

The panacea hybrid solution but not for site installation

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Typical fronthaul architecture

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Where hybrid infrastructure makes sense

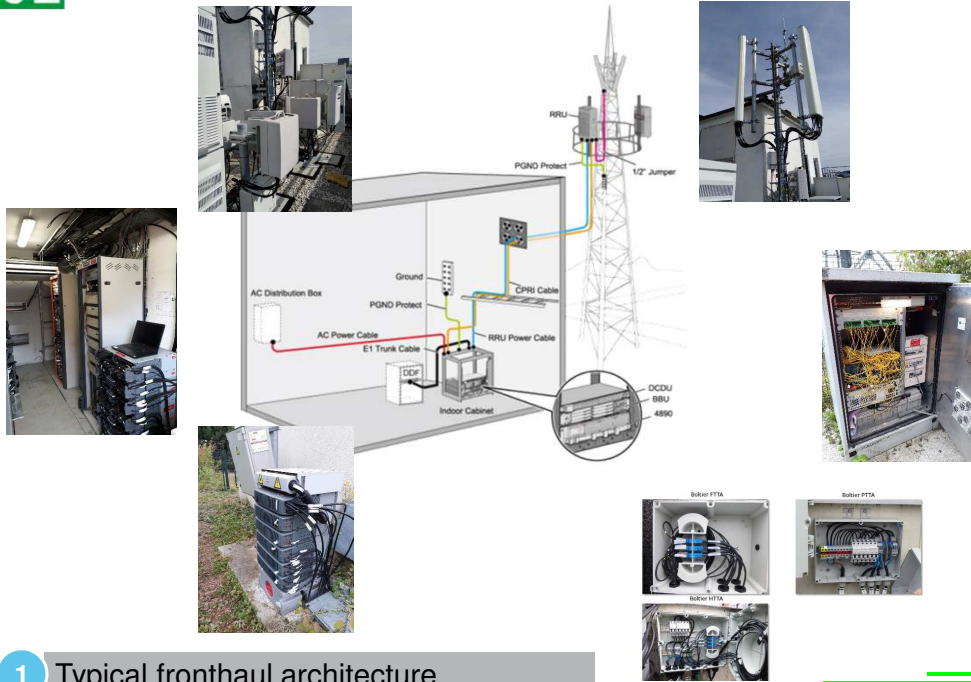
This presentation aims at highlighting cable infrastructure types where the use of hybrid cables makes sense and where it does not.

Section 1 describes the front haul options.

Section 2 addresses how 5G network will rollout and its different successive deployment phases.

Section 3 provides recommendations.

Multiple site configurations



1 Typical fronthaul architecture

The centered sketch represents a typical macro site architecture. This is a well know configuration since most of the tower macro sites, worldwide, are organised the same way. For rooftop sites, we may find different configurations, but the concept is the same.

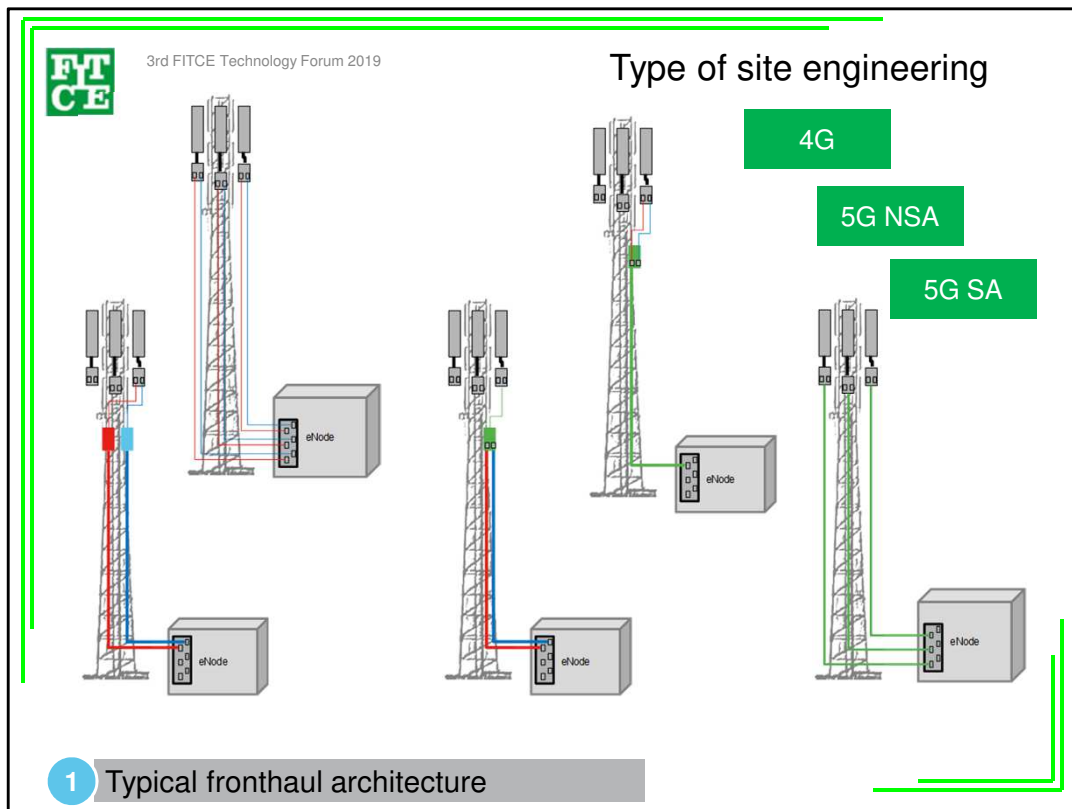
In real life, the sites are not so well organised and the various pictures illustrates this point.

Why? Mainly because macro sites are in limited number, difficult to acquire and costly to manage.

Thus, Mobile Network Operators (MNO) are re-using the same site for the successive small network upgrades: 2G to 3G, 4G, 5G, adding new microwave and routing equipment, sharing the site with another carrier... When the shelter is full, Telcos* start to add equipment outdoor and share the pole.

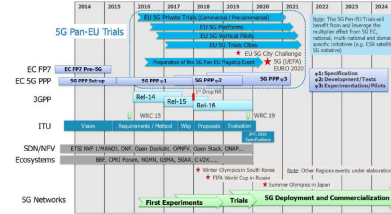
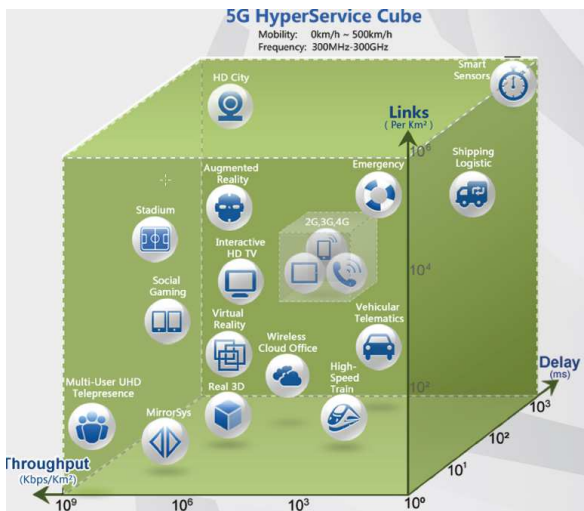
The last picture (on the middle right) shows a poorly managed outdoor cabinet.

*Telco = Telecom Operator



Looking deeper in the site configurations, we have seen different architectures when connecting the radio units to the antennas. The well known feeder solution is gradually being replaced by FTFA solutions. These FTFA solutions exist in various options: from the most economic one, made of a preterminated optical fibre cable and a raw power cable between the BBU and the RRU, up to the most sophisticated solution, made of preterminated hybrid cables (combining fibre and power in the same jacket) with outdoor plug&play solutions. We can find solutions with or without boxes on top of the tower. This is the current situation for 4G, and will still be the case for 5G networks.

The 5G promise

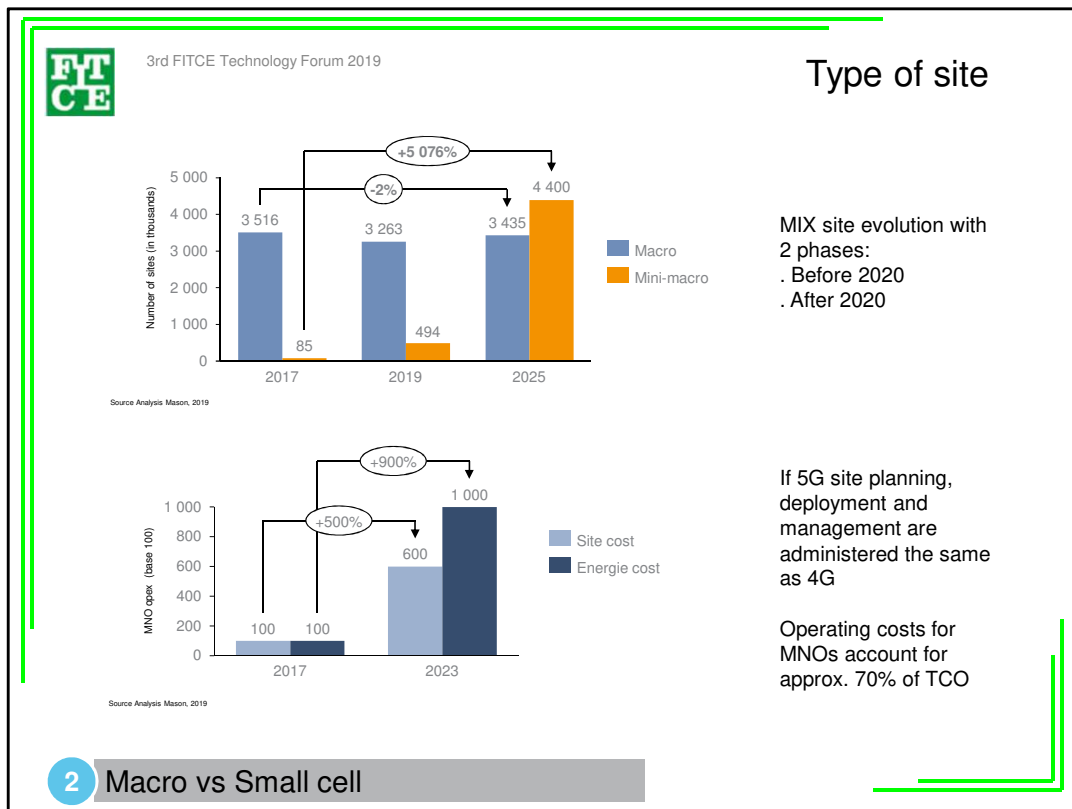


Coming back to the 5G promise and the magical triangle:

- Speed with Gbps at device level, for online gaming and video streaming
- Density with up to 1 million devices connected every 1km², for IoT applications
- Latency in the range of ms for critical applications, like autonomous vehicles and smart factories

The standardisation body for 5G, called 3GPP, has built a roadmap with key milestones and releases.

This roadmap, made in collaboration with the industry leaders, takes into consideration the time needed for developing the solutions, the required CAPEX and the implementation of successive releases to gradually bring to the market new opportunities and new use cases.



Looking at the successive deployment phases, I think that the 2 first waves are just ahead of us. But the deployment timing could be slightly different in each country, depending on the frequency allocation. For example, some countries in Europe have still not yet allocated these bands.

The first wave is currently ongoing, with Telcos installing low band RRU to deliver the 5G service: ultra mobile broadband. This is key as it will deliver to smartphone users a new experience with higher data rate. This will have an immediate impact on the consumer business. For this first wave, Telcos are re-using current macro-sites and upgrading the RRU with new features.

The upper graph shows clearly a stable situation in number of macro sites. After 2020 and probably after 2021, Telcos will start deploy small cells to densify the network.

Why? To address new use cases and some building situations, low band spectrum is not the appropriate solution: mid-band (approx. 3,4GHz) and high band (>26GHz) are required. But increasing the frequency, we reduce drastically the coverage, this is why we call them small cells.

The RRU and antenna are combined and the power consumption is lower, so the small cell site is far much simpler than a macro cell site. Small cells can be installed in a lot of different locations: building façade, bus shelter, light pole, traffic light pole, advertising pole...

Some analysts predict that if we deploy 5G in the same way we are currently deploying 4G networks, the site cost will increase by 500% and the power consumption will jump up by 900%. This is not sustainable, given that operating cost today accounts for approximately 70% of TCO* for MNOs.

*TCO = Total Cost of Ownership

Using hybrid makes life easy?



YES	NO
<p>For small cell</p> <ul style="list-style-type: none"> • Numerous sites • Proliferation of new type of site • Single antenna • Limited reconfiguration • Shared equipment / resources 	<p>For macro sites</p> <ul style="list-style-type: none"> • Tower and rooftop are existing sites • Limited number of new sites • Shared site with 2G, 3G, 4G, 5G... • Site survey? • Position of Data/DC plant equipment? • Extra length?



2 Macro vs Small cell

Having introduced the 5G network deployment options, let's come back to our initial concern: where and when to use hybrid solutions?

Hybrid solution seems an ideal approach and we can easily understand all the great benefits it provides:

- a single cable combining data and power transmission,
- easy and fast installation,
- plug & play solution when preterminated with outdoor connector.

But do not forget the macro site configuration and the need for evolution, for site sharing, for cable sharing...

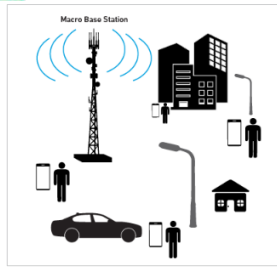
A macro site is definitely a site with a lot of successive evolutions, with a lot technical constraints: working on a pole requires skilled workforce, working on a rooftop requires specific building access, etc.

By experience we know that site surveys are difficult to run, and then hardly accurate, especially when it comes to cable lengths and exact position for the equipment.

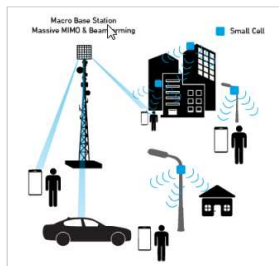
This is why hybrid solution is certainly not the right choice for macro sites.

Moreover, the use of pre-terminated cables requires a sophisticated supply chain to provide the exact length to a dedicated site. But it is more likely that extra length of cable will be delivered, resulting in extra cost and more installation job on site, not talking about the visual impact of cable loops on top or bottom of the tower. Some rooftop sites might have different considerations, but splitting on site the hybrid cable to connect on one side the data and on the other side the power is not as easy as it seems.

But for small cells deployments, hybrid solutions makes sense and may even be mandatory. Indeed, the installers are not numerous enough to massively deploy the thousands of needed antennas within the requested time limit. The plug&play solution addresses this concern. The site being much simpler, we could imagine a single hybrid connector at the small cell end to be plugged. If the site houses several small cells, hybrid outdoor termination is an easy solution (see the photo on the top). The cable is then blown or pulled back to the BBU station located few meters away.

**Macro**

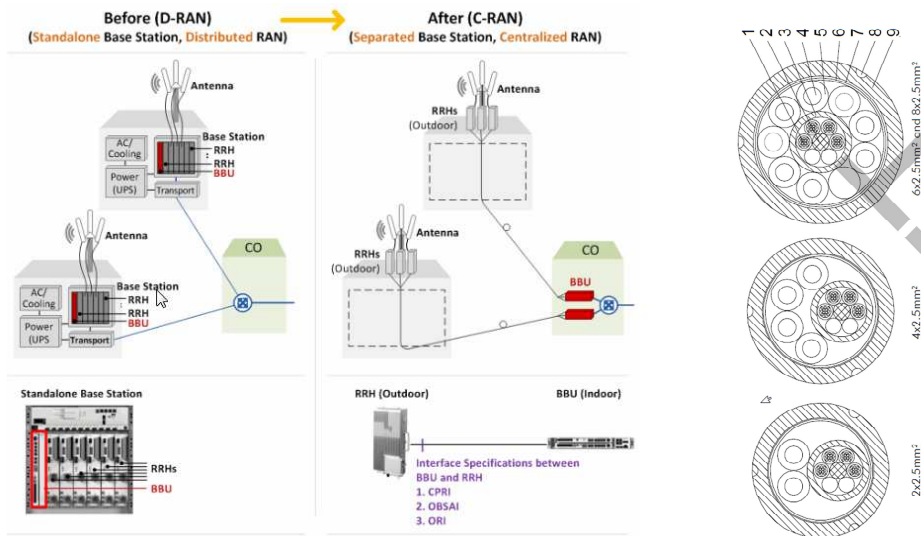
- Limited number of new sites
- Upgrade of existing sites
- Require multiple configurations
- High flexibility in number & performance
- Multiplication of equipment
- Site sharing
- Skilled workforce

**Small**

- Numerous new sites
- Speed of deployment
- Limited number of equipment
- Unskilled workforce

These 2 sketches represent a simplified version of a macro and a small cell sites.

Remote powering w/ C-RAN



3 Where hybrid infrastructure makes sense

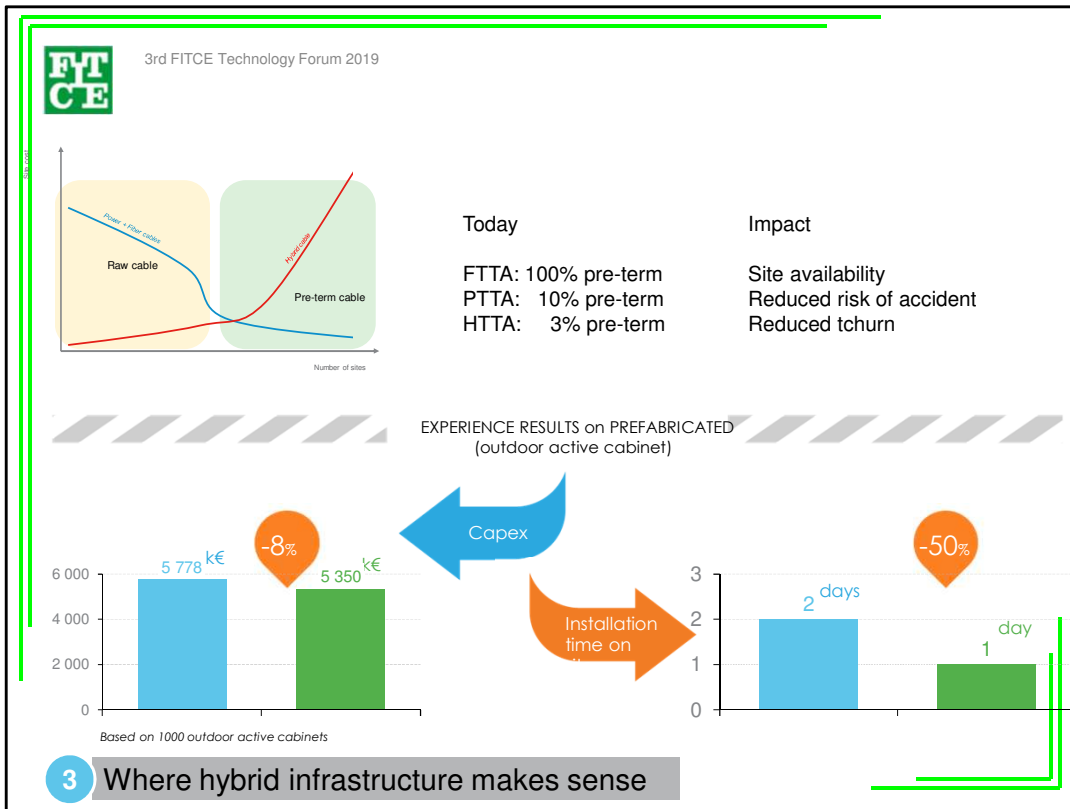
Keep in mind that 5G network architecture will be totally different than 4G, and remember that if we don't change, the TCO will be far too heavy.

One of the major architecture changes with 5G is the trend towards Centralised Radio Access Network. In this configuration, BBU are not anymore located at the base of the tower or close to the radio unit. Instead, BBU will be located in a central point (BBU station) where equipment and resources could be shared among several sites. This will bring significant savings, both in CAPEX and OPEX. Equipment could also be virtualised and cloud hosted.

Centralising the BBU brings another advantage: we could potentially remote power the RRU. Here comes additional savings in reducing monthly fees, having less equipment to buy, manage and maintain...

To remote power this equipment, the use of a hybrid cable is a great option, in particular for sites with well known power consumption: small cell site, outdoor cabinet.

At Nexans, we already have several solutions for duct and/or aerial configurations.



Our experience combined with our partner's shows that today, most of the macro sites are installed with non hybrid solutions. Preterminated cable is widespread for fibre to the antenna, while power cable is mainly supplied through raw cable on drum.






Since the number of small cell sites is growing, the use of hybrid preterminated cable impacts positively the site TCO.

We have a similar experience on other telecom equipment, like outdoor cabinets. Deploying a large number of active cabinets (including OLT or WDW or BBU equipment) significantly impacts the CAPEX.

The more obvious advantage is the site installation time reduction which can be cut by half. Great TCO impact!

Quickly installing the new equipment is a real challenge for MNOs to keep competitive advantage and thus generate revenue quicker, and reduce churn.

Conclusion

- ✓ 5G network will be made of **successive** deployment waves 
- ✓ Wave 1 is **4G-like**, with focus on macro sites 
- ✓ Hybrid is the solution where site evolution is **low** 
- ✓ Hybrid will be mandatory **tomorrow** for small cell 
- ✓ The challenge of hybrid is on the **power** 

To conclude and sum up this presentation

- 5G network will be made of successive deployment waves, for economical, technical and regulatory reasons
- The 1st wave will likely be very similar with 4G deployment, as low band equipment and existing macro sites will mainly be used. The 2nd wave will be the one of small cells deployment.
- Hybrid cable solution is the perfect match for sites with no or low evolution, as the hybrid is by nature combining 2 functions for a single equipment. The cable preparation and wiring needs simple configuration.
- Combining the increasing number of cells with the availability of skilled technicians, makes mandatory the use of hybrid solution in the future for small cell deployment.
- Finally, we have to remember that the challenge lays in the power cable and not in the fibre one. The fibre cable has a very similar size whereas it contains 2, 6 or 12 fibres, which is not the case for the 4, 10 or 16 mm² power cables. WDM is also a solution to maximise existing fibre count. Full power needs to feed the equipment.



Thank you!