# Joint Experts' Report on Technical Issues

## 1 Background

As part of the process for the proceeding initiated by Toronto Hydro before the Ontario Energy Board (Process OEB-2013-0234), an experts' conference was held to allow the expert witnesses for all parties to meet, discuss the issues, and prepare a joint statement on areas in which they agree, and identify any areas of disagreement. This report expresses the joint views of Nordicity, technical consultant to Board Staff, and Dr. Charles L. Jackson, technical consultant to Toronto Hydro. The report proceeds in three parts: (1) a summary of the experts' views generally, (2) observations on the expert's reports, and (3) a statement of the experts' views on the specific issues as set forth in the issue list specific to technical or technology matters.

## 2 Summary of Views

Both Dr. Jackson and Nordicity prepared technical reports for this proceeding. The authors wish to note that their respective reports were created at different points in the proceeding. Dr. Jackson's report was prepared as part of the initial evidence filed by Toronto Hydro in the proceeding, whereas the Nordicity report was created later in the process, and substantially written after the initial Issues conference. As a result, the narrative in each report will have slight variations in their approach. Regardless, it is the authors' views that these reports complement each other, and they agree on almost all substantial points on technical issues. Both reports support the following points:

- At present the use of small cells, such as would be served by wireless equipment attached to utility poles, is growing and is expected to grow substantially in the future.

- The use of wireless services is also growing and is highly likely to grow substantially in the future. Multiple sources indicate a majority of all wireless

traffic will originate indoors[1]. Consequently, most of the hardware supporting small cells will be located indoors where it provides the necessary coverage, where it is out of the weather, and where access to electricity and communications networks is usually easily available.

- Pole access is not a necessity for a wireless service provider. However, pole access is a useful option and, for a variety of reasons, a network designer would find the availability of pole access desirable.

The authors encourage board staff to refer to the specific reports for greater detail on these points, and others.

## 3 Observations on the Reports

The reports are complementary. Dr. Jackson's report was prepared in anticipation of THESL's filing the Notice of Application that led to this proceeding. The Nordicity report was prepared several months later. The Nordicity authors were familiar with Dr. Jackson's report and had participated in the development of the technology issue list. The Nordicity authors tried to avoid pointless duplication of the Jackson report; rather they offered commentary and perspective on material in the Jackson report and tried to provide detail on topics that they felt were not sufficiently covered in the Jackson report. Thus, although the reports address much the same topics, in large part they are complementary rather than duplicative.

The Nordicity authors and Dr. Jackson corresponded regarding the few significant differences in their reports and met in the Experts' Conference held at the OEB's facility on April 23, 2014. Through the correspondence and meeting, the experts were able to reconcile the differences in their views and prepare this joint report. The experts would note the following points regarding the content of the reports:

[1] For example, Qualcomm states that 70% of mobile traffic originates from indoors, see: http://www.qualcomm.com/media/documents/web1000x-mobile-data-challenge , a second example is from CISCO, who reports that almost 80% of mobile traffic is originating indoors. See: http://www.cisco.com/c/en/us/solutions/collateral/service-provider/service-provider-wi-fi/solution_overview_c22-642482.pdf

Regarding Table 1 in the Jackson Report, the Nordicity report states ". . .the content of this table itself is not a point of debate . . ."; however, they believed the table would be more useful and informative if an additional column were added to the table. Nordicity offers such an additional column in Figure 24 of the Nordicity Report. Dr. Jackson has no disagreement with the contents of that additional column. Dr. Jackson notes that there is a slight difference between the original (Jackson) item in row 3, column 2, and the corresponding Nordicity item in column 3. Dr. Jackson believes that the Nordicity item is the preferred of the two.

The Nordicity Report addresses machine-to-machine (M2M) communications, a topic that the Jackson Report does not discuss. Dr. Jackson believes that the discussion of M2M in the Nordicity Report is appropriate and informative; he does not note any technical errors. Both Dr. Jackson and Nordicity agree that (1) the likely proportion of wireless traffic that will be associated with M2M is reasonably characterized by the 5.7% share predicted by Cisco and that is quoted in the Nordicity Report; (2) M2M traffic will not be sufficiently different from other wireless traffic that it will have a significant impact on the design and deployment of wireless networks; and (3) as with other wireless systems, the option to mount M2M equipment on utility poles would be a useful option that either a network designer or an M2M application designer would value.

# 4 The Joint Expert Position on the Issues List

## 4.1 Issue 1: What is the current and likely future state of modern wireless networks?

The majority of both expert reports address this question; in large part, those reports are complementary, not duplicative, and should be read together. A one-sentence response to the Issue 1 question is: Wireless networks will be faster, more responsive, and carry much more traffic than they do today.

## 4.2 Issue 2: For the technical operation of a modern wireless network, are there certain kinds of wireless network elements for which pole access is an option?

### (a) For each such element, what purpose(s) does it serve and/or for what services and applications is it used?

The network elements most likely to be mounted on utility poles are antennas and associated equipment such as transmitter electronics, batteries, and/or solar cells. It may be the case that, from time-to-time, there will be other network elements that would also benefit from pole mounting. But, the experts are not aware of any such today. With respect to the question of what services and applications such equipment is used for, the authors jointly offer this: Equipment mounted on poles is generally used to provide network access to users in close proximity to such equipment, and not generally in moving vehicles. In other words, this equipment facilitates the use of mobile wireless services for individuals walking in the area, or dining nearby, etc. The services and applications used are identical to those used on the macro-cellular network, namely, data consumption and voice traffic.

### (b) For each such element, are there siting alternatives to pole access?

In the vast majority of cases, there will be siting alternatives to pole access. Dr. Jackson quoted research results from Qualcomm, a leading wireless technology company, showing that indoor small cells provide "substantial outdoor coverage." Similarly, in the Nordicity report, the diagram included as Figure 18 illustrates where small cell equipment can be sited, indicating that alternatives to pole siting include indoor wall mounting, and the sides of buildings. The joint experts note that in rare instances there will be situations in which a utility pole is by far the preferred option.

### (c) For each such element, are there technological alternatives?

Antennas are fundamental components of wireless systems. There are no alternatives to antennas in wireless systems, and the experts believe it unlikely that there will be in the future. However, the experts are of the view that in the context of technological alternatives to 'small cells', as an example, a network provider could deploy additional

macro cell (large cell towers) or perhaps also use more spectrum (which is, however, a scarce resource). However, in both cases, this 'technological alternative' may be at odds with the reasoning behind deploying a small cell, which is specifically to provide capacity and coverage in a limited geographic space.

### 4.3 Issue 3. For each of the elements discussed in Issue 2, is there an expectation that this is likely to change in the foreseeable future?

The experts agree that there is no such expectation for change in the foreseeable future. The very nature of mobile wireless traffic growth dictates that greater amounts of equipment will be required to satisfy the needs of consumers. Accordingly, the current projections all indicated a steady growth of the use of wireless equipment such as small cells. For a good overview of the so-called "1000x" challenge (referring to the growth in wireless networks), the authors invite interested readers to refer to a presentation prepared by Qualcomm and can be downloaded here:

http://www.qualcomm.com/media/documents/web1000x-mobile-data-challenge