Study Committee D2

Information Systems and Telecommunication

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5G AND THE POWER SYSTEM APPLICATIONS REQUIREMENTS

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Motivation

- Recently, the development of the fifth generation of cellular networks (5G) brings aspects that suits the requirements of the electric power system more efficiently.
- This paper presents the applications in the electric power system that can be benefited by the 5G technology, mapping the communication requirements for each application.

Method

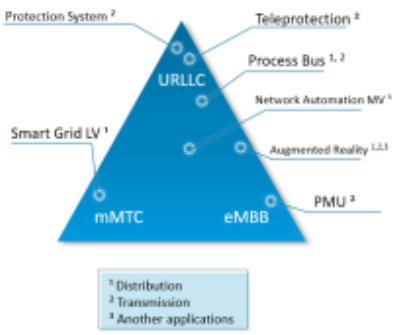
- In this work, a bibliographic review was carried out on the parameters and requirements of applications in the electricity sector.
- The survey of the Power System applications requirements is described in the following table:

	Data rate	Latency E2E	Reliability	Availability	Density of connection
Teleprotection	< 64 kbps	< 10 ms	99,999 %	99,999 %	Low
Process Bus: Analog signals	> 15 Mbps	3 - 10 ms	99,999 %	99,999 %	Low
Protection System	< 10 kbps	3 - 10 ms	99,999 %	99,999 %	Low
Phasor Measurement Units (PMU – Class M)	> 62 kbps	500 ms	99,000 %	99,98 %	High
Smart Grid in Distribution Field	1 kbps	< 1 s	-	99,897 %	High
Medium Voltage Network Automation	> 1 Mbps	< 50 ms	99,999 %	99,990 %	Medium
Augmented Reality	> 1 Gbps	<10 ms* <1 ms **	99,999 %	99,999 %	Low

* General Applications
** Critical Applications

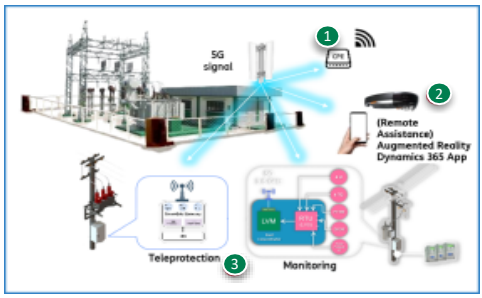
Discussion

- Given the survey, it was possible to classify each application among the service classes in which they best fit:



Proof of concept (PoC)

- Considering the potential applications for the 5G technology in the power system, a PoC has been implemented in a substation of Enel São Paulo Company, an electric power distribution company in the State of São Paulo – Brazil.



Stage	Description
1 Fixed Wireless Access	• Allow ultra-fast, low-latency connections with CPEs; • **Use case:** WiFi connection with câmeras/PC, smartphones and Smart Glasses.
2 Remote Assistance (Digital Twin)	• Enhance the infrastructure with 5G + AI connectivity to enable high-speed, low-latency connectivity • **Use Case:** Augmented Reality (AR) with App Dynamics 365 and Smart Glasses; Real-time remote assistency using smartphones.
3 Grid Automation (future)	• **Use case:** Distribution Transformer Sensor and Teleprotection of Automated Reclosers.

Setup	Max. DL Rate	Max. UL Rate	Latency
CPE – 5G	613 Mbps	40 Mbps	40 ms
5G – 5G	1231 Mbps	82 Mbps	43 ms
4G – 5G	50 Mbps	10 Mbps	40 ms

Conclusion

- The promises of 5G technology can offer an alternative to conventional networks used in Power System applications.
- More studies and tests need to be carried out to verify the compatibility of this technology and the fulfillment of application requirements.