

**Question**

Even with the adoption of 5G, it is expected that utilities will continue to adopt a mix of radio technologies for different purposes. Describe the differences, advantages, and disadvantages between 5G and other wireless radio technologies in the context of power utility use cases.

**Answer**

1. I will show you the two cases of utilizing different kinds of private radio technologies for labor-saving, and supporting efficient operations and maintenance at substations in Japanese EPUs.

Case 1 : Building private Wi-Fi networks in control houses at substations

In order to use substations as satellite offices, one EPU built private Wi-Fi networks in control houses at some substations as shown in Figure 1. These networks allowed us to make efficient use of time between projects such as when on patrol or performing inspections. In addition, since these Wi-Fi networks are directly connected to our private IP network, we can access our internal network with stable and congestion-free communications, even if a serious disaster occurs.

Comparison between Wi-Fi and 5G is shown in Table 1. The reasons why we selected Wi-Fi, not 5G, are as follows:

- ✓ Since there is no need to be licensed and no need to install another management system, such as a 5G Core network, it has a lower cost.
- ✓ Wi-Fi is a common wireless radio technology worldwide, so there are already many commercial devices to use.

Case 2 : Constructing private LTE networks outside the control house within the substation premises

This network is expected to utilize for transmission of still images of the analog meters on the substation equipment as shown in Figure 2. With this, automation of meter reading, data collecting and data analysing can be realized, and ultimately saving labor.

Characteristics of Private LTE are shown in Table 2. The following is the reasons why we chose Private LTE over 5G:

- ✓ Performance, such as transmission speed or latency etc., of Private LTE was sufficient for our needs.
- ✓ This type of Private LTE using 1.9GHz frequency bands, which is called sXGP standards in Japan, does not need to be licensed and it covers a larger area than 5G. Therefore Private LTE was less expensive than 5G and easier to construct.



Fig. 1 Private Wi-Fi networks in control houses

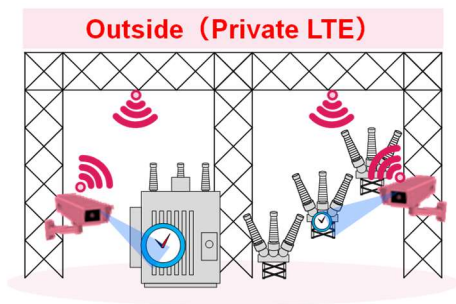


Fig. 2 Private LTE networks outside the control houses

Table. 1 Comparison between Wi-Fi and 5G

	Wi-Fi	5G
Transmission Speed	Slower than 5G	Fast
Latency	Higher than 5G	Low
Security Level	Lower	High
Licensing	No	Yes
Management System	No	Yes e.g. 5GC
Cost	Low	High
Compatible devices	Many	Less

Table. 2 Comparison between Private LTE and Private 5G

	Private LTE	Private 5G
Transmission Speed	Slower than 5G	Fast
Latency	Higher than 5G	Low
Security Level	High	High
Licensing	No (in Japan)	Yes
Cost	Low	High
Covered Range	Large	Small

2. When we think about which radio technology to use, first we need to clarify the problems to be solved, and then select the proper radio technology from the perspective of communication performance such as transmission speed, latency, quality, security, coverage area, etc. In addition, we also need to think about other factors such as public/private, required/not required to be licensed, costs, etc. Figure 3 is a concept image of radio technologies selection.

In the two cases we showed, we did not require 5G, so we chose different radio technology. However, in the future, in order to realize more efficient operations and maintenance, for example equipping multiple ultra-high definition cameras or automatic inspection robots to substations, then I'm convinced that 5G technology will be required.

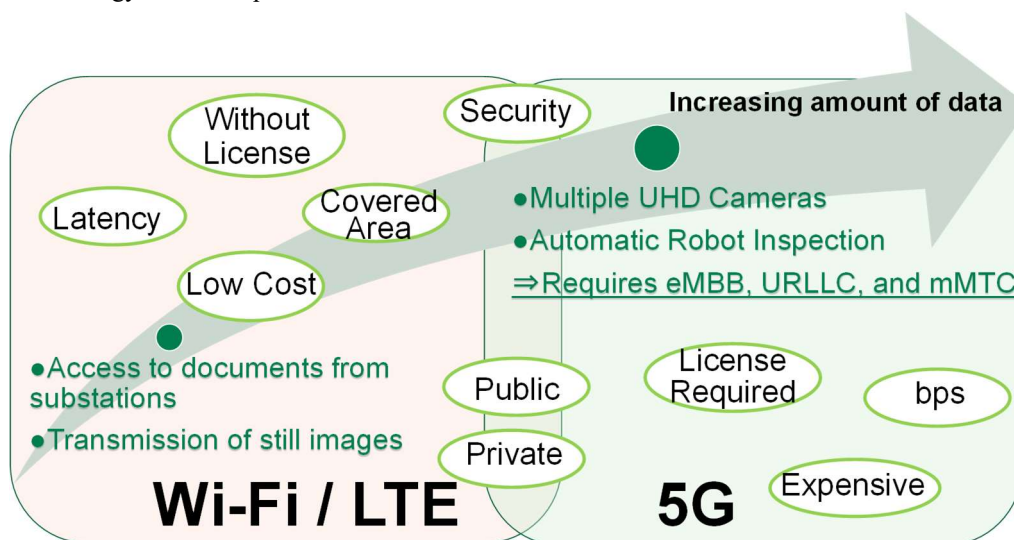


Fig. 3 Keywords for utilization of radio technologies