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Exposing The Invisible Enemy

How Network Location Intelligence and Analytics Saves Lives

A Technical Paper prepared for SCTE•ISBE by

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1. Introduction

A flu pandemic swept the world from 1918 to 1920, infecting approximately a quarter of the world's population and killing over 50 million. A century later, the world is again facing the reality of a viral pandemic. But things are different this time around: we have accumulated 100 years of health and technological advances that can fortify the fight against this pandemic. The invisible, hard-to-track, rapid transmission and replication of today's virus a critical danger, and these characteristics have caused the world economic and social wheels to grind to a halt. Absent a broader toolkit against this virus, the default defense strategy is isolation with everyone going on lockdown within their homes. Fortunately, now there are mature technologies in the world's arsenal that are being used to fight, in a smart way, the viral transmission and containment dilemma. These technologies are saving lives while enabling the gradual return to some social and economic normalcy. We will continue to embrace technology as the pandemic evolves, and to help with any future outbreaks.

Figure 1 - Example City Scape with Different verticals and locations

2. The MobileTelecommunications Revolution

A 2019 Pew Research Center Fact Sheet [1] showed that almost 96% of the US population owned a cell phone of some kind, up from 35% in 2011. Almost Two Thirds [2] of the world's population today have mobile phones, and this percentage is above 90% if you only consider the top industrial nations. Compare this to the few million switchboard-based telephones during the 1918 flu pandemic. In the early 1970's the first handheld cell phone was invented. Fast forward fifty years, and more people have mobile phones than toilets [3]. Astonishingly, if we create a 2 minute time-lapse video showing the fast and explosive penetration of mobile technologies in the last thirty years, and compared it with a 2 minute-time-lapse video showing the new virus infections rate throughout the world in the first three months of 2020, the similarities between the two videos would be eye opening.

3. Mobile Network Advantages

Unlike the hard-to-track location of new virus transmissions, all mobile phones rely on mature network technology that manages, tracks and operates these devices in real-time to provide several services and advantages. Many countries are using their mobile network to help track, surveil, and stem the spread of the novel virus pandemic. The mobile network offers a level of data and location-based analytics using anonymized, highly granular, and accurate data and location intelligence insights that are being used by local and regional decision makers and health professionals to save lives and control the spread of the virus. There are also significant advantages to using network based location data versus application-based location data. Indeed, there has been significant issues in countries using app-based data rather than network based data to help track and trace [4]. Testing of Apps has shown issues with the technology at scale, despite Apple and Google working together on a common platform. Using network based (subscriber generated) data is well known and deployed in many operators world-wide covering all network technologies and always-on regardless of data connectivity issues.

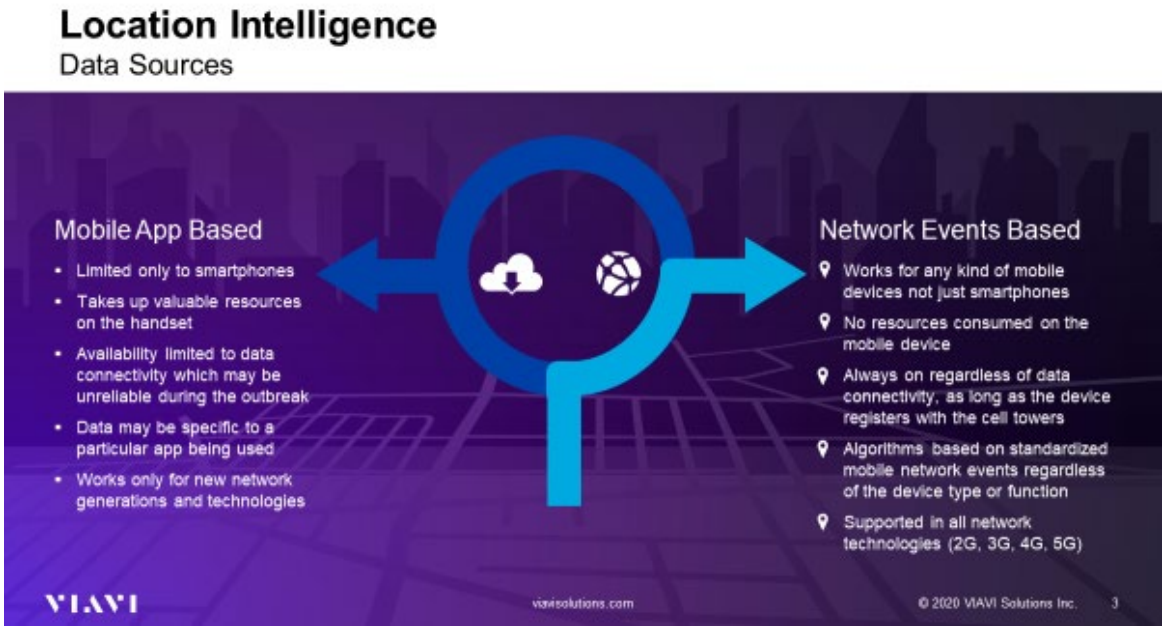

Figure 2 - Comparison of App Based and Network Based Location Data

4. The Role of Location Intelligence

At VIAVI, we are working closely with communications carriers and governments around the world developing and deploying solutions that leverage Location Intelligence (LI) and Machine Learning (ML) technologies derived from mobile network events. These solutions, traditionally used for engineering, optimization and troubleshooting, provide powerful, accurate and reliable geolocation of subscriber's activities across the network. Correlating these activities with other core network usage insights turns the entire mobile network into a data analytics engine. Applying Machine Learning (ML) and data mining algorithms on such an engine provides valuable and actionable insights into network traffic levels and patterns of population movement and usage behaviors. In addition, detecting international roaming and inter-states movements within the network helps to accurately identify where the majority of subscribers are and where they've been. These insights can be tracked back in time for weeks, and in some cases, several months, all depending on the amount of historic data that has been stored. With 5G

communications, Location Intelligence will apply to much denser networks, both vertically and horizontally, adding another 3D dimension to deliver insight into network activities.

Figure 3 - Deriving Insights from Mobility Data

5. The Privacy Debate

The issue of privacy is often raised when looking at the role of Location Intelligence because many countries have very strict regulatory policies on the use of this type of data. Operators have used individual subscriber data for troubleshooting and diagnostics at the consent of the subscriber. Here, Location Intelligence is predominantly anonymized and aggregated to look at patterns, trends, and changes rather than individual analysis. The use and availability of this data is generally dependent upon the specific country and its regulations.

The process of anonymization is critical. It needs to be performed in a manner that both protects the privacy of the individual end user while allowing the mobile operator or the relevant governmental agencies to perform the relevant analysis. So far, it has been most effective to use a 24-hour static ID as the anonymized ID for each user in order to be able to track the mobility and determine if this represents reduced mobility, for example, in the society at large. If the same ID is used for a shorter period of time, critical mobility may not be observed. And if the ID is used for a longer period of time, it becomes possible to analyze who is behind the anonymized ID.

6. Better Informed Decision Making

Location Intelligence analytics enables decision makers to track travelers to and from affected countries and determine when and where quarantine rules can be enforced. The algorithms use the Location Intelligence aggregate data over time to identify hotspots that at-risk subscribers visited or where they congregated to detect potential contamination areas and implement proactive containment policies. The solution also monitors, in real-time, events (lawful or unlawful) for potential outbreaks and enforcement issues.

It also assists in outbreak investigations to identify contacts and apply appropriate measures to prevent further spread. This is particularly important as borders start to open up where countries go through different waves at different times. Being able to capture analysis on hotspots (e.g. where and when the

population has been moving across borders) becomes more important. Indeed, as life gets back to something that looks like normal, location data and analytics can help to manage outbreaks as it can continuously monitor people movements.

7. Real-Time Pandemic Hostpots Tracking And Analysis

While the virus is invisibly attacking communities through travelers and locals carrying it from highly infected areas, its effect can still be uncovered, tracked, and quickly contained using Location Intelligence analytics. The Location Intelligence technology tracks inbound roamers from affected countries or high-risk areas and monitors their locations and interactions in real-time. It also alerts outbound roamers and provides the latest information on the outbreak and government policies to keep the roamer away from harm and potential hotspots. We continue to work with several governmental departments for disease control along with operators that requested help to monitor and manage the spread of the pandemic in their respective countries. In cooperation with in-region telecom operators, we are providing them with Location Intelligence and Machine Learning systems analyzing location data for inbound roamers and at-risk or positively-diagnosed cases of the virus. The system automatically identifies at-risk inbound populations, creates logical geofencing of quarantined patients with automatic alerting, and provides movement history and contact history for positive cases allowing notification and action to be taken to minimize infection risk. It also monitors critical infrastructure including hospitals, airports, and emergency services to assure they are getting the high connectivity, capacity, and performance from the network.

8. Ensure Enacted Policies Make a Difference

As many of us enter the next phase in defeating the pandemic and gradually restoring life to normal, the ability to monitor and ensure the policies enacted—such as shelter in place, work from home, and curfews—is making a difference in the war against the virus. Here again, Location Intelligence and Machine Learning solutions can be of great assistance. Our solution helps governments and telecom carriers across the world with implementation of their policies by providing them with insights and actionable information that tracks potential contamination areas and reinforces verifications, alerts and health support for these policies. Again, this is done by monitoring patterns and movements of people, analyzing transport usage (location can determine speed and so can make predictions on whether someone is for example walking or in a motorized vehicle).

As more and more governments order school closures, and as people are encouraged to work from home, an immediate load and shift in network traffic was noticed for collaboration applications on the operators' networks. Our solution helps to detect this shift in real-time and recommends load-balancing and optimization action to mitigate these issues and assure efficient use of network and services resources.

Working from home policies may continue to be the norm for many people as they embrace a more blended model of work place and home. This shift may be permanent with operators needing to continue to analyze usage by location enabling networks to adapt and change to the evolving environment and delivering an optimized network at all times.

9. The Day After

The use of Location Intelligence and Machine Learning does not stop when a pandemic ends. The question remains of how to deal with the aftermath—the unforeseen challenges that will arise from the social tensions, the economic impact, the shortage of essentials and food, unemployment, and so forth. The evolution of solutions like Location Intelligence, Network Assurance, and Machine Learning to

Artificial Intelligence (AI) helps governments and authorities to be prepared to tackle these issues with real time actionable information and decision making. Remote proactive monitoring and automation to actuate changes in the network or the services will be needed to offset the expected personnel shortages and the wide-spread nature of events

10. Conclusion: A Future with No Pandemics

Will we be able to completely defeat and eradicate viral pandemics in the next 100 years? The answer may be yes, if we consider the exponential advances in Artificial Intelligence, Machine Learning, data analytics, and the Internet of Things (IoT) coupled with the promises of 5G and next-generation networks. That conclusion is not a big stretch if we extrapolate the advancements achieved in the 100 years since the last deadly viral pandemic. The use of smart technologies is saving lives today, and the upward curve of innovations is not slowing. The network of the future will have the capability to detect a new viral pandemic at its onset, track all the infections in real-time, and stop it before spreading. Fully automated testing and in vivo monitoring are leaving the science fiction realm to become practical applications. Ultimately, we are on the side of technological innovations and human ingenuity to win the war against pandemics.

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