

# FINDING 5G IN STAKEHOLDER THOUGHT LEADERSHIP

## Thought-leadership guides 5G use-case development

5G use-cases will be defined by the strategies of their stakeholders. In our report entitled, *Meaningful Stakeholder Engagement Is a Bellwether for 5G* we show that the public engagement of 5G-stakeholders is increasing. As this occurs, the strategies of 5G-stakeholders will evolve and new 5G-stakeholders will emerge. A clear understanding of the strategic priorities of these stakeholders is crucial in anticipating the drivers and inhibitors for 5G use-case development. These strategic priorities are investigated in this report by analyzing the thought leadership blogs for a basket of 5G-stakeholder companies.

Technology companies typically publish several hundred thought leadership blogs annually. The blogs of 12 5G-stakeholder companies were analyzed using natural language processing (NLP) techniques. Keywords and phrases, which are relevant to 5G were identified in the blogs and classified. The stakeholder companies assessed in the study included ABB, Amdocs, Bosch, Cisco, Ericsson, Huawei, IBM, Intel, Juniper, Nokia, Oracle and Qualcomm.

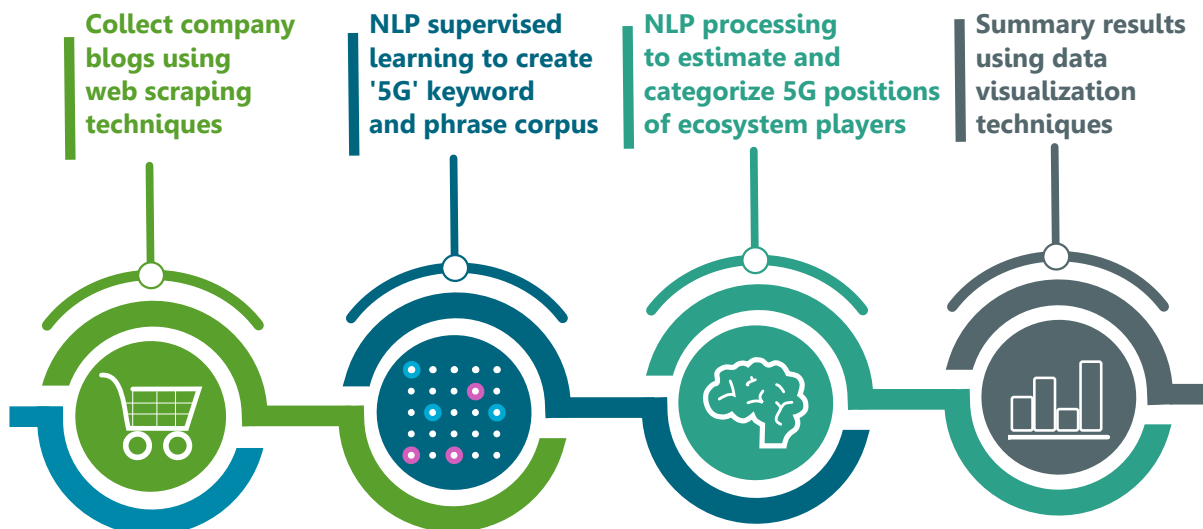
## NLP to the Rescue

The NLP analysis used for the study described in this report included the following (see Exhibit 1):

- **Data collection.** The blogs for all 12 5G-stakeholder companies were 'scraped' from the web and rendered in text format so that further analysis could be conducted.

### Exhibit 1: NLP techniques used to analyze 5G-stakeholder blogs

Source: Tolaga Research 2018





- **NLP supervised learning** was used to create a corpus of keywords and phrases that relate to 5G. For this purpose, all blog documents were initially analyzed using a keyword ranking algorithm, similar to that described in Meaningful Stakeholder Engagement Is a Bellwether for 5G. Blog documents that ranked the '5G' keyword within the top 10 percent were analyzed further with a supervised learning algorithm to identify and classify 700 keywords and phrases that relate to 5G (5G-keywords-and-phrases). The keywords were then classified according to the primary and secondary categories, which are listed in Exhibit 3.
- **NLP processing analysis and data visualization** of stakeholder blog documents between 2016 and 2018 was completed. These documents were searched to identify and rank 5G-keywords-and-phrases when they were used. The maximum rank of each keyword or phrase was taken from the individual blog documents and classified according to the categories listed in Exhibit 3. The classified ranks for each document were averaged over all the blogs for each stakeholder company to derive an overall rank score. The scores were then averaged again to estimate the stakeholder company-wide average scores.

## Placing the 5G Building Blocks

Exhibits 2 and 3 have 15 primary keywords and phrase categories that are associated with 5G. The average scores for these categories across the 12 basket companies are shown in Exhibit 2, with a Simple Average score for all categories that reaches

the 'Modest' threshold. In Exhibit 2 the 'Transformation', 'Compute', 'Security' and 'Internet of Things' categories rank in the 'Modest' to 'High' range, in addition to the 'Industrial Technologies' and 'End User Services'.

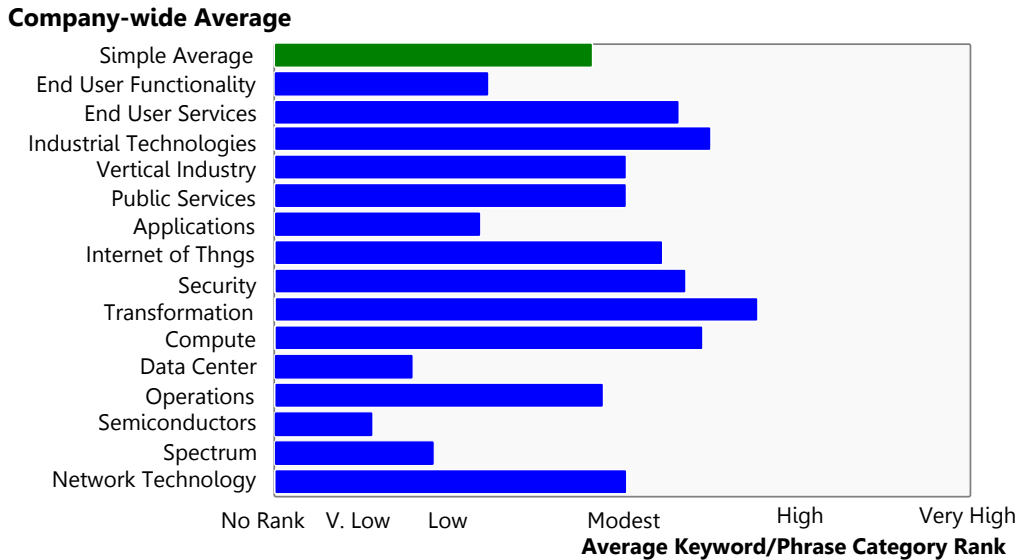
'Transformation' and 'Compute' activities largely reflect commercial and architectural changes that are occurring in parallel with 5G. These changes are necessary for many advanced 5G use-cases to succeed. For example:

- We believe that for 5G network slicing to be effective it would require that more than 60 percent of the network and service delivery environment is virtualized, and;
- Ultra-low latency services generally require advanced edge compute capabilities to meet the necessary performance requirements.

'Security' and the 'Internet-of-Things' are broad categories that are particularly important for digital services and use-cases that will benefit from 5G capabilities. This is particularly relevant to business and mission critical use-cases, such as those associated with Industry 4.0 and autonomous vehicle connectivity.

The 'Industrial Technologies' and 'End User Services' categories demonstrate a level of thought leadership maturity amongst 5G-stakeholders by focusing on end user requirements. This focus is particularly important for 5G services, but is prone to lofty goals and requires careful assessment to ensure that the stakeholders are capable and motivated to realize their thought leadership ideas.

**Exhibit 2: Average 5G Category Ranking of Keywords and Phrases for the 5G-stakeholder companies**  
*Source: Tolaga Research, 2018*



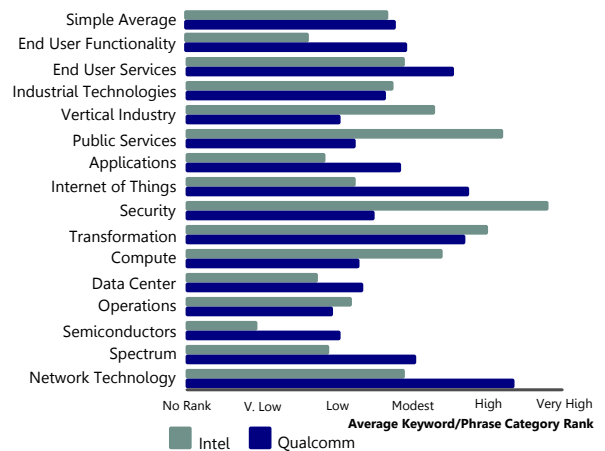
## Assessing the Stakeholders

### Intel and Qualcomm are thought leaders with a unique perspective

Although the 'Semiconductors' category has a low average ranking in Exhibit 2, it does not reflect the thought leadership of Intel and Qualcomm. Instead of focusing specifically on semiconductor technology, the thought leadership of both companies is focused on categories higher up the value chain. In particular, the top three ranked categories in Intel's blogs were for Security, Public Services and Transformation, and for Qualcomm were Network Technology, Transformation and the Internet-of-Things.

We believe that the 'Semiconductor' category is under-represented in the thought leadership blogs published by 5G stakeholders. Even though merchant silicon is doing more, the performance demands of 5G and companion technologies such

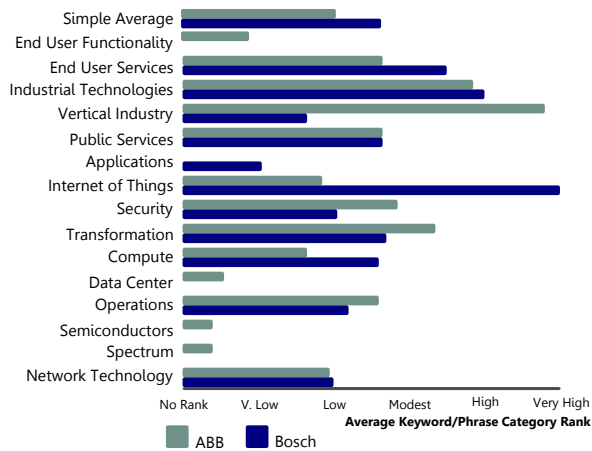
as cognitive computing are creating new demands for proprietary semiconductor solutions. New definitions are needed to ensure that broad industry initiatives that focus on the benefits of open architectures and white label platforms don't obscure the continued need for proprietary and specialized solutions.



## Industrial Companies get Digital

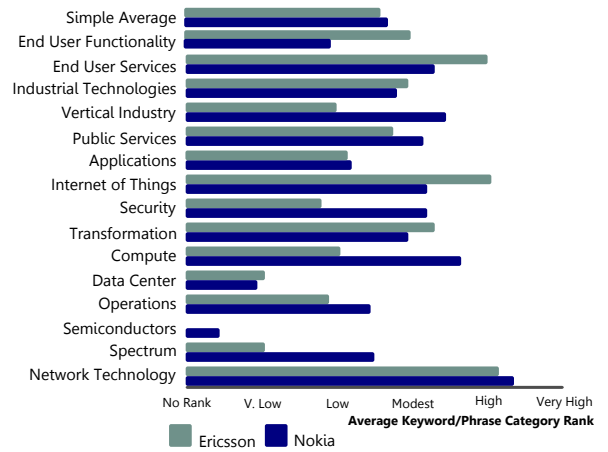
Industrial companies like ABB and Bosch are challenged by the proliferation of digital services. This is impacting their thought leadership and innovation priorities to the long-term benefit of 5G.

ABB's top three ranking categories were 'Vertical Industry', 'Industrial Technologies' and 'Transformation', and Bosch's were 'Internet-of-Things', 'Industrial Technologies' and 'End User Services'. All these categories reflect the vertical industry focus of ABB and Bosch, and the important roles that they will play in determining the prospects of many future 5G use-cases. Both companies have engaged in 5G trials and saw their public 5G engagement profiles increase significantly in 2018, (see *Meaningful Stakeholder Engagement Is a Bellwether for 5G*).

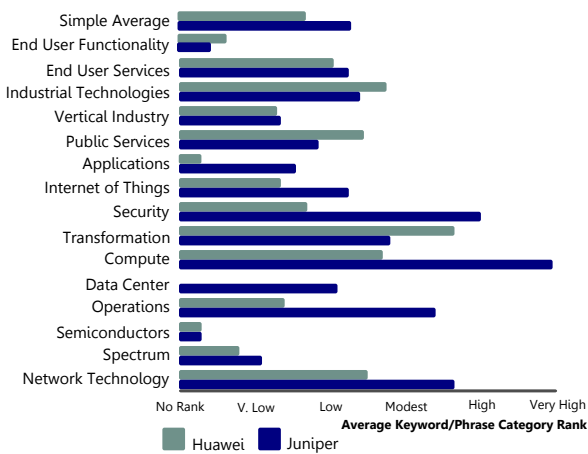


## Network and IT Vendors Sing Different Tunes

Although companies like Ericsson, Huawei, Juniper and Nokia still have a strong focus towards Network Technology, efforts to broaden the scope of thought leadership is clear in their blogs. Ericsson's top three ranking categories included Network Technology, the Internet of Things and End User Services. Nokia's were Network Technology, Compute and Vertical Industry solutions. Ericsson and Nokia also had relatively high ranks for the 'End User Services' and 'Transformation' categories. These are important categories for both companies, but are prone to aspirational and overly optimistic thought leadership expectations, which must be interpreted carefully.

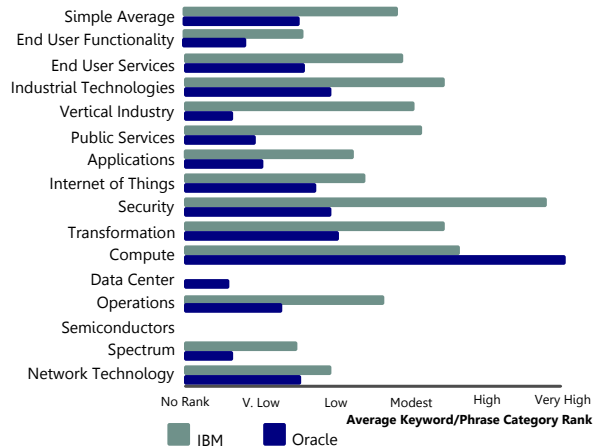
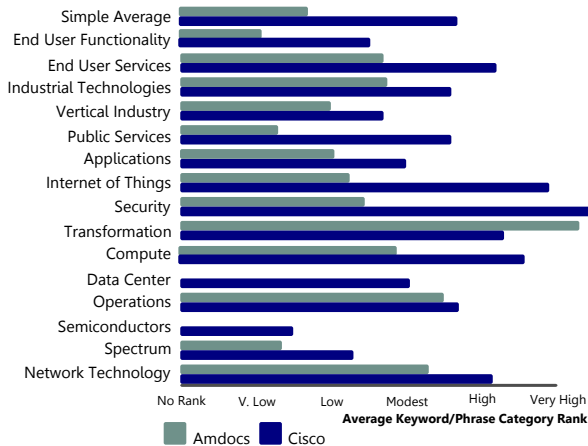


Amongst the 5G-stakeholders that were assessed in this report, Juniper continues to maintain a greater emphasis in its thought leadership towards network technology. Juniper's three highest ranking categories in its blogs were Compute, Security and Network Technology. In contrast, Huawei's were Network Technology, Transformation and Industrial Technologies.



Of all the company's profiled, Cisco had the strongest average rank across all categories, particularly 'Security'. Cisco's thought leadership and blogs illustrate its significant presence in communication network infrastructure and amongst industry verticals. If it plays its cards right, Cisco is well positioned to capitalize on its broad customer base to drive vertical market opportunities for 5G.

The ranks for the blogs of Amdocs, IBM and Oracle were different and reflected their respective market positions. Amdocs derives most of its revenues from communication service providers (CSP) and its blogs ranked highly in the Operations, Network Technology and Compute categories. IBM benefits from having a broad vertical market presence and its blogs ranked high with the Security, Compute, and Industrial Technologies categories. Oracle's blogs ranked high with the same categories as IBM, albeit with lower average scores and a higher emphasis towards the Compute category.





**Exhibit 3: 5G Keyword and Phrase Categories**

*Source: Tolaga Research, 2018*

Primary Category	Secondary Categories
<b>Network Technology</b>	Radio Access Network   Transport   General   Virtualization   Gateways   Media Services   Access Architecture   Core   Indoor   Broadband   Ethernet   Fixed Wireless Access   Capacity   Internet Protocol   Unlicensed   Channel Coding   IoT   Edge Compute   Millimeter Wave   Regulation Connectivity   Fixed Access   Routing   Convergence   Slicing   Transformation   Synchronization
<b>Operations</b>	Agile   Transformation   Business Process   Network   Big Data   Transformation   Intelligence Access Network   Logistics   Managed Services   Virtualization   Operations and Maintenance Optimization   Operations Support Systems   Performance Management   Automation
<b>Radio Spectrum</b>	Aggregation   Licensed   Refarming   Sharing   Spectral Efficiencies   Unlicensed
<b>Semi-Conductors</b>	In-house Silicon   Merchant Silicon   Modem   Network Processor   Radio Frequency
<b>Computing</b>	Edge Compute   Data   Cloud   Cognitive   Virtualization   Transformation   Micro-Compute
<b>Data Center</b>	
<b>Security</b>	Architecture   Authentication   Block Chain   Cryptography   Encryption   Identity Management Vulnerabilities
<b>Transformation</b>	Cognitive   Digital   IoT   Platform   Virtualization
<b>Applications</b>	Augmented Reality   Cognitive   Developers   Open Source   Onboarding   Media Services Virtual Reality
<b>Industrial Technologies</b>	Assets   Automation   Business Process   Control   Infrastructure   Internet   IoT Manufacturing   Marine   Mining   Oil and Gas   Retail
<b>Vertical Industry</b>	Agriculture   Asset Tracking   Enterprise   Factories   Infrastructure   Machinery   Mining Oil and Gas   Retail   Textiles   Transformation   Utilities
<b>End User Functionality</b>	Augmented Reality   Cognitive   Location   Mixed Reality   Transcoding   Virtual Reality Wearables
<b>Internet of Things</b>	Asset Tracking   Sensor Networks   General   Modules   Security   Machine Type Communications Sensors   Transformation   Metering   Wearables   Telematics
<b>Public Services</b>	Healthcare   Smart City   Transport   Public Safety   Environment   Utilities   Telemedicine
<b>End User Services</b>	Gaming   Virtual Reality   Voice   Healthcare   Transportation   Devices   Augmented Reality   Transportation   Healthcare   General   Connectivity   Media Services   Entertainment   Security Latency   Mobile Broadband   Navigation   IoT   User Interface   Smart Home Enhanced Mobile Broadband



## 5G is a moving target

A hallmark of 5G is uncertainty, and it will remain so for many years into the future. Beyond the basic use cases, such as enhanced mobile broadband, there is still uncertainty for advanced 5G use-cases that will be adopted. In our recent report: *Meaningful Stakeholder Engagement Is a Bellwether for 5G*, we demonstrate that there is growing public engagement amongst key 5G stakeholders, in developing and trialing advanced use-cases. Even with this trial activity, we estimate that it will take five to ten years for many of the advanced 5G solutions to gain significant market traction. In addition, the characteristics of these use-cases are

likely to change based on market demands and the priorities of key 5G stakeholders.

The keyword and phrase analysis developed in this report identifies stakeholder aspirations through their thought leadership and provides insights into their priorities. The thought leadership and associated priorities and challenges of the stakeholder companies illustrate their recognition of the growing complexities in the ecosystems that they support. Today 5G-stakeholder thought leadership is biased towards 'Transformation', 'Compute', 'Security', 'Industrial Technologies' and 'End User Services'. In the years to come, this will change and provide important insights into the moving target of opportunities for 5G.

### About Tolaga Research

Tolaga is a leading consulting and advisory firm for the mobile industry and the Internet of Things. We are experts in networks, security, critical communications and complex system modeling.

**Our Clients:** Service Providers, Technology Vendors, Enterprise End Users and Private and Institutional Investors

We capitalize on many decades of industry knowledge, implementation experience, advanced modeling and analytics platforms to deliver differentiated services to our clients.

**Our Solutions:** Research Advisory Services, Custom Consulting and Modeling Platforms

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