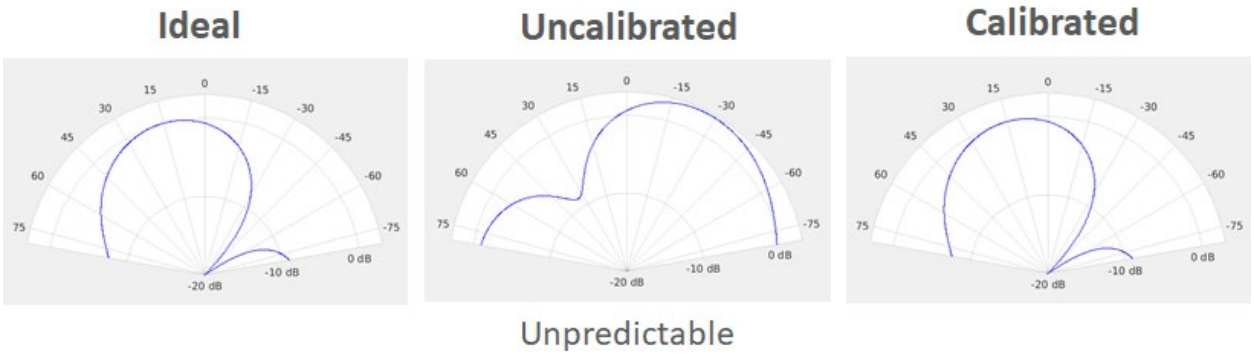
Beam Calibration is in Cohere Technologies' DNA

I wonder what Claude Shannon would think while seeing a perfect totally cleaned-up and calibrated communications channel like those Cohere Technologies offer with its novel software named Dynamic Network Alignment (DNA)? As reported by the communications service providers (CSPs) that tested it, this novel software enables successful zero touch multi-user multiple input multiple output (MU-MIMO) calibration.

One year after successfully launching its Universal Spectrum Multiplier (USM) that provides substantial spectral efficiencies, the DNA software comes as an USM add on to address real-time perturbations, which unaddressed, can seriously degrade the end-to-end cellular network performance and deteriorate the user experience.

What's remarkable is that all cellular systems' 5G antennas in the world are initially set to perform accordingly to specific sets of parameters before going live. In the wireless jargon, we talk about "antenna calibration." However, once the antennas are calibrated, the job is considered "complete" and no additional interventions or actions are deemed to be necessary. But the issues are: today's 5G antenna calibration, as an installation activity, is not sufficient to support dynamic orthogonal beam forming in a MU-MIMO environment, whether TDD or FDD. The reason is that the beams are continuously affected by a flurry of factors including thermal expansion and contraction, extreme weather, component aging, impedance mismatches related to corrosion, aging and failing connectors, manufacturing variations and other undetected subsystem variations. As a result, as soon as this calibration effort ends, the system starts to drift away from its initial settings and becomes uncalibrated (see Figure 1)! What DNA does is ensure that the beam pattern remains always calibrated in any propagation conditions.

Figure 1: Ideal vs. calibrated and uncalibrated beam radiation patterns

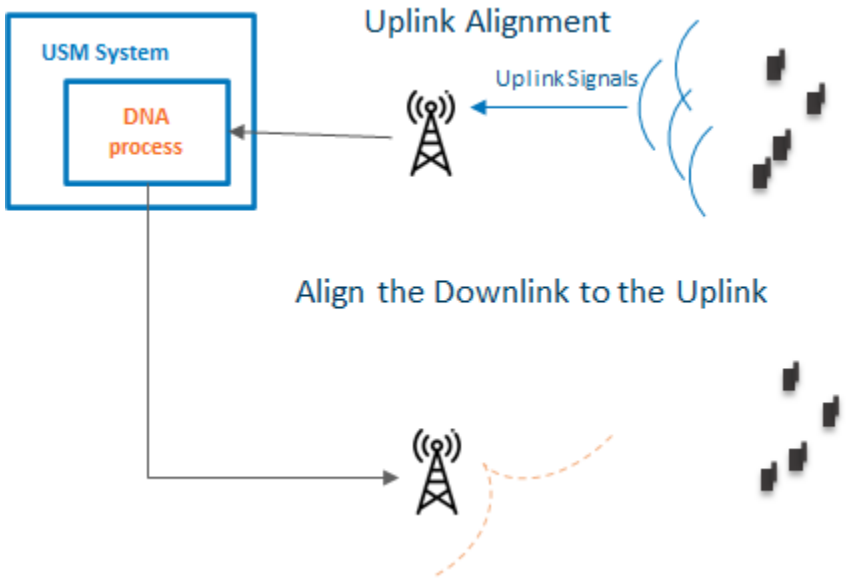


Source: Cohere Technologies

DNA IS A NOVEL TOOL THAT MAINTAINS BEAM CALIBRATION

It's during heavy testing of its USM software that Cohere Technologies discovered how both short- and long-term variations were impairing the 5G macro cell network and therefore cancelling the benefits of MU-MIMO and massive MIMO. Thence, a clear need for a tool to continuously monitor beam patterns and implement corrective actions emerged. Surprisingly, no such tool was commercially available, and Cohere Technologies decided to develop its own by leveraging its USM software. As illustrated in Figure 2, embedded in the USM module, DNA periodically processes the uplink signal and continuously compensates for all variations detected in the UEs (user equipment) in a sector. Put another way, DNA computes corrections coefficients that are necessary to keep the 5G macro cellular system aligned.

Figure 2: USM and DNA implementation



Source: Cohere Technologies

DNA ALSO SIMPLIFIES THE PERFORMANCE OF THE USM MU-MIMO SOFTWARE

The majority of global 5G rollouts in low and mid-band FDD spectrum left millions of existing 4T4R or 8T8R antennas in place. DNA allows these legacy antennas to be calibrated alongside the rest of the technology chain to successfully implement MU-MIMO spatial multiplexing. This innovative use of legacy infrastructure preserves capital resources and eliminates the need to acquire and install new antennas on many thousands of towers.

DNA ACTS AS A NEW SON MODULE CASE…

By using the UEs registered to a 4G or 5G base station in FDD or TDD spectrum as tools to calibrate the whole system in a non-disruptive manner, DNA acts as a Self-Organizing Network

(SON) for MU-MIMO infrastructure that uses automation to eliminate the need for manual processes and adapts to conditions. Consequently, the process of calibration is no longer a specialized one-time process performed by a technician, but an automated and continuous process natively performed in the operating software.

DNA ENABLES BEAM SELF-HEALING

It's worth reminding that since its development by the 3GPP more than a decade ago, the chief goal of SON is to supply intelligence to mobile networks to enable self-configuration and setup, self-network organization, optimization, and healing, which in turn generates capital and operating expenditure savings. In this SON context, DNA provides the very first self-healing iteration.

…AND AS AN APP IN THE O-RAN ARCHITECTURE

Since Day 1, Cohere Technologies has been a strong proponent of Open RAN, in which its software suite can easily be integrated. In fact, Cohere Technologies' USM software includes channel estimation, prediction, and precoding, and supports any waveform, any G, any RAN, including open RAN and RIC-based xApps (RAN Intelligent Controller). By attaching the USM xApp to gNBs and using the UEs in the sector(s) as instrumentation, the zero touch DNA process treats the whole system as a "blackbox" where the xApp periodically measures system alignment and creates compensating factors to maintain peak spectral performance. In addition, Cohere Technologies' roadmap includes the xApp providing notifications to CSPs' NOC (network operations center) when a system is violating compensation thresholds and requires service. And finally, the dynamic nature of DNA makes it a perfect candidate for a system management rApp in the non-Real Time RIC domain, as well.

BOTTOM LINE: COHERE TECHNOLOGIES' SOFTWARE SUITE EMBRACES BOTH THE PRESENT AND THE FUTURE

That's what happens when applying mathematics and physics to address the thorny spectrum issue in cellular networks: the birth of OTFS that led to USM and DNA, respectively. Cohere Technologies invented and developed orthogonal time frequency space (OTFS) as an alternative to the orthogonal frequency division multiplexing (OFDM) currently used 4G and 5G networks. While OTFS is positioned as a strong candidate for the upcoming 6G standard, its USM and DNA offshoots are addressing today's and tomorrow's issues. We all know that the scarcity of spectrum is here to stay and having USM and DNA in the toolbox is great news for CSPs.

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