The AFG Communications as a Service

Facilitated by the Fractal Nature of Smart Grid

Smart Grid

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10-01-2020

One of the vertical services that will be launched on top of the expanding Agile Fractal Grid infrastructure is that of wholesale communications. Using the highspeed fiber deployment necessary to control the real-time aspects of the power grid, some dark fiber can be reserved for other communications purposes. That said, it still may not be economical for CSPs to provide their own equipment for cellular service at those remote rural locales. However, by leveraging the AFG fiber resources and using the AFG neutral hosting microcell and “visiting” access services, it may be perfectly fine for those carriers to provide romancing services to subscribers who may live or travel through those locales. Further, if those carriers can support the new MORAN standard, they can use the CBRS spectrum to provide services in the area much less expensively than traditional expensive roaming charges.

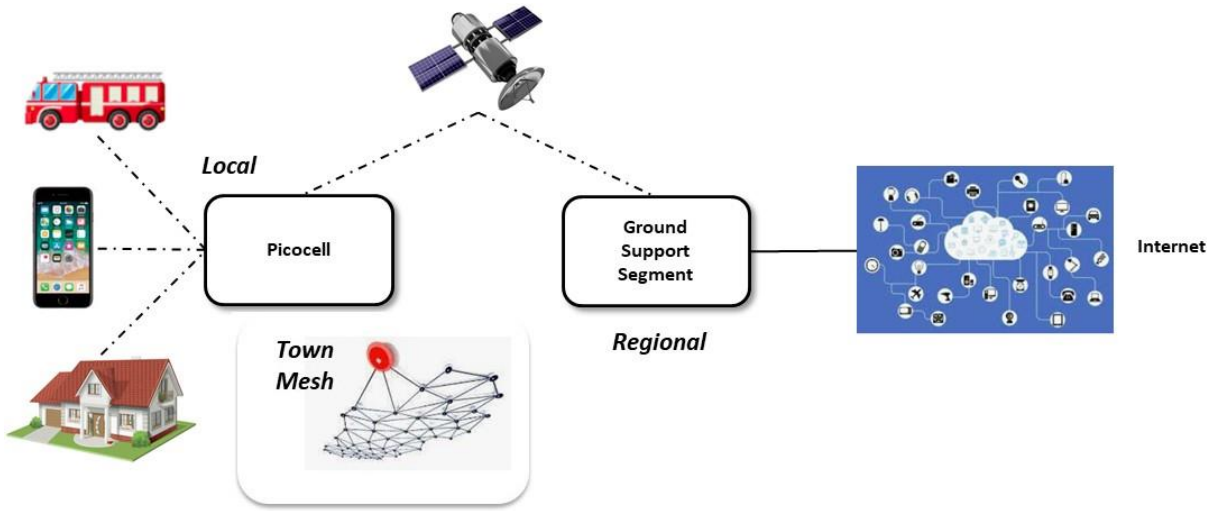
However, because of the latest realities of the Covid-19 coronavirus pandemic, the time it will take for the full deployment of all the fiber required for, say, an entire state, is far too long relative to the current imperatives in providing broadband and cellular access to all, especially in remote areas.

With the new imperatives for speed to rollout, new opportunities for rapid rollout are becoming more important. The Agile Fractal Grid is working on a rapid deployment strategy involving the new SpaceX StarLink satellite services being deployed right now.

The introduction of thousands of new satellites for the purposes of both retail connection to individuals as well as wholesale access for relay purposes is showing some 100 MB services to each individual or shared point. This medium

speed is excellent for areas that have no service at all right now. As a rapid, interim approach, this coverage will be welcomed in many rural areas.

The approach for rapid rollout of the multiple services using the satellite-based approach for fronthaul to remote areas is shown in the following diagram.



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The idea shown in the figure is that many, many locations will be selected for picocells attached to utility poles and other convenient high places. These services include a relay to homes adjacent to the utility pole for Internet service. It includes neutral host cellular access services to smartphones that happen to be used within the cellular coverage area. (This includes both 4G and 5G

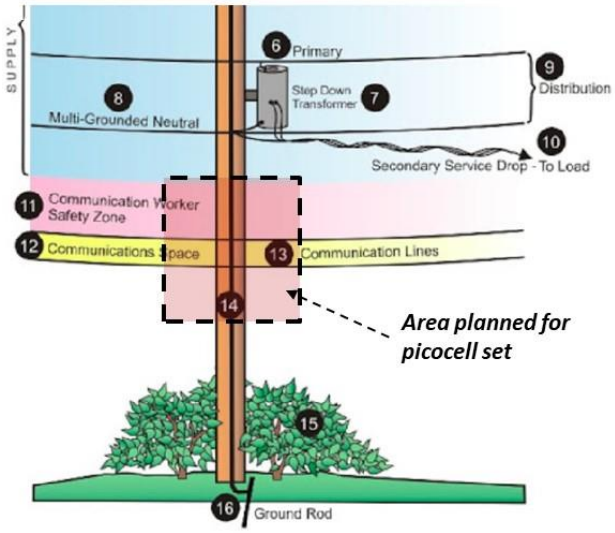
connections.) If arrangements for access service are in place, the picocells can be used to enhance public safety communications using wireless backhaul to “bring your own coverage” communications gateways in firetrucks, police squad cars, ambulances, and other first responder vehicles. The system also provides

participation in high speed mesh networks serving more populated areas for general wi-fi access in that district.

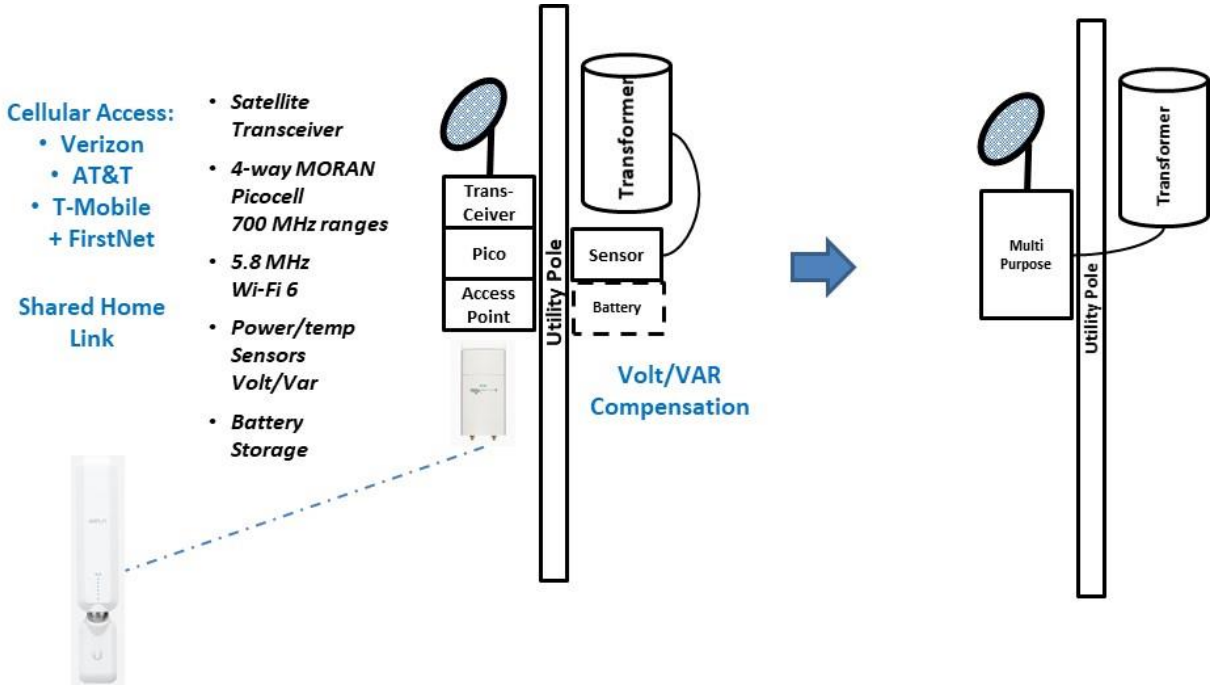
The satellite coverage brings the communications path back to a ground support segment that is linked via high speed fiber access to a Super-PoP for interconnection out to the Internet at large.

For the picocells themselves out on the rural roads, it is important to mount them on the poles with transformers for direct access to electric power. This is always done in partnership with the local electric cooperative who also wants the Internet service for their members whom they serve in the area.

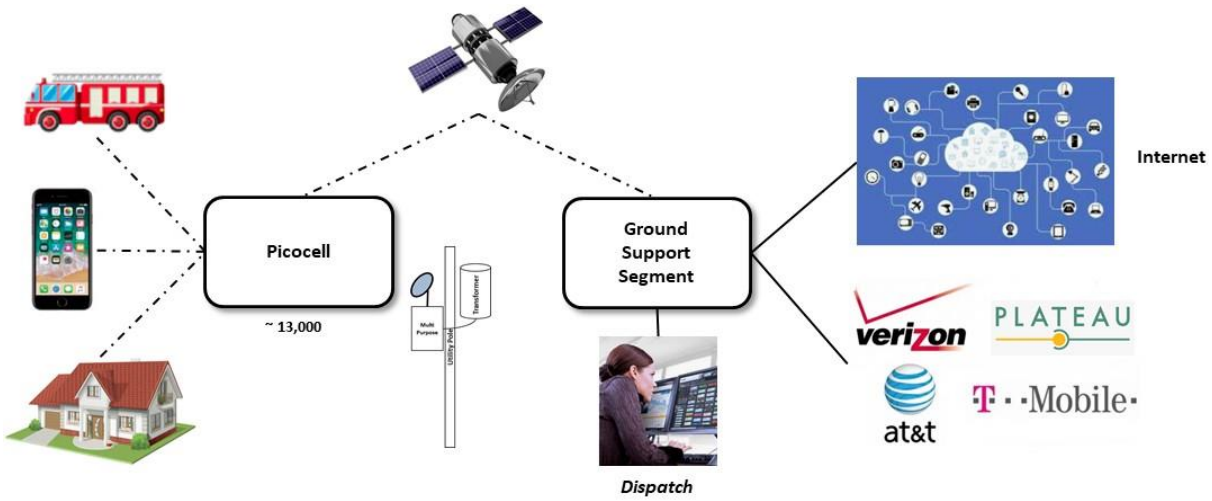
For safety reasons, the mounting of the picocell is always done in the "communications zone" on the pole as is shown in the following diagram.



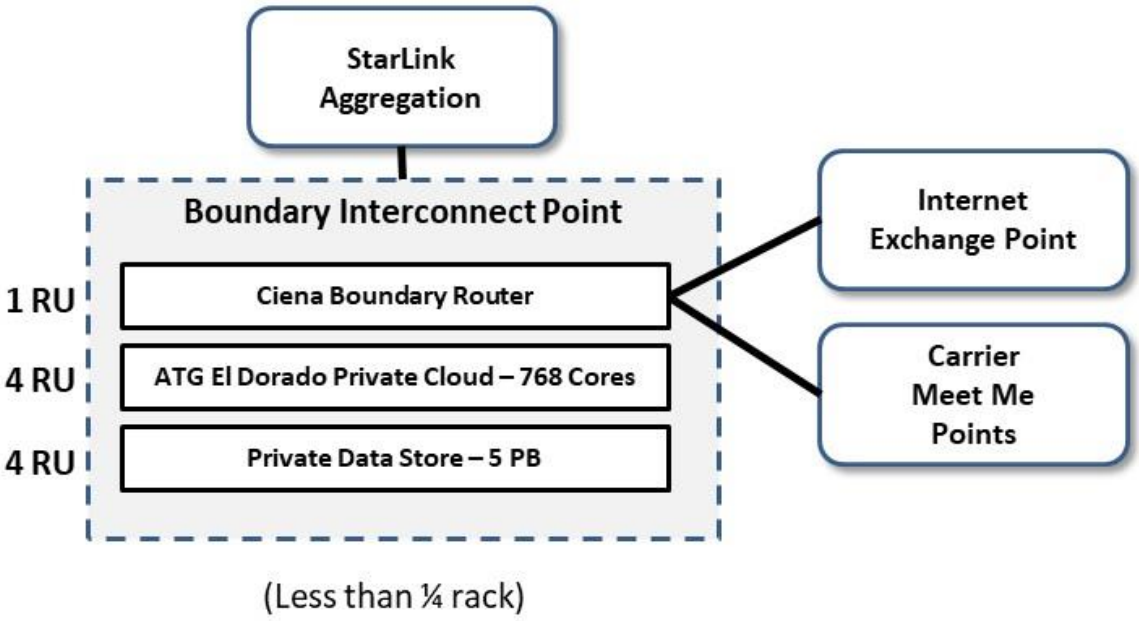
Initially the first deployments of the picocells will initially use discrete components to launch the program rapidly. As the program continues, the picocells will be packaged into the new SmartCone multi-purpose gateways that will allow for further location-specific attachments as needed.


Cellular Access:
• Verizon
• AT&T
• T-Mobile
+ FirstNet
Shared Home Link
• Satellite Transceiver
• 4-way MORAN Picocell 700 MHz ranges
• 5.8 MHz Wi-Fi 6
• Power/temp Sensors Volt/Var
• Battery Storage
Trans-Ceiver
Pico
Access Point
Utility Pole
Transformer
Sensor
Battery
Volt/VAR Compensation
Multi Purpose
Utility Pole
Transformer

As the initial Direct Internet Access is being deployed, the back-office arrangements will be put into place to begin to use the neutral host multi-operator picocells for direct access expansions for the major carriers as well as local carriers as shown in the diagram below.



To implement this extension service, the ground support segment will need to be enhanced in capability as shown in the following diagram.

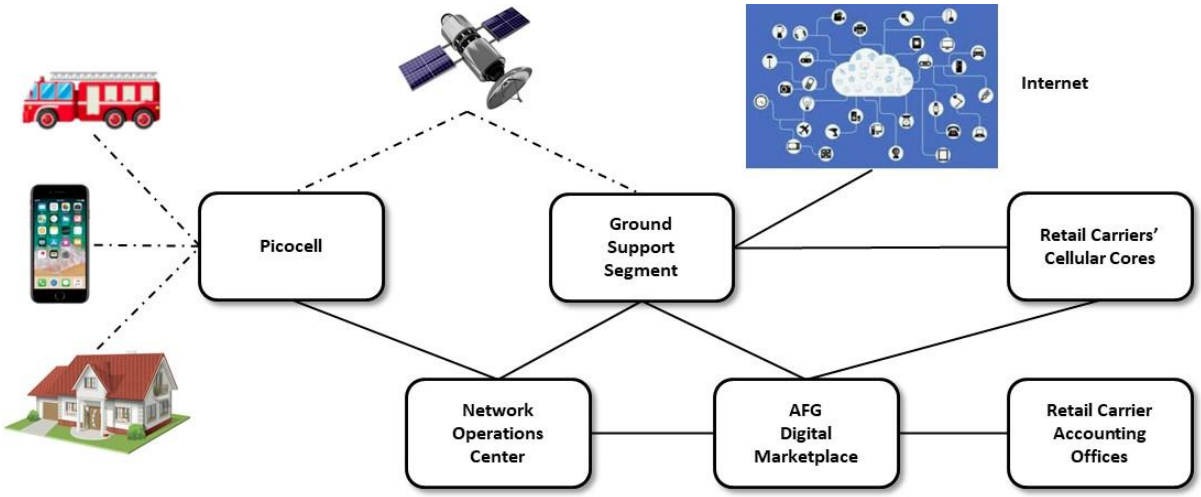


-5-

At the Boundary Interconnect Point within the ground support segment itself, we have a miniature supercomputer running the Tier-2 Cluster Node[1] for the "district" covered by satellites operating off this ground segment. The networking facility is sliced such that the paths for general Internet usage are sequestered from the operational technology aspects of the carrier's interconnection. Each carrier is kept separate from each other so that the true benefit of the 5G SD-WAN is nicely realized for everyone's benefit.

[1] Whitepaper on the Tier-2 Cluster Node AFG #2

The actual networking arrangement for both the management of the Network as a Service itself as well as the BSS/OSS interfaces with the different carriers is as shown in the figure below.



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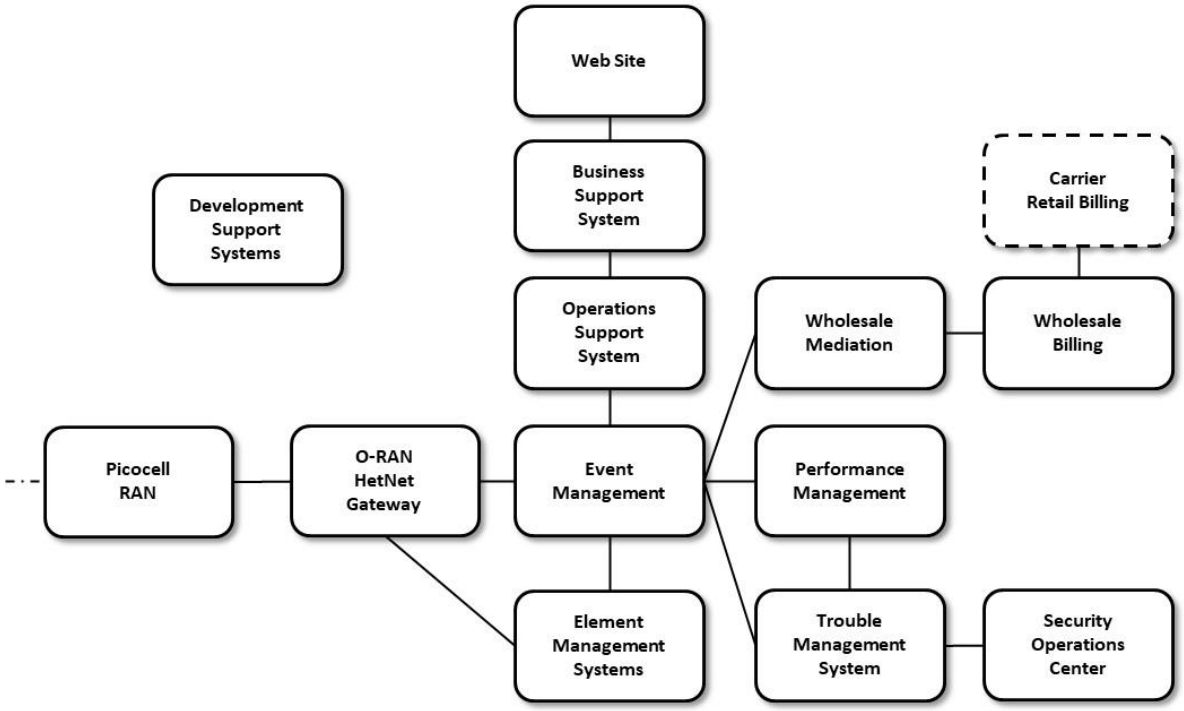
The Network Operations Center function itself coordinates all resource deployment as well as the service assurance functions. The Tier-3 Regional Energy Operations Center that also handles all telecommunication accounting functions relative to settlements with all the participating carriers. If desired, the AFG Digital Marketplace also interfaces with the retail carriers' cellular core networks for communication performance measurements that are pertinent to the 15-minute service level agreement instrumentation used to ensure quality service at the endpoints.

The functional architecture for the BSS/OSS combination operating out of the multi-tiered fractal control system thus contains the functions as described in the following diagram.



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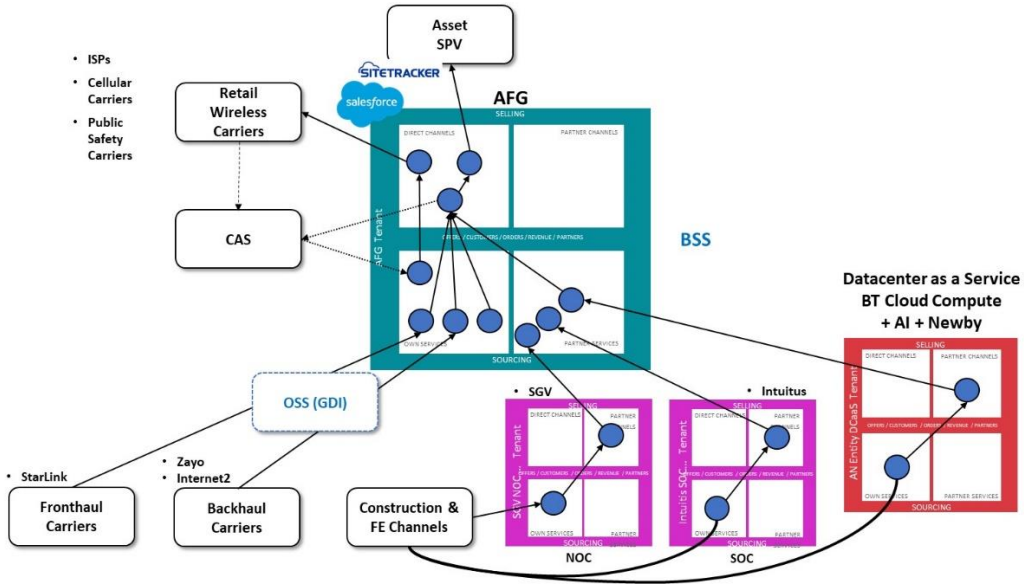
Although there are many sites and several points for management of service assurance across a country, the interfaces to the participating carriers are curated such that there are only a small number of interfaces. The communications can be established to be fault tolerant if desired[2], but the interfaces are quite finite.

[2] *Whitepaper on the Tiered Logging System*

The Digital Business Marketplace as is used for this service, uses the Infonova approach, and there are several frictionless tenants in the supply chain-oriented partnerships as are illustrated in the following diagram.



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The AFG itself is one tenant offering these services to all the retail carriers that would like to have the extended access reach into the rural areas covered by the service. It is supported by the following partners:

- The network operations center is a large specialty center that also provides similar services for the transportation industry, the oil and gas industry, law enforcement, the hospitality industry, and large private firms.
- The Intuitus Security Operations Center as a Service maintains monitoring and controls services for all points of the network requiring concierge level support for cybersecurity matters, both for the infrastructure as well as endpoint locations that would like this supplemental service.
- The Datacenter as a Service supporting the private cloud services embedded within the entire AFG network uses the BT Cloud Connect for administration and accounting purposes, nut also the Automated

Intelligence resources for managing the Platform as a Service operations of the endpoints as well as Newby for real estate support.