Project GRACE

- Towards a Secure Internet -

Dr. KangWei Woo
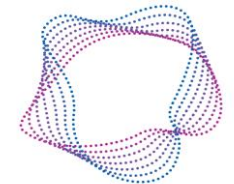
Executive Director, QuantumCIEL
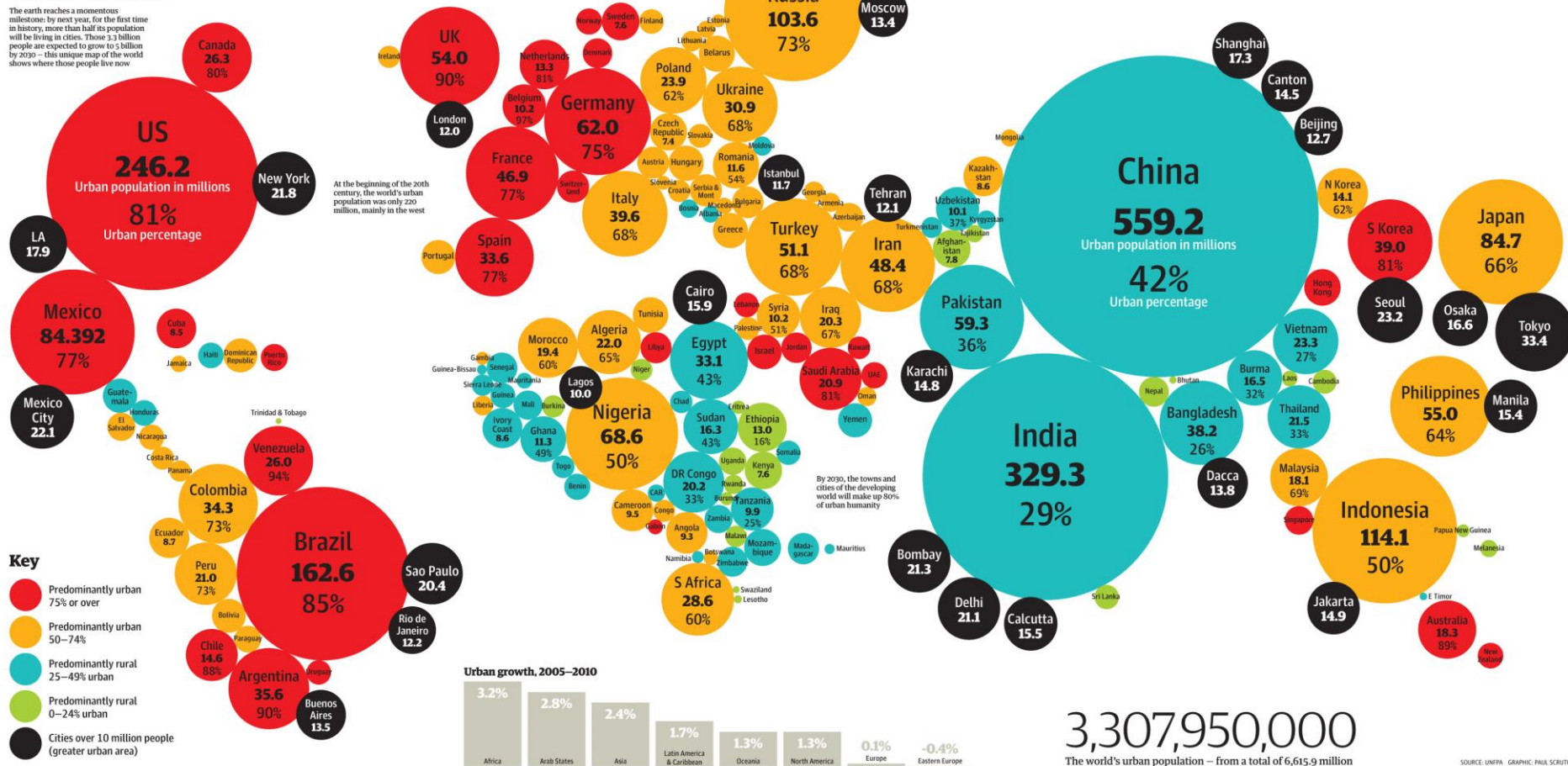
20 June 2018

Team Members

What Issues Are We Addressing?

Half the world's population currently lives in cities.

By 2030 **80% of the world's population** will live in cities.

Source: United Nations Population Fund

The new urban world

The earth reaches a momentous milestone: by next year, for the first time in history, more than half its population will be living in cities. Those 3.3 billion people are expected to grow to 5 billion by 2030 — this unique map of the world shows where those people live now

At the beginning of the 20th century, the world's urban population was only 220 million, mainly in the west

By 2030, the towns and cities of the developing world will make up 80% of urban humanity

US 246.2 Urban population in millions 81% Urban percentage — LA 17.9 — New York 21.8

Canada 26.3 80%

Mexico 84.392 77% — Mexico City 22.1 — Cuba 8.5 — Haiti — Dominican Republic — Puerto Rico — Jamaica — Guatemala — Honduras — El Salvador — Nicaragua — Costa Rica — Panama — Trinidad & Tobago

Venezuela 26.0 94% — **Colombia** 34.3 73% — Ecuador 8.7 — **Peru** 21.0 73% — Bolivia — Paraguay — **Brazil** 162.6 85% — Sao Paulo 20.4 — Rio de Janeiro 12.2 — **Chile** 14.6 88% — Uruguay — **Argentina** 35.6 90% — Buenos Aires 13.5

UK 54.0 90% — London 12.0 — Ireland — Netherlands 13.3 81% — Belgium 10.2 97% — Denmark — Norway — Sweden 7.6 — Finland — Estonia — Latvia — Lithuania — Belarus — **Germany** 62.0 75% — Poland 23.9 62% — Czech Republic 7.4 — Slovakia — Austria — Hungary — Switzerland — **France** 46.9 77% — **Italy** 39.6 68% — Slovenia — Croatia — Serbia & Mont — Bosnia — Albania — Macedonia — Bulgaria — Greece — **Spain** 33.6 77% — Portugal

Russia 103.6 73% — Moscow 13.4 — **Ukraine** 30.9 68% — Moldova — Romania 11.6 54% — Istanbul 11.7 — Georgia — Armenia — Azerbaijan — Mongolia — Kazakhstan 8.6 — Uzbekistan 10.1 37% — Kyrgyzstan — Tajikistan — Turkmenistan — Afghanistan 7.8 — **Tehran** 12.1 — **Turkey** 51.1 68% — **Iran** 48.4 68%

Shanghai 17.3 — Canton 14.5 — Beijing 12.7 — **China** 559.2 Urban population in millions 42% Urban percentage — Hong Kong — N Korea 14.1 62% — **S Korea** 39.0 81% — Seoul 23.2 — **Japan** 84.7 66% — Osaka 16.6 — Tokyo 33.4

Pakistan 59.3 36% — Karachi 14.8 — Nepal — Bhutan — **India** 329.3 29% — **Bangladesh** 38.2 26% — Dacca 13.8 — Bombay 21.3 — Delhi 21.1 — Calcutta 15.5 — Sri Lanka — **Vietnam** 23.3 27% — Burma 16.5 32% — Laos — Cambodia — **Thailand** 21.5 33% — Malaysia 18.1 69% — Singapore — **Philippines** 55.0 64% — Manila 15.4 — **Indonesia** 114.1 50% — Jakarta 14.9 — Papua New Guinea — Melanesia — E Timor — **Australia** 18.3 89% — New Zealand

Cairo 15.9 — **Morocco** 19.4 60% — **Algeria** 22.0 65% — Tunisia — Libya — **Egypt** 33.1 43% — Lebanon — **Syria** 10.2 51% — Palestine — Israel — Jordan — **Iraq** 20.3 67% — Kuwait — **Saudi Arabia** 20.9 81% — UAE — Oman — Yemen — Niger — Gambia — Senegal — Guinea-Bissau — Mauritania — Sierra Leone — Guinea — **Lagos** 10.0 — **Nigeria** 68.6 50% — Liberia — Ivory Coast 8.6 — Mali — Burkina — **Ghana** 11.3 49% — Togo — Benin — Chad — **Sudan** 16.3 43% — Eritrea — **Ethiopia** 13.0 16% — Somalia — Uganda — Kenya 7.6 — **DR Congo** 20.2 33% — Rwanda — Burundi — Cameroon 9.5 — Congo — Gabon — CAR — **Tanzania** 9.9 25% — Zambia — Malawi — Angola 9.3 — Namibia — Botswana — Zimbabwe — Mozambique — Madagascar — Mauritius — **S Africa** 28.6 60% — Swaziland — Lesotho

Key
- Predominantly urban 75% or over
- Predominantly urban 50–74%
- Predominantly rural 25–49% urban
- Predominantly rural 0–24% urban
- Cities over 10 million people (greater urban area)

Urban growth, 2005–2010

3.2%	2.8%	2.4%	1.7%	1.3%	1.3%	0.1%	-0.4%
Africa	Arab States	Asia	Latin America & Caribbean	Oceania	North America	Europe	Eastern Europe

3,307,950,000
The world's urban population — from a total of 6,615.9 million

SOURCE: UNFPA   GRAPHIC: PAUL SCRUTON

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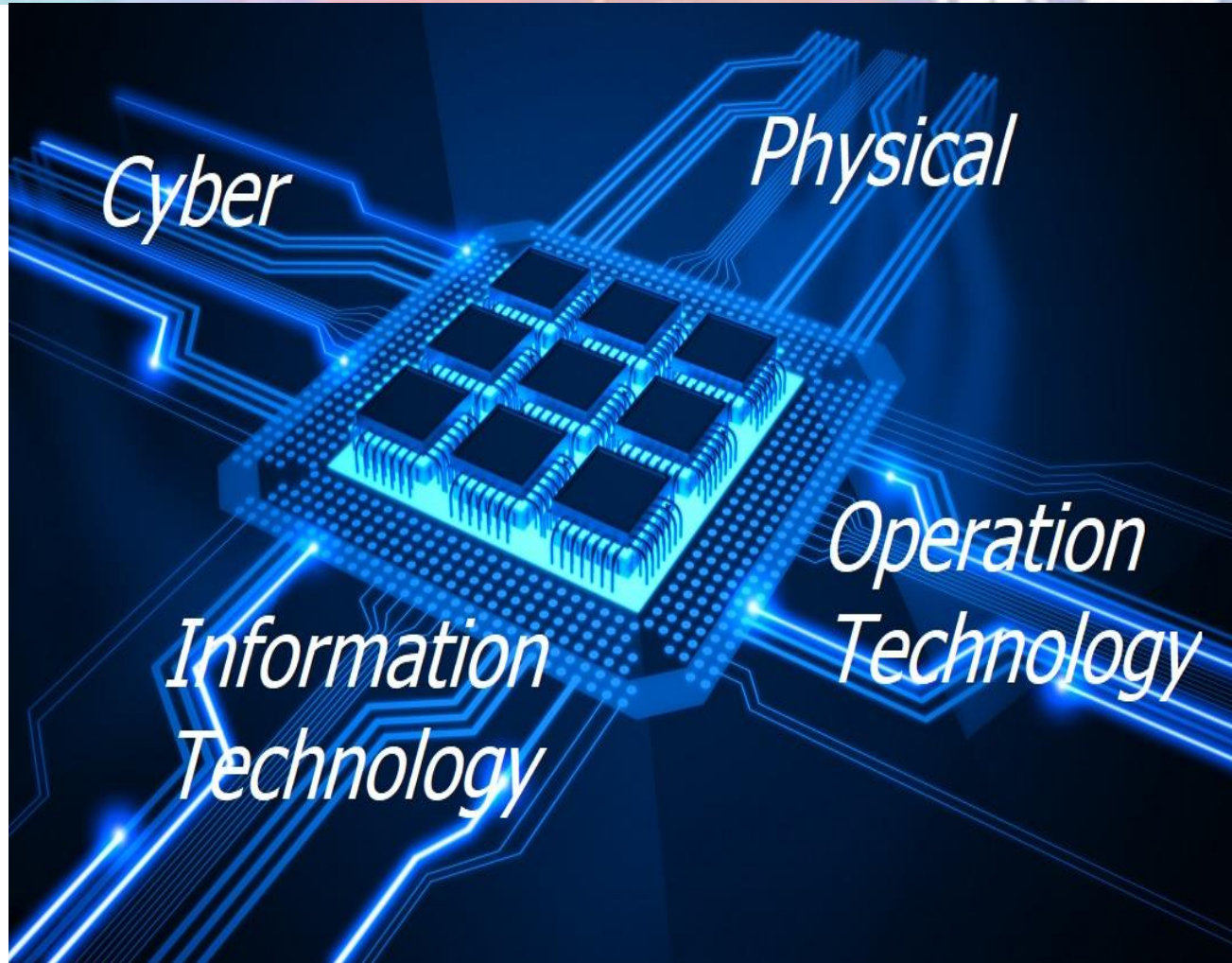GLOBAL CITY TEAMS CHALLENGE

Waseda-IAC International e-Government Ranking

No	Total Rankings	Score
1	Singapore	91.057
2	Denmark	88.739
3	USA	87.117
4	Japan	81.236
5	Estonia	81.198
6	Canada	77.425
7	New Zealand	75.041
8	South Korea	74.828
9	UK	74.214
10	Taiwan	73.224

The Waseda University Institute of e-Government (Prof. Dr. Toshio OBI, Director) has released the results of the 2017 Waseda-IAC International e-Government ranking survey, the 13th annual edition.

Reference: https://www.waseda.jp/top/en-news/53182

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GLOBAL CITY TEAMS CHALLENGE

At the Digital Crossroads…

Not Sharing?

New Sharing Economy
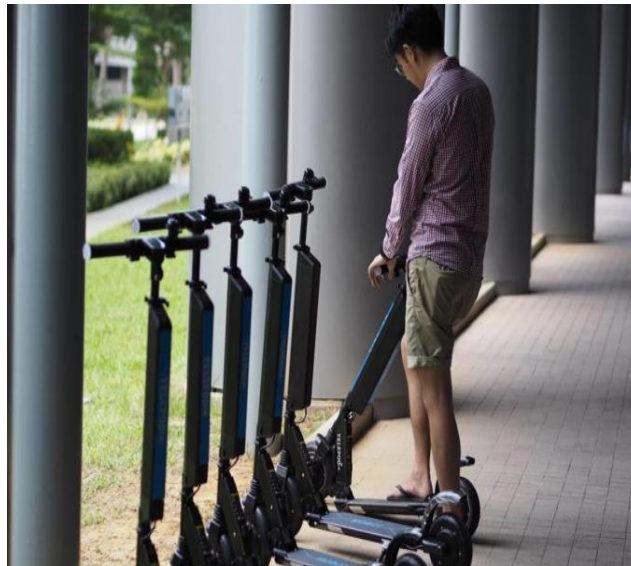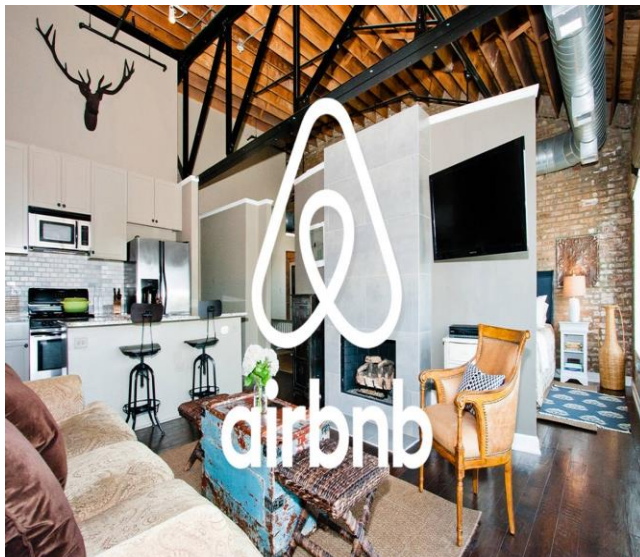
Spatial-temporal Sensitivity

Sharing Is Rooted In TRUST

Slow Moving IoT

Faster Moving IoT

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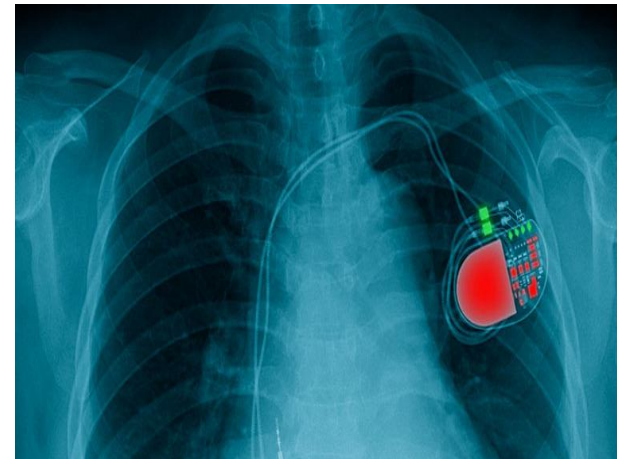
GLOBAL CITY
TEAMS CHALLENGE

Global City Teams Challenge 2018

- Project GRACE is an Action Cluster, representing Singapore. Participating in the Wireless Supercluster where the members have sustained interests in municipal Wifi projects.

- GRACE-enabled smart metering over public (Wifi) networks to mitigate security challenges of the smart grid.

- Counter-measure against time spoofing. Future work – counter-measure against location spoofing.

- Secure and portable. VIBE inside Secure Element (SE). MicroSD form factor.

QuantumCIEL GLOBAL CITY TEAMS CHALLENGE

The GRACE Advantage

- Asymmetric encryption with certificate-less key management.

  - Simple – no certificate and revocation lists.
  - Scalable – O (N) complexity vs O (N^2) for PKI. N is the number of devices.
  - Secure – protect the keys, the device, the system.

- Authentication at the application layer.

  - Completely P2P, resistant to Man-in-The-Middle attacks.
 - GRACE-enabled TLS 1.2.

GRACE Secures the Vulnerable Systems

- The Secure World consists of the Secure Element (SE), the Trusted Execution Environment (TEE), and the Trusted Applications.

- GRACE secures the keys and the device.

- Keys are stored in the SE.

- Crypto functions are computed in the SE.

User World

Rich OS Applications

TEE Client API

Rich OS

Secure World

Trusted Application

TEE Internal API

TEE Kernel

Hardware Platform

Secure Element (VIBE inside)

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TEAMS CHALLENGE
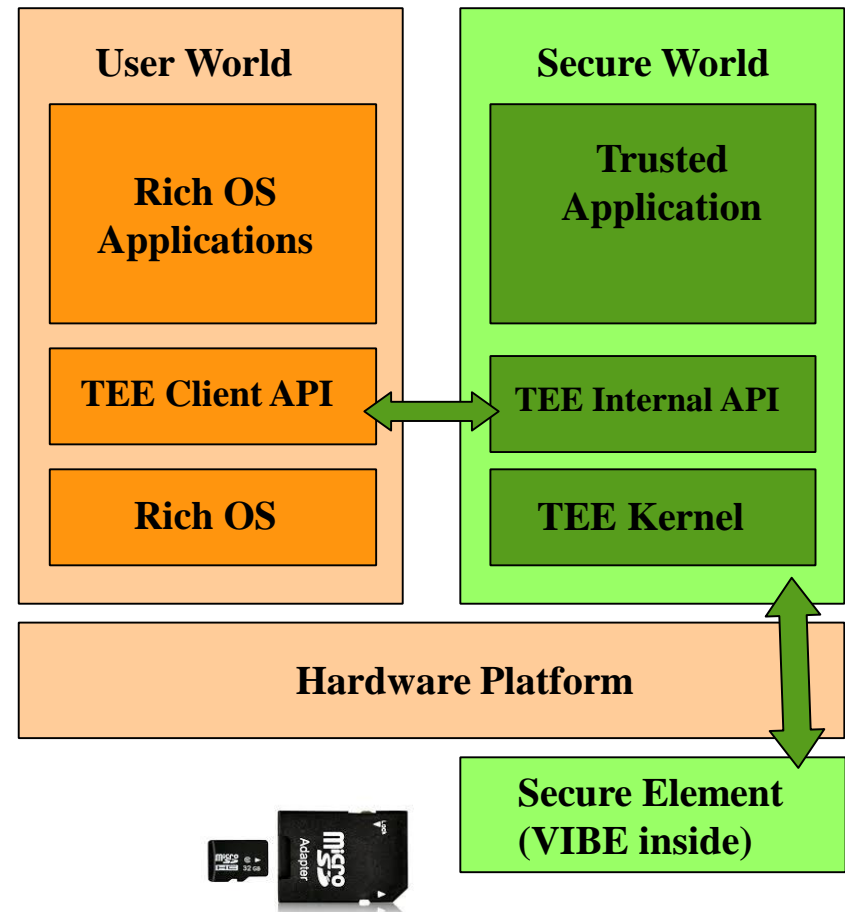
We DO The Impossible...

According to Pike Research (now Navigant Research), *end-to-end protection of private and commercial usage data is impossible*...until NOW.
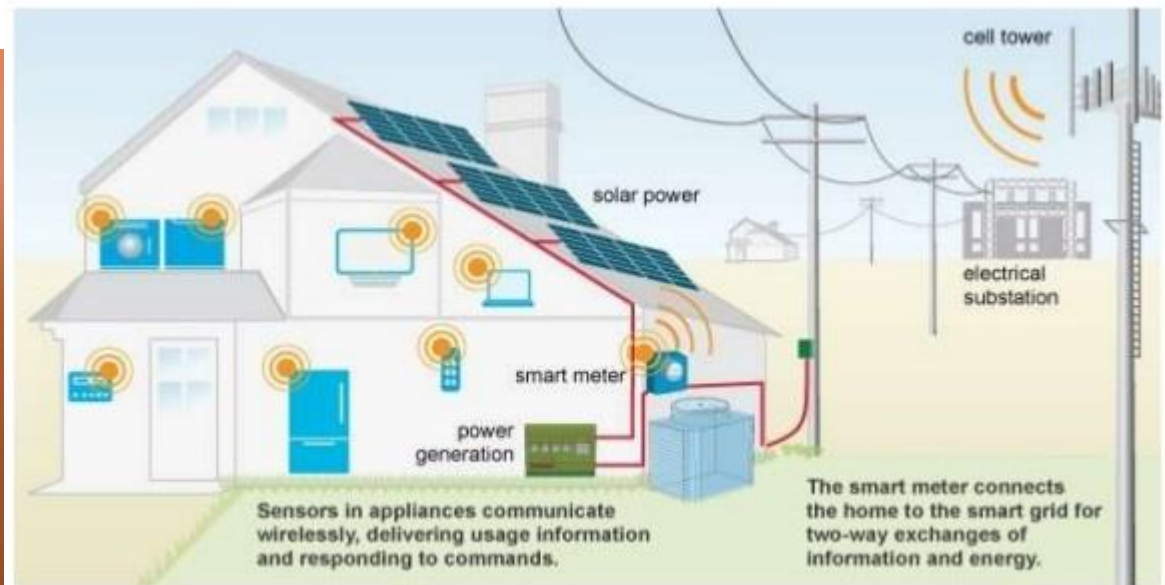
The secure Android app communicates with the smart meter over NFC.

THANK YOU

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