



Single Photon Technology for 21st Century Connectivity and Autonomy

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Princeton Lightwave Inc.

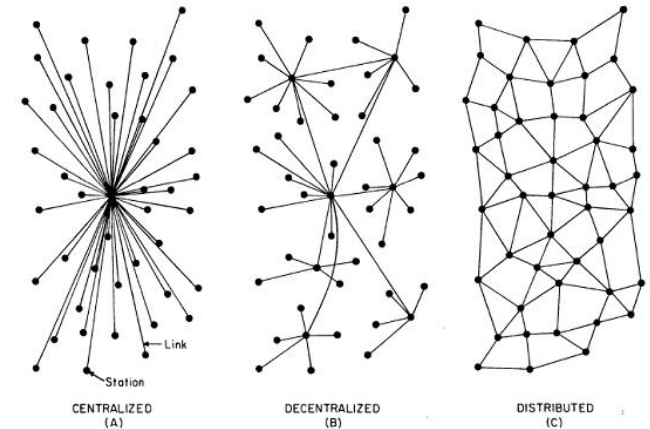
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21st century technology explosions

Connectivity of devices

Distributing information



Autonomy of devices

Collecting information

Processing information



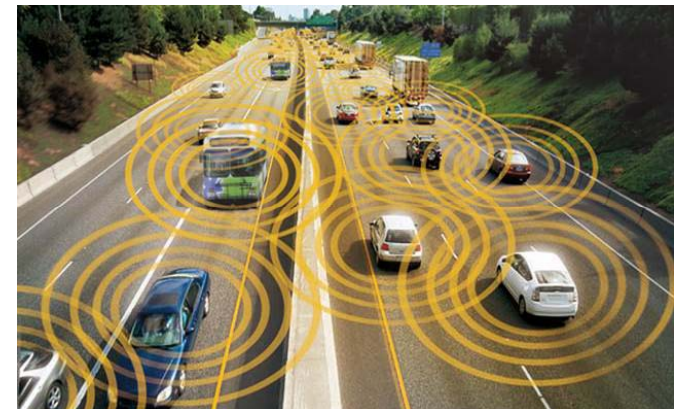
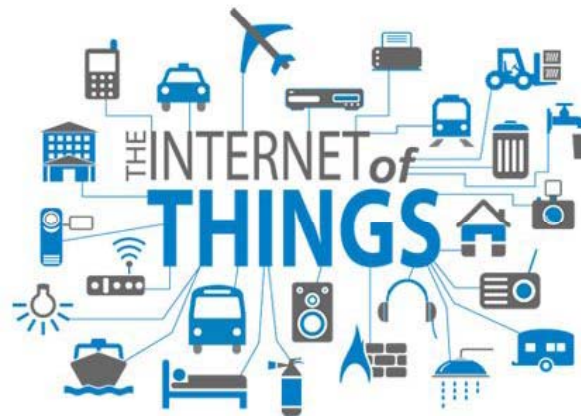
Device Connectivity

Distributing information with

High Performance

High Sensitivity, High Rate

Security (= Privacy)



Device Autonomy

Collecting information

Processing information

to achieve

Environmental Sensing / Situational Awareness



From 20th to 21st century challenges...

For **distributing** and **collecting** information:

RF (20th cent.)  Photonics (21st cent.)

Copper  Fiber

Radio  Free-space optics

Radar  LiDAR

Optical bandwidth \gg RF bandwidth
10,000 X

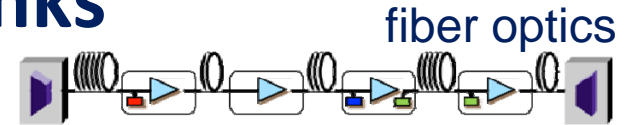
Maximum efficiency

Minimum power

using **single-photon technology**

Connectivity with Photonics:

20th cent.: “short” terrestrial links



21st cent.: long free space optical links

Expanding the internet

Sky-Fi

Apr 11, 2015

The
Economist

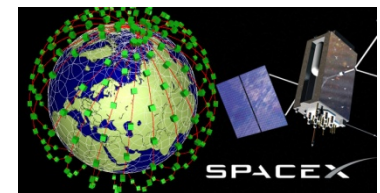
balloons



drones



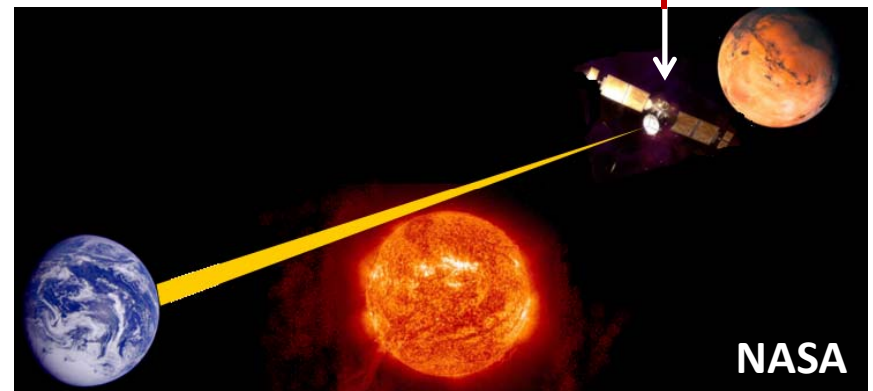
satellites



Networking the solar system!

Single-photon technology
for ultimate sensitivity

Princeton
Lightwave receiver



For Security / Privacy:

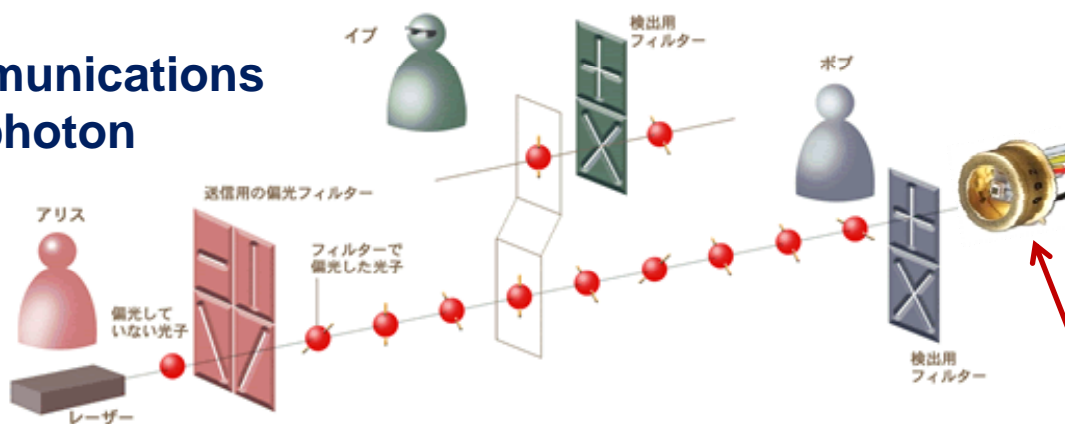
20th century:
security by inaccessibility



21st century:
security w/accessibility



Secure communications
with single-photon
technology
(QKD)



Princeton
Lightwave
single-photon
detector

For **Autonomy**:

Replace human sensors & computing... (20th cent.)



...with robotic sensors & computing (21st cent.)

“auto-mobile” → autonomous mobility

passive optical cameras

2D



radar (reflected radio waves)

low-res 3D



LiDAR (reflected light waves)

hi-res 3D

single-photon LiDAR w/ Princeton Lightwave detectors



Example: disruptive data collection

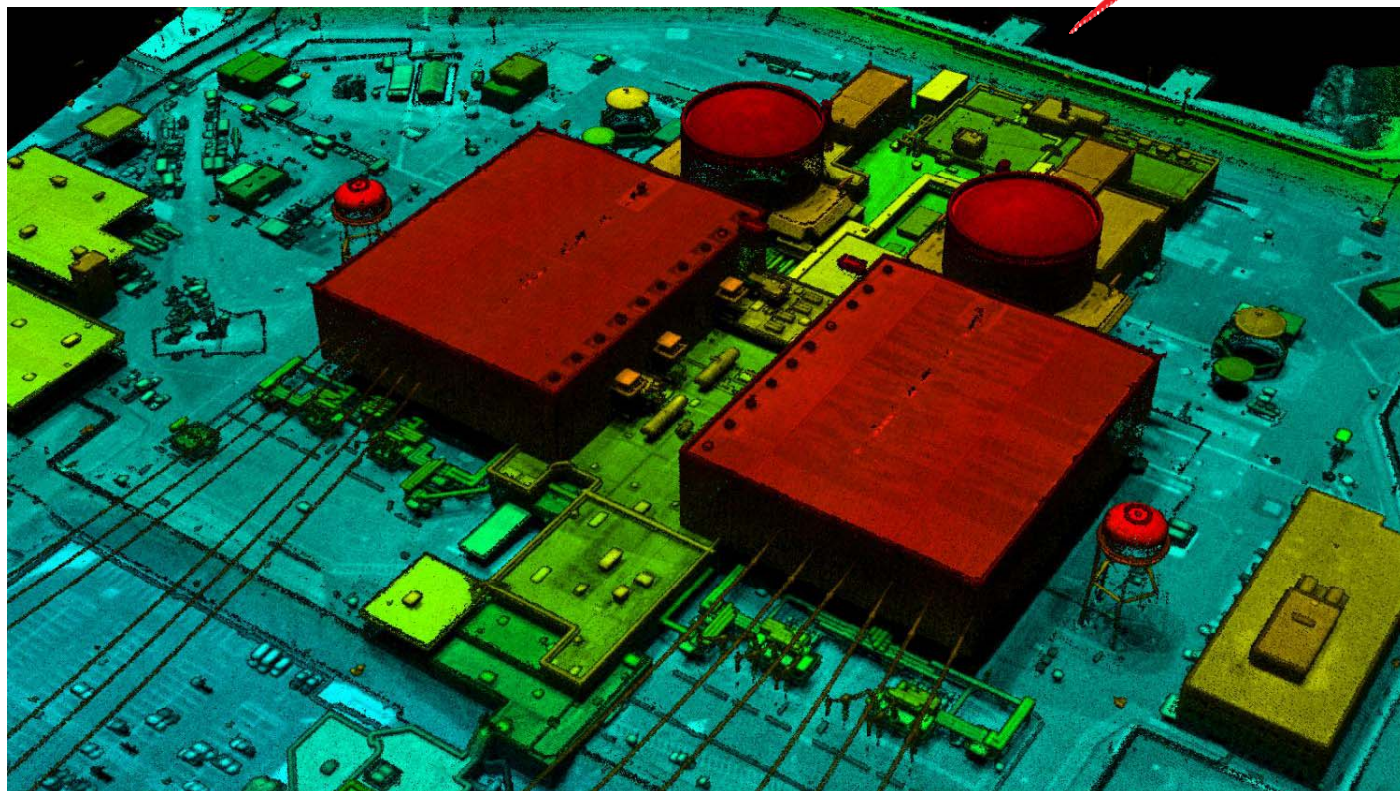
Environmental sensing by aerial mapping:

Single-photon 3D LiDAR imaging

enables 10X faster data collection than other technologies

data courtesy of **HARRIS**

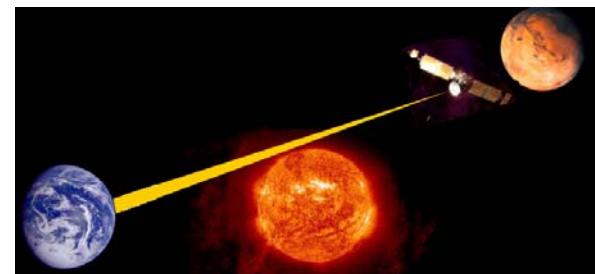
Princeton
Lightwave
single-photon 3D
LiDAR camera



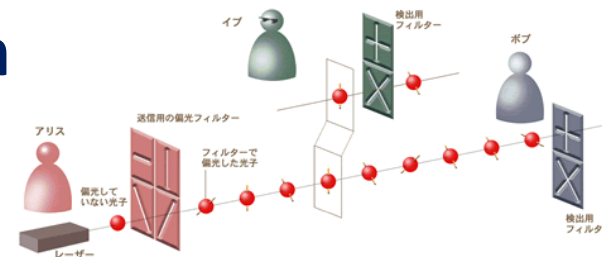
Photonics for 21st century challenges

Connectivity → Distributing information

High Performance: single-photon tech
 Long-distance communication



Security & Privacy: single-photon tech
 Quantum cryptography



Autonomy → Collecting/Processing information

Environmental sensing: single-photon tech
 3D LiDAR imaging

