



CAROLINA TECHNOLOGY CONSULTANTS

November 2009

Tech Brief

Architectural Issues in IT and Data Communications

Topic

Visible Light Communications

Prepared By

Tyler R. Johnson

Summary

Visible Light Communications (VLC) enables Internet service to be delivered over your home lighting system, and traffic lights to communicate road conditions to your automobile. The IEEE is standardizing a protocol that allows data to be transported wirelessly using inexpensive lights.

How It Works

In order to transmit data over light, the light source is pulsed on and off rapidly to create a data stream. Optical receivers convert the light pulses to an electronic signal. By pulsing lights many thousands (and millions) of times per second, data transmission occurs at a rate undetectable by the human eye.

Recent years have seen a move toward light emitting diode (LED) technology for residential and commercial lighting applications. LED lighting fixtures in the home can be pulsed at speeds above 100 megabits per second. Thus, a home using VLC technology can be blanketed in high speed, wireless, data transmissions.

Visible Light Communications

- * VLC is an IEEE 802.15.7 working group effort in progress.
- * The VLC Consortium has already released an industry specification.
- * Theoretical speeds beyond 100 Megabits per second.

Advantages of Light

Visible light has a number of unique properties which make it a good choice for specific applications. The existing radio frequency spectrum is exceedingly crowded. Light is (currently) unregulated. Unlike radio, it's propagation is easily controlled. It can be spread ambiently in a room, or focused tightly to a pinpoint. Optical emitters and receivers are inexpensive and can be readily incorporated into consumer and industrial electronics.

Standardization Efforts

VLC standardization efforts have been taking place since 2008 within the IEEE 802.15 working group, which is charged with overseeing standards for wireless personal area networks, including body area networks (interconnecting devices on and around the human body) and smart grid systems (networks of utility sensors). VLZ specifications are developed within the IEEE 802.15.7 task group.

The first standard will be a



physical layer transport standard (like Ethernet) that is capable of carrying different protocols, including IP.

A great deal of emphasis is being placed on optimizing the specification so that it works well within its particular constraints. For example, VLC environments can be more lossy than wired environments, so more loss-resilient coding schemes are being employed.

VLC Consortium

The VLC Consortium (VLCC) is an industry collaboration focused on commercial development of VLC technologies and applications. VLCC has produced version 1.0 of a physical layer specification for pre-standard applications. This specification is based on the re-use of existing IrDA systems (used in portable electronics) and achieves a data rate of 4 megabits per second, making it a reasonable pairing with data intensive 3G/4G mobile multimedia applications.

Applications for VLC

Industry proponents, especially in Japan and Korea, imagine a multitude of applications for VLC.

- A lighthouse that transmits digital information to ships at sea.
- LED signs that transmit information

to your mobile phone.

- Municipal lighting that transmits public and traffic safety information.
- Television programs with encoded data streams that carry supplementary data.
- Peer to peer communications for digital appliances.

Strategy Considerations

Due to propagation characteristics RF is an excellent choice for highly mobile applications such as smartphones. However, due to its low cost and extreme localization, VLC is well positioned to be implemented in “Internet of things” applications allowing intelligent communications between individuals and a rich environment of data-enabled appliances.

For Further Information

1. IEEE 802.15.7 Working Group, <http://www.ieee802.org/15/pub/TG7.html>
2. The Visible Light Communications Consortium. <http://www.vlcc.net/>.
3. Cree Lighting (commercial lighting vendor), <http://www.creeledlighting.com/index.aspx>