Want to stave off a broadband disaster? Wi-Fi offloading's the way to go!

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There is good news on the way for mobile data growth: industry forecasts suggest that data traffic will grow at a CAGR of around 40% between now and 2022. This forecast does not take into consideration the data generated by the IoT that mobile networks would need to carry. Besides, as traction for AR and VR applications grow, data demand will swell even further. This spells good business, but cellular operators also know that this will trigger massive network congestion, leading to a death spiral in customer experience. Network operators, concerned about their Quality of Service (QoS), are already investigating ways to prevent the coming broadband disaster.

A popular and convenient workaround is frequency reuse to expand capacity, as spectrum availability is limited. The solution has its restrictions. It results in co-channel interference and performance degradation. In parallel, other approaches must, therefore, be considered and their unique challenges examined.

We look at three approaches here and select what we believe will constitute a robust solution:

• **Small Cells:** Small Cells use the same cellular technology such as 3G or LTE. They are categorized into Femto, Pico or Micro cells, depending on the density, capacity and coverage needs. Small Cells are effective but pose a challenge with RF planning, site selection, installation, network coordination and interference management with macro networks. The last is an especially significant problem when the number of Small Cells goes up. The resulting interference reduces capacity and coverage of macro networks.

• **Distributed Antenna Systems (DAS):** DAS use fiber-optic cables from a macro base station to an array of antennas spread over a wide area. This extends coverage and improves connection reliability. It also supports multiple carriers, bands and operators over a single backhaul. However, DAS are complex and notoriously difficult to test, optimize and maintain during and after installation.

• **Wi-Fi Offload:** Wi-Fi is the familiar face of wireless technology. It has matured over the years and the high-speed broadband experience has won over consumers. However, operators have been apprehensive of Wi-Fi as they risk losing control over devices and subscribers due to its independent operations. The other significant challenge is related to switching over to Wi-Fi – an experience that is not seamless.

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Wi-fi offloading's the best bet

A number of factors fall in line to make it the solution of choice. Most devices today are already Wi-Fi enabled, consumers are familiar with the technology, there are no license costs and Wi-Fi infrastructure is relatively inexpensive. As a bonus, quite a bit of Wi-Fi infrastructure is already in place and operators own a substantial number of hot spots.

While Wi-Fi is attractive from a consumer acceptance and infrastructure/cost point of view, it presents a technical hurdle. The hitch lies in creating a seamless interplay between cellular and Wi-Fi while maintaining security. Largely, user names and passwords are necessary to gain access to Wi-Fi networks. To ensure data traffic flows quickly and flawlessly from cellular to Wi-Fi will require automated authentication processes to work in the background so the consumers have a smooth experience. The other challenges include:

- **From a customer perspective**

  - Network selection based on user preferences/contracts

  - Single billing for Wi-Fi and cellular networks

  - Wi-Fi and cellular customer care integration

- **From an operator perspective**

  - Driving efficiency and QoS through real-time decision making

  - Providing the means of network selection that prioritize traffic with option for policy-based dynamic-control at an IP flow level

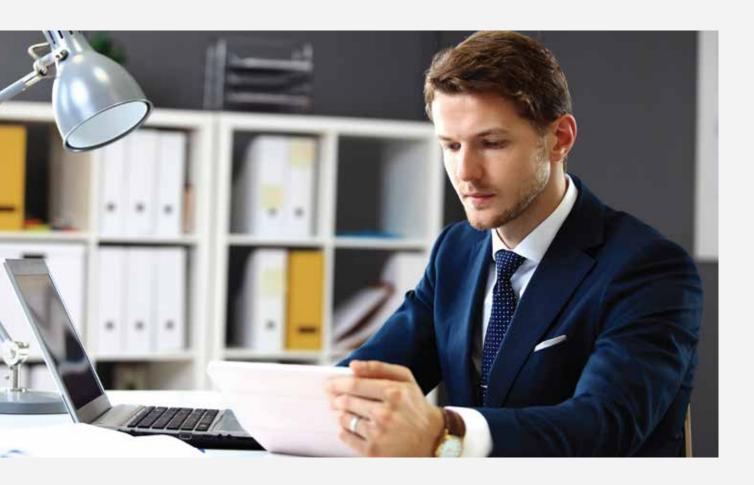 - Routing data through Wi-Fi and cellular networks

Standards to support wi-fi & cellular integration

Help is on the way. Already, IEEE, Wi-Fi Alliance and 3GPP have defined standards and certifications that enable easy authentication and seamless interworking between cellular and Wi-Fi networks. For the technically minded, the IEEE standard 80211u simplifies network discovery and selection. To enable this, the OS wireless chip firmware and host controller software need to be changed. Once this is done, devices can make intelligent decisions when associating with cellular and Wi-Fi networks.

Hotspot 2.0 also has technical specifications that call for additional information elements. These aid in automated user authentication, based on credentials stored on the SIM. This method allows devices to securely access hot spots using the host operator credentials.

3GPP, too, has been driving the standards for cellular-Wi-Fi interworking. These include intelligent network selection using intelligent connection managers, ANDSF (Access Network Discovery and Selection Function), automatic logon mechanisms as well as technologies that allow devices to decide when and what to offload over Wi-Fi networks.

IEEE standards and protocols continue to evolve. These enable tighter coupling between cellular and Wi-Fi networks as well as improving the capacity of Wi-Fi deployments. 3GPP is also developing LTE Wi-Fi aggregation and upcoming technologies like 5G that have a stronger focus on inter networking. Overall, developmental path for the future of Wi-Fi Offload looks secure.

The future is cellular + Wi-Fi

Given that the building blocks for bridging cellular and Wi-Fi are in place, some industry leaders have been deploying Wi-Fi hotspots alongside cellular networks and have simultaneously started integrating with third-party Wi-Fi service providers. To drive a seamless experience their focus is on access control/security, use of trusted and untrusted networks, QoS, common billing and customer care integration.

With licensed spectrum already scarce and expensive, operators will be drawn to Wi-Fi integration, ensuring that subscribers get what they want. The most encouraging aspect is that Wi-Fi fits snugly with the online lifestyles of subscribers. For operators, the upside is in reducing network congestion, managing churn and unlocking new business opportunities.

Small Cells and DAS solutions must not be ignored either. They deliver impressive capacity gains. However, these should be considered after having exhausted Wi-Fi Offload option.

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About the authors

Vishnu Vardhan Kandan
Director and Principal Technology Architect,
Modem & Wireless Communication Systems

Vishnu Vardhan Kandan is Director and Principal Technology Architect at Wipro's Modem & Wireless Communication Systems. He has over 18 years of experience in the wireless industry and has worked across the entire software development lifecycle of cellular modem in 2G & LTE rollouts as well as in M2M communication.
He can be reached at:
vishnu.kandan@wipro.com

Raghunathan Kailasanathan
Senior Practice Manager, R&D

Raghunathan Kailasanathan is a Senior Practice Manager with 17 years of experience in managing R&D, design and presales business for embedded system-on-chip solutions. His primary domain expertise is in Wi-Fi/BLE short-range wireless technologies and Android engineering. Raghunathan has worked with customers across verticals in the connectivity domains, including peripherals, automotive, healthcare, mobile, defense and IoT.
He can be reached at:
raghunathan.kailasanathan@wipro.com