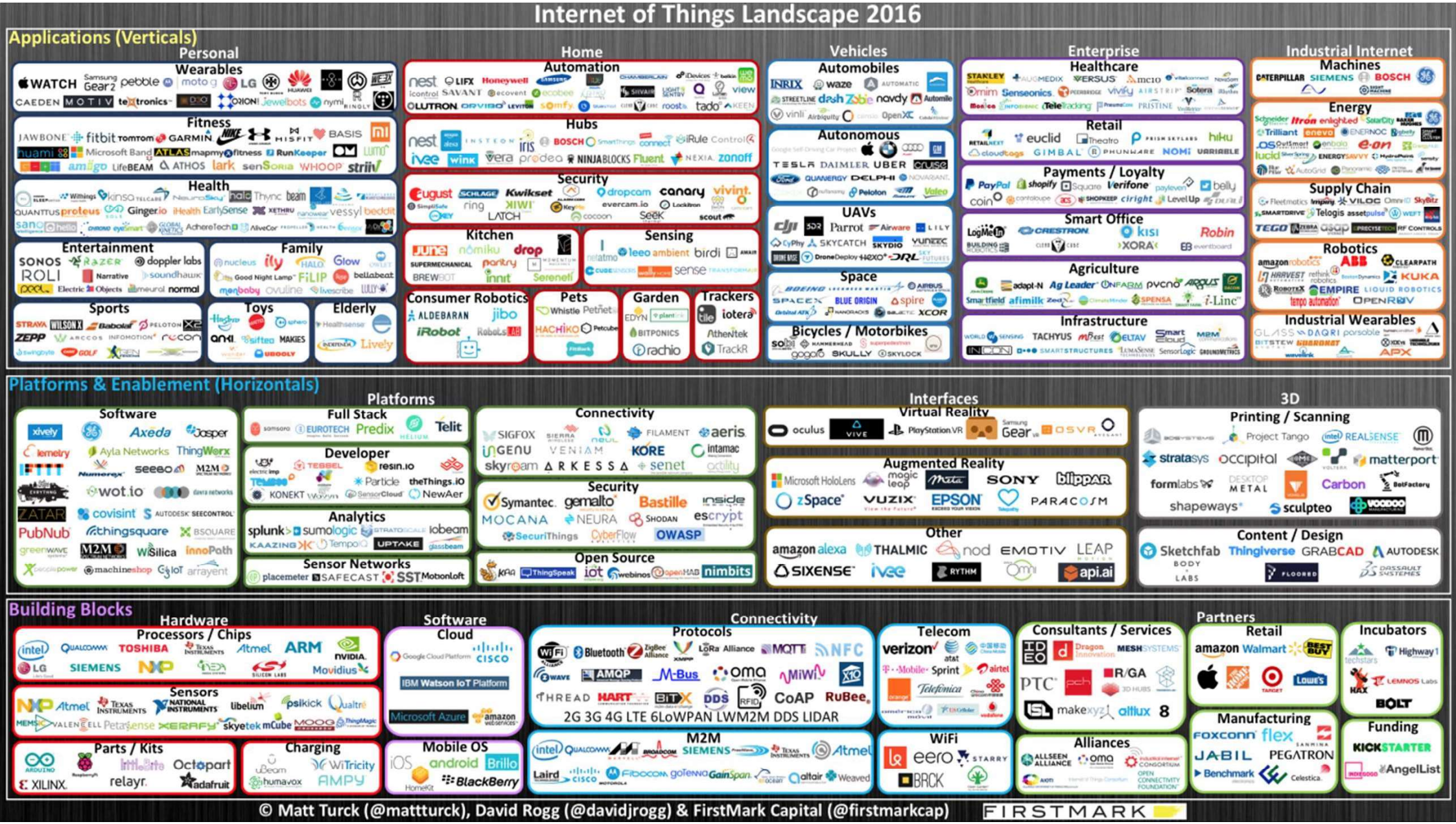


Typical IOT architecture



Typical IOT Applications

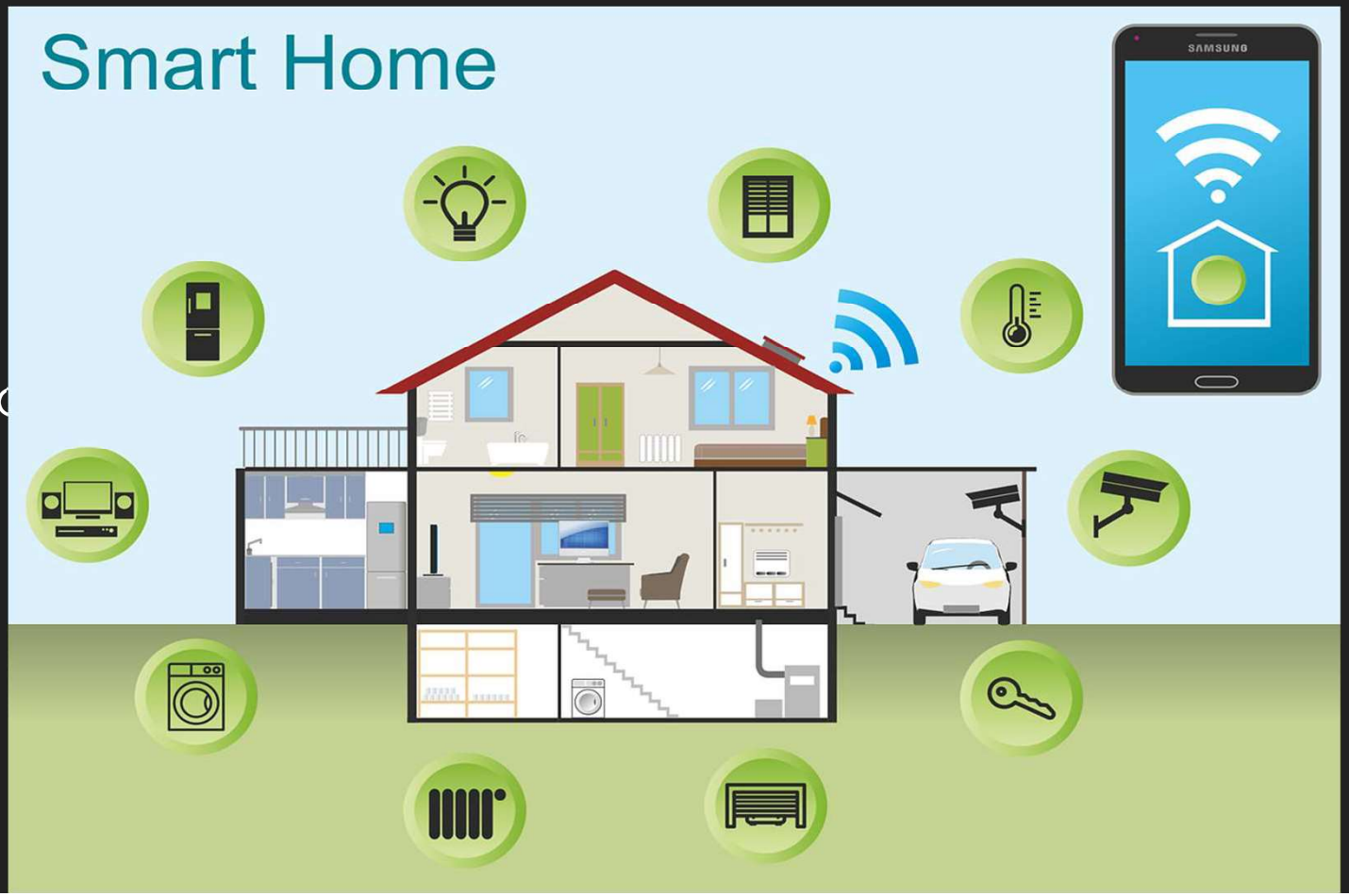



Internet of Things Landscape 2016
Applications (Verticals)
Personal
Wearables
Fitness
Health
Entertainment
Family
Sports
Toys
Elderly
Home
Automation
Hubs
Security
Kitchen
Sensing
Consumer Robotics
Pets
Garden
Trackers
Vehicles
Automobiles
Autonomous
UAVs
Space
Bicycles / Motorbikes
Enterprise
Healthcare
Retail
Payments / Loyalty
Smart Office
Agriculture
Infrastructure
Industrial Internet
Machines
Energy
Supply Chain
Robotics
Industrial Wearables
Platforms & Enablement (Horizontals)
Platforms
Software
Full Stack
Developer
Analytics
Sensor Networks
Connectivity
Security
Open Source
Interfaces
Virtual Reality
Augmented Reality
Other
3D
Printing / Scanning
Content / Design
Building Blocks
Hardware
Processors / Chips
Sensors
Parts / Kits
Charging
Software
Cloud
Mobile OS
Connectivity
Protocols
2G 3G 4G LTE 6LoWPAN LWM2M DDS LIDAR
M2M
WiFi
Telecom
Consultants / Services
Alliances
Partners
Retail
Manufacturing
Incubators
Funding
© 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 condition Unit
- Refrigerated truck
- Home security systems
- Sensors, switches, actu



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

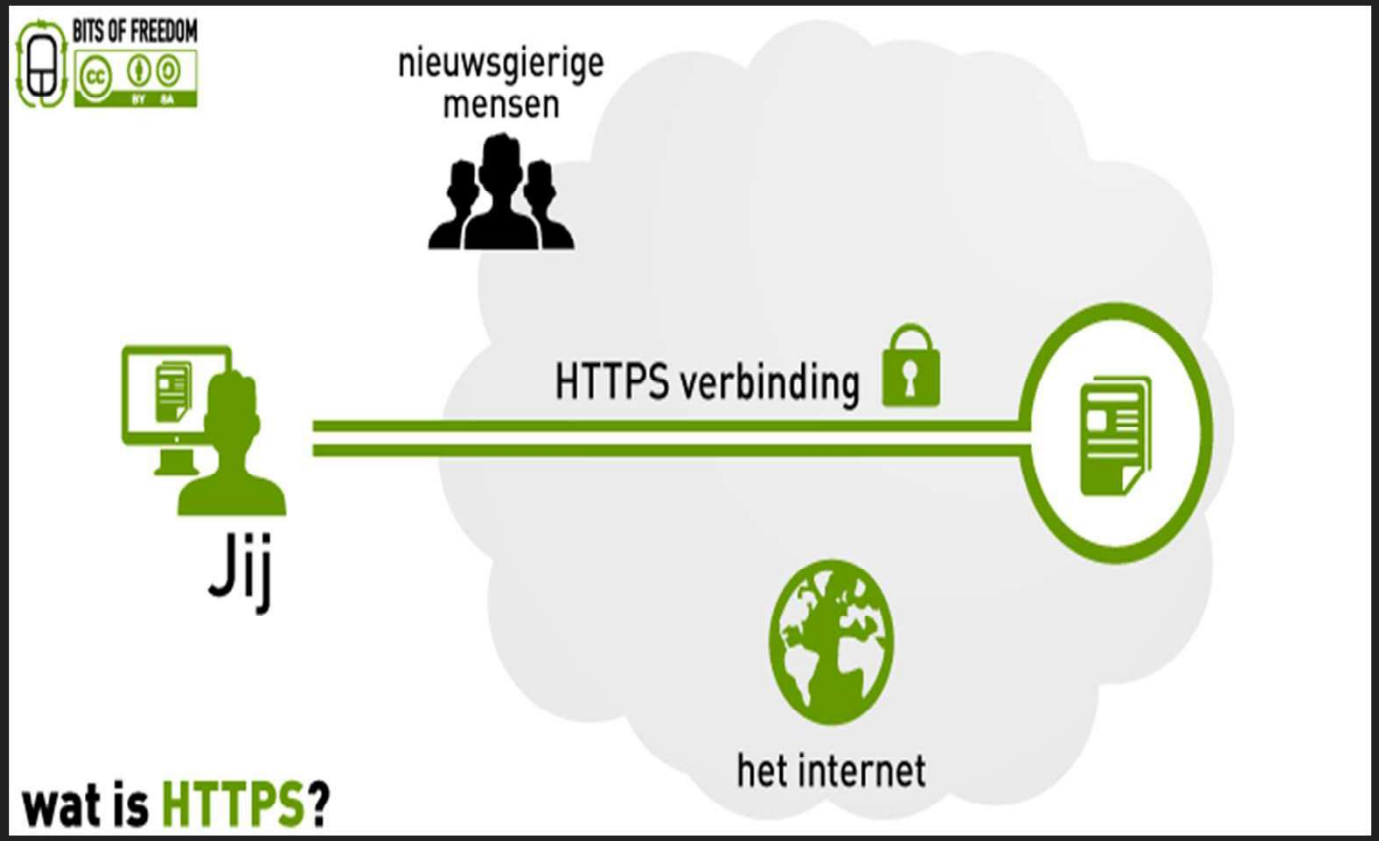
```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml" xml:lang="en" lang="en" dir="ltr">
        <head>
                <meta http-equiv="Content-Type" content="text/html; charset=utf-8" />
                        <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

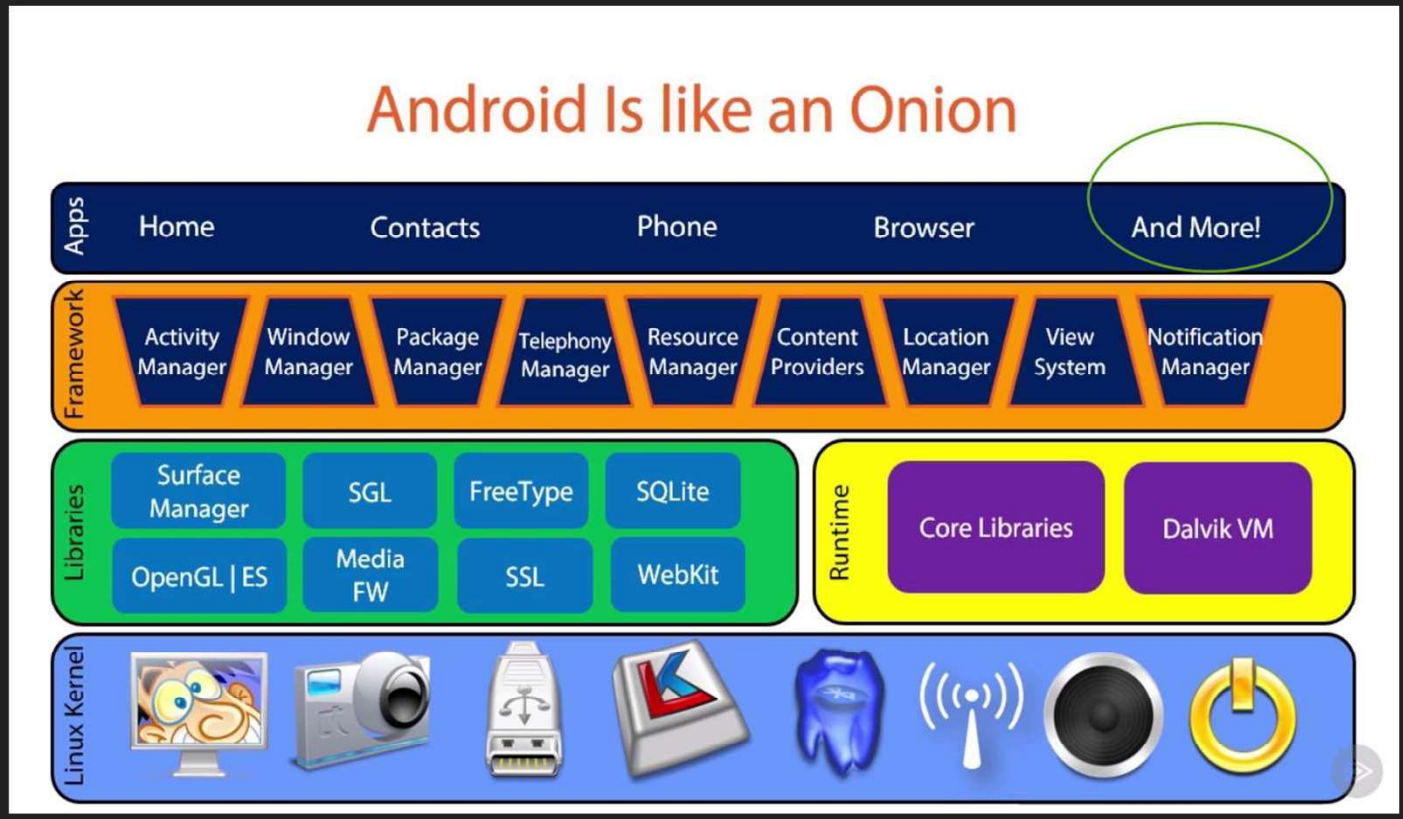
Api Testing

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

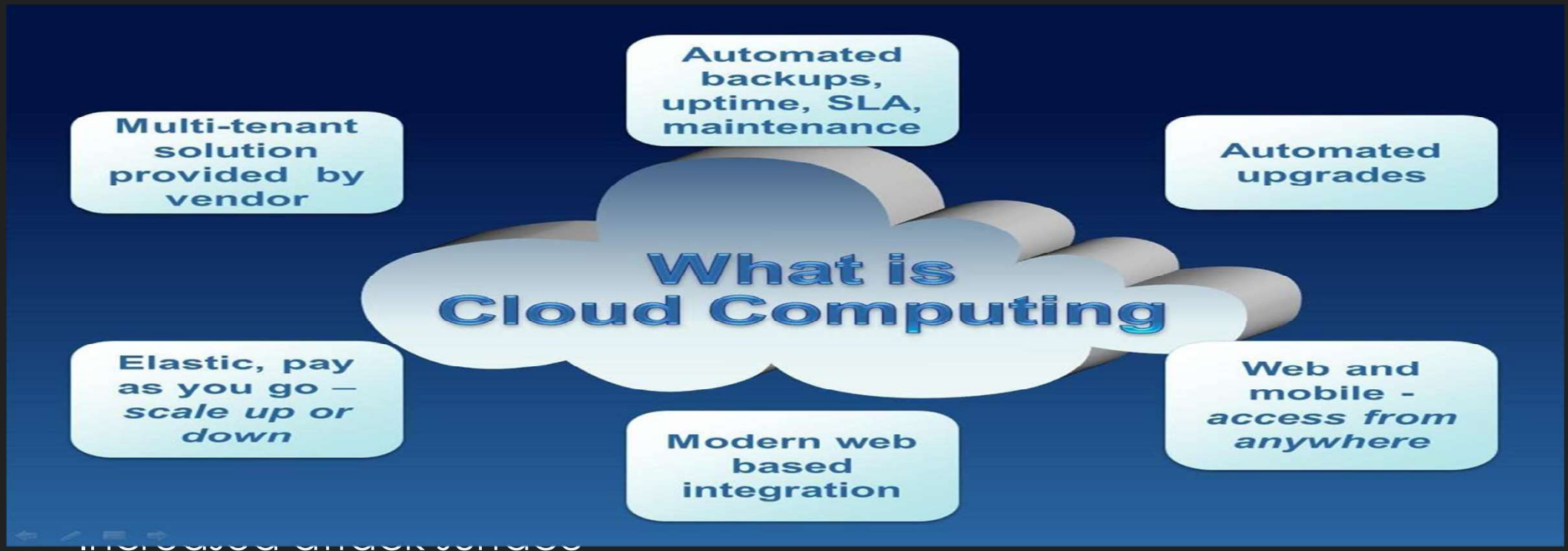


Mobile devices

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



The Cloud


What is Cloud Computing
Automated backups, uptime, SLA, maintenance
Multi-tenant solution provided by vendor
Automated upgrades
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

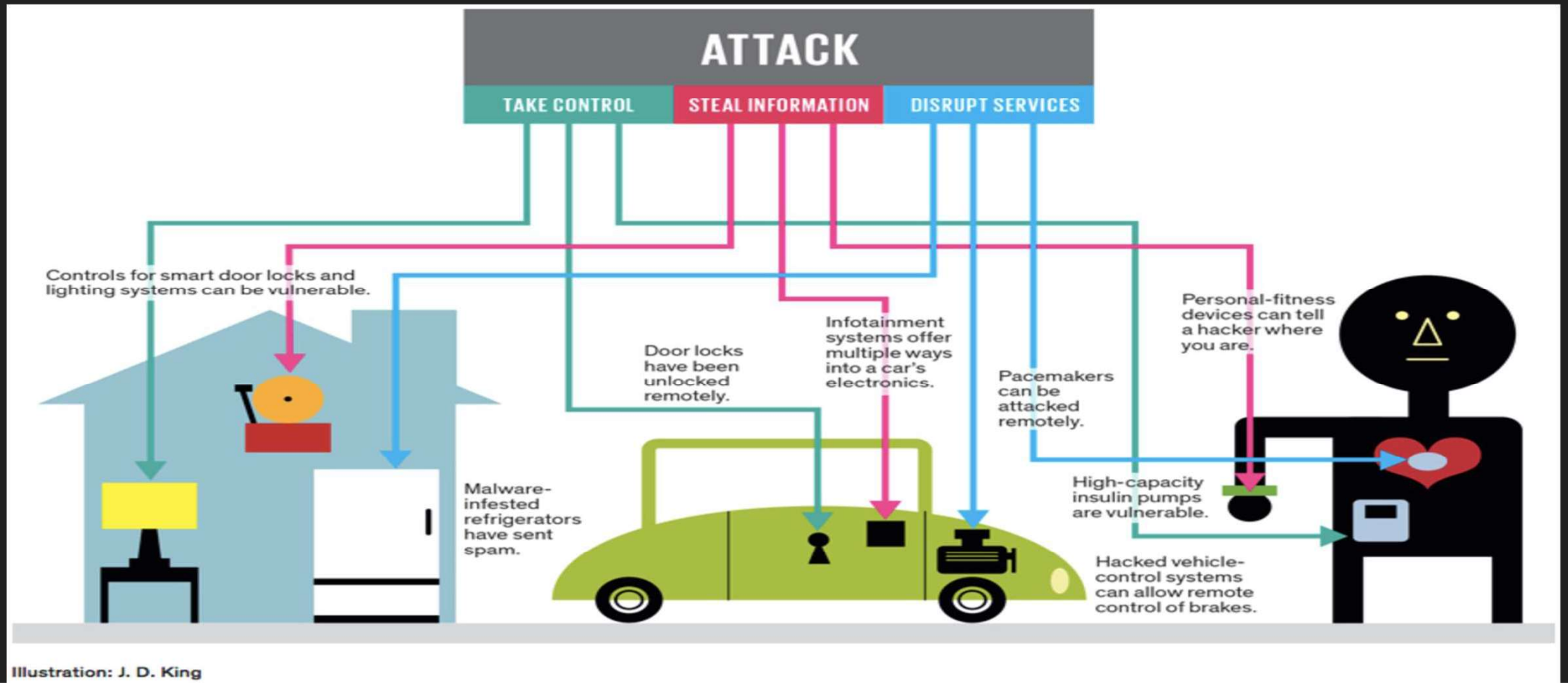


Illustration: J. D. King

Availability & Reliability

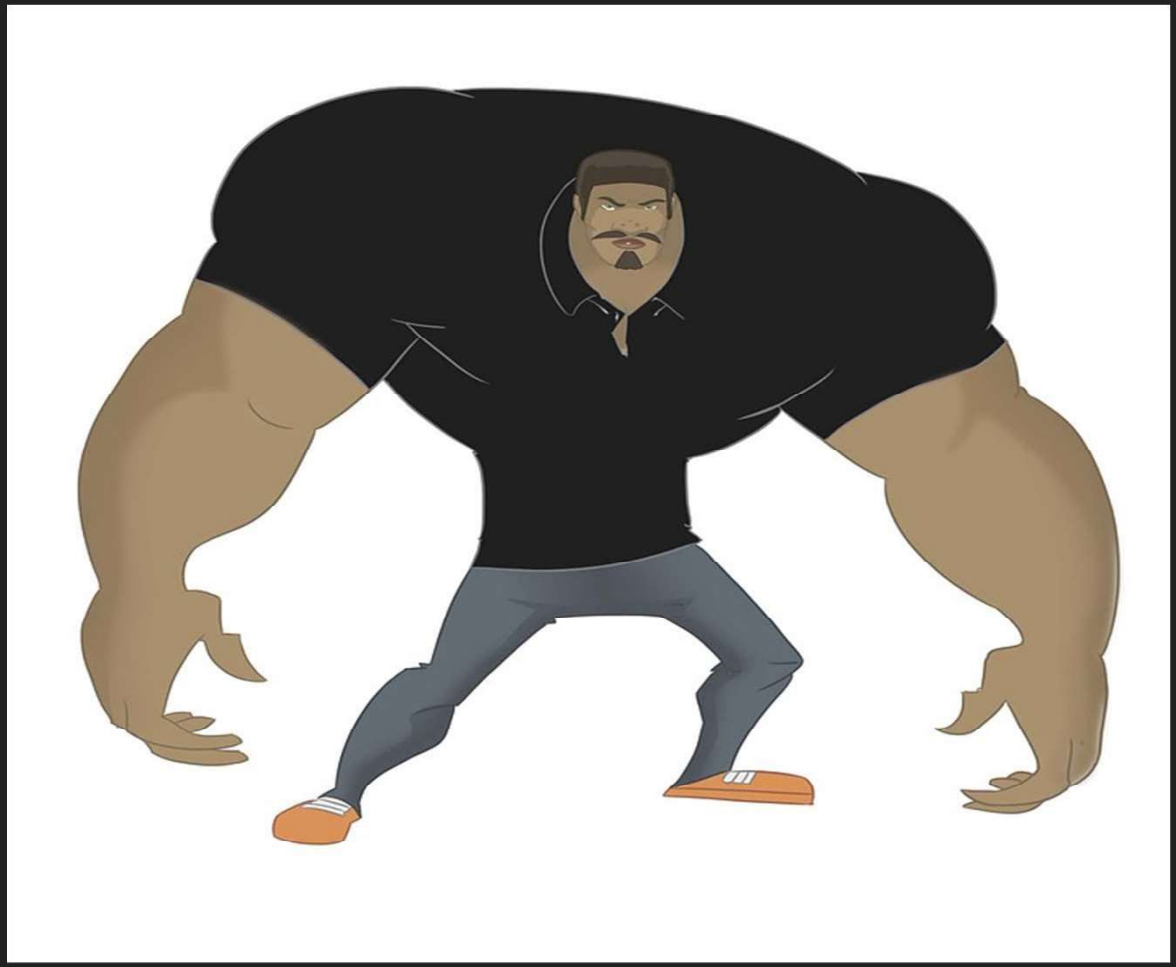
- Remote
- Moving
- Low battery
- Rely on wireless

Safety

- Irresponsible operators >>
- Decoupling the fate of the driver/pilot from that of the passengers
- Unattended devices & 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’

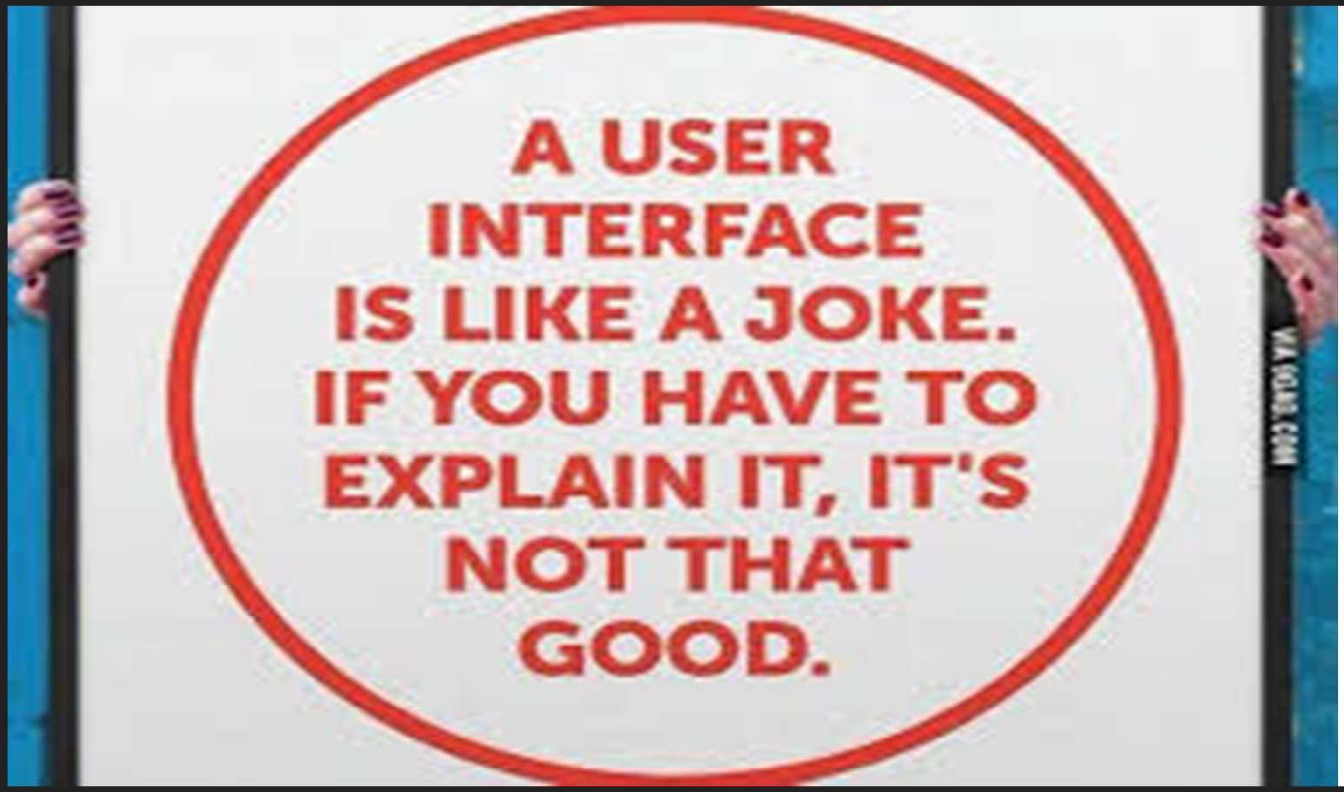
- Drive the truck
- Fly the drone
- Go at sea
- Physical ‘things’

Service virtualization

Security/Penetration testing

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

User Experience!



“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.”…..

“The entire setup process felt absurd. ---. The user experience will need to improve, especially for lower-cost devices, so that they are truly plug-and-play.”

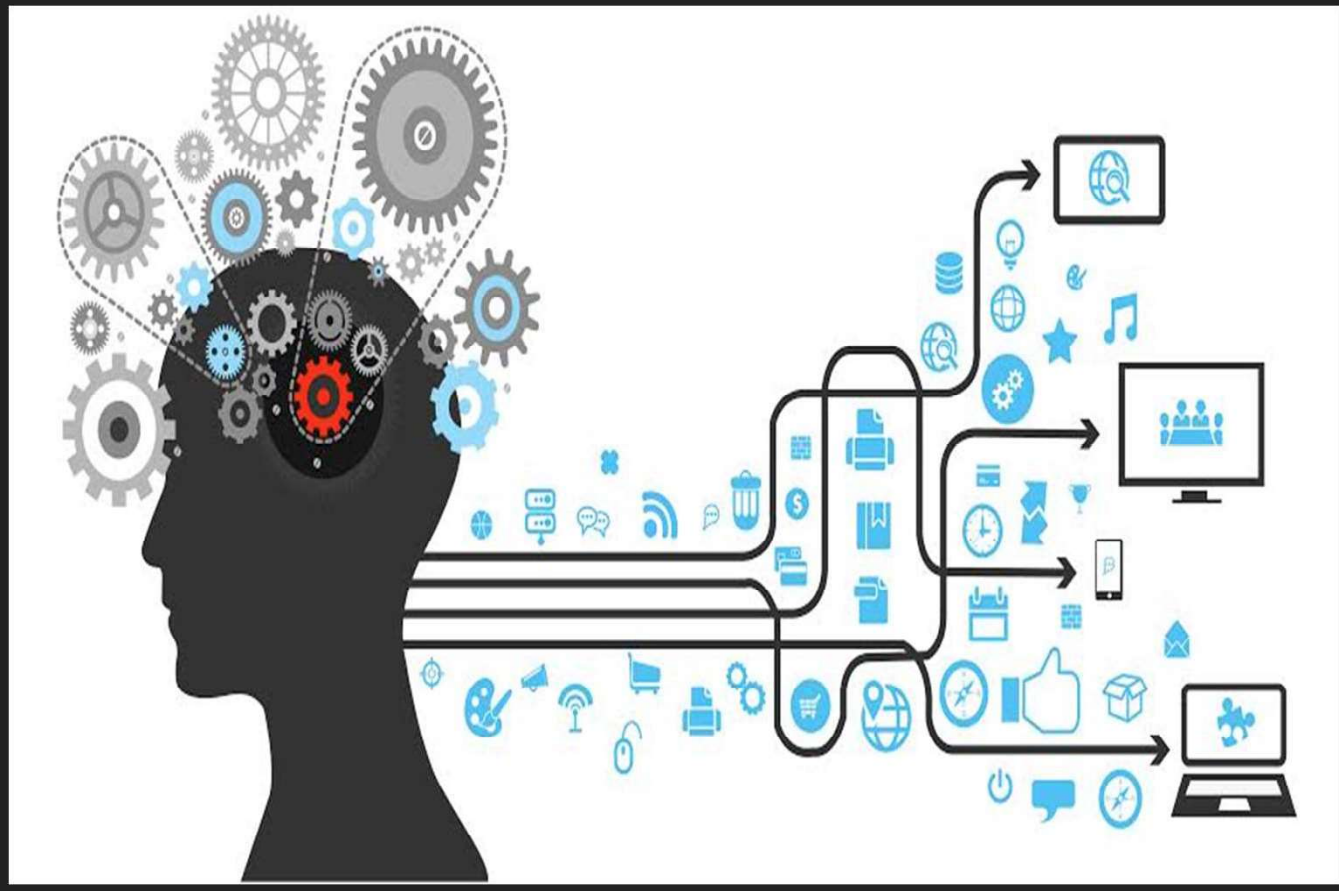
David Berkowitz

So what? For testers?

- 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 open-source
  - GUI based (Postman, Fiddler, etc.)
  - code-based 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

References

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