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*Q1* Internet Draft:

Internet Draft is a series of working documents published by the IETF. Typically, they are drafts for RFCs, but may be other works in progress not intended for publication as RFCs. During the development of a specification, draft versions of the document are made available for informal review and comment by placing them in the IETF's Internet-Drafts directory. This makes an evolving working document readily available to a wide audience, facilitating the process of review and revision.

Internet-Drafts have no formal status, and are subject to change or removal at any time; therefore they should not be cited or quoted in any formal document.

**(b) Difference:**

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| --- | --- | --- |
| Proposed Standard | Draft Standard | Standard |
| 1) The entry-level maturity for the standards track is "Proposed Standard". A specific action by the IESG is required to move a specification onto the standards track at the "Proposed Standard" level | A specification from which at least two independent and interoperable implementations from different code bases have been developed, and for which sufficient successful operational experience has been obtained, may be  Elevated to the "Draft Standard" level. | A specification for which significant implementation and successful operational experience has been obtained may be elevated to the Internet Standard level. |
| 2) A Proposed Standard specification is generally stable, has resolved known design choices, is believed to be well-understood, has received significant community review, and appears to enjoy enough community interest to be considered valuable. | A Draft Standard must be well-understood and known to be quite stable, both in its semantics and as a basis for developing an implementation. | An Internet Standard (which may simply be referred to as a Standard) is characterized by a high degree of technical maturity and by a generally held belief that the specified protocol or service provides significant benefit to the Internet community. |
| 3) Further experience might result in a change or even retraction of the specification before it advances. | A Draft Standard is normally considered to be a final specification, and changes are likely to be made only to solve specific problems encountered. | All specifications unconditionally accepted. |
| 4) Usually, neither implementation nor operational experience is required for the designation of a specification as a Proposed Standard. However, such experience is highly desirable, and will usually represent a strong argument in favor of a Proposed Standard designation. | The requirement for at least two independent and interoperable implementations applies to all of the options and features of the specification. In cases in which one or more options or features have not been demonstrated in at least two interoperable implementations, the specification may advance to the Draft Standard level only if those options or features are removed. | Has cleared requirements of both Proposed and Draft and beyond. |
| 5) A Proposed Standard should have no known technical omissions with respect to the requirements placed upon it. However, the IESG may waive this requirement in order to allow a specification to advance to the Proposed Standard state when it is considered to be useful and necessary (and timely) even with known technical omissions. | In cases in which one or more options or features have not been demonstrated in at least two interoperable implementations, the specification may advance to the Draft Standard level only if those options or features are removed. | All features have been time tested. |

**Q3** *Current and future issues:*

**Mobility:**

The current Internet, designed for stationary end-hosts, does not handle mobility easily within the Internet architecture. The issue of mobility relates to handling changes in location and underlying network connectivity of mobile end-systems at each protocol layer. Note that in this paper, we focus on host mobility. Network Mobility (NEMO) (RFC 3693, 2005), or site mobility, is out of scope of this paper. However, some of the techniques for host mobility can be extended to support network mobility and site mobility as well.

**Multihoming:**

In the past, most hosts/nodes or computers had only one networking interface. Hosts stayed within one network with one egress path. However, multi homed hosts or devices having multiple networking interfaces are becoming more common. Additionally, users may be multi homed too. Each user can be reached through many different hosts, such as computers, PDAs (Personal Digital Assistant), and cellular phones. We call this user multi homing. Finally, the network that users reside in may have several egress paths as well. This is the so-called site multi homing. All these use the multi homing functionality to support fault-tolerance, load sharing and/or load balancing, and traffic engineering.

**Routing Scalability:**

A common solution for IP network sites to allow changing their service providers is to use Provider Independent (PI) addresses. However, these addresses are not aggregable and lead to an exponential increase in size of the routing table in Default Free Zones

(DFZs) (RFC 4984, 2007).

**Deploy ability:**

Deploy ability of new mechanisms is an extremely important factor. The literature is rife with examples of technically superior proposals that have seen limited or no deployment in the real world owing to the lack of a proper and practical deployment plan.

**CURRENT AND FUTURE CHALLENGES:**

**Using New Spectrum Wisely:**

We have outgrown the radio spectrum we use for wireless communication. Fortunately, in 2020 we will see growth in the use of new frequency bands. First, we’re going to see high frequencies, from about 30 to about 60 GHz, called “millimeter wave” rolled out for mobile data communications (5G) and as an extension of Wi-Fi (802.11ay).

Signals in these short wavelengths can be pointed by antenna arrays with high directionality, which improves spectrum use by limiting interference between devices. There’s a challenge in improving how radios do signal acquisition and tracking for these focused beams. Assuming we succeed at optimizing our use of mm Wave, the next band of terahertz frequencies provides even greater directionality.

**Maximizing Performance:**

Wireless today is very fast, but performance falls off considerably in complex or crowded environments. If a sporting arena wanted to provide every person in every seat with their own customized augmented-reality experience, we couldn’t do it efficiently today. (However, there are creative proposals, such as putting a wireless access point under every attendee’s seat, which is both cost-prohibitive and would lead to interference issues.)

**Networks that Know Themselves:**

In a few years, literally billions of new wireless devices will come online. How should each wireless network treat each new device as it connects? Some devices will need lots of bandwidth. Some will require ultra-low latency. Some will be battery-power-limited. Some may be malicious. It is surprisingly challenging for network admins to know what is even on their networks. Not all devices identify themselves. Malicious devices can lie about what they are. Furthermore, as more traffic becomes encrypted (as it should be for security) identification becomes even harder.

## **Network as Sensor:**

## We can use wireless networks for more than just data transfer. Network devices are constantly painting their environments with radio waves; how those waves are reflected back provides useful information about the environment.

Today, we can use various techniques to geolocation devices indoors, where GPS doesn’t work: We collect data based on received signal strength, time-of-flight, and angle-of-arrival to estimate the location of various devices relative to indoor APs. Improving the accuracy, frequency, and scale of estimating indoor locations can open up many applications, like autonomous indoor robots.

Radios as Software:

There are fascinating engineering challenges ahead in the field of software-defined radios (SDRs) and cognitive radio. Rather than having to engineer all the advancements I discussed above into new radio hardware, and worry about them quickly becoming outdated, we may be able to add capabilities to our wireless systems through software updates – just like we update our smartphones today. As new spectrum or encoding methods become available, we could update existing devices in place.