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Cook Over IP

Cordless Smart Kitchen
Appliance Architectures
and Protocols



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Architectures and Protocols

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Chapter 1

Introduction



Every person needs to eat regardless of whether he/she follows a “live to eat” or a “eat to live” philosophy. As food intake is an inevitable aspect of survival, food and everything around food have continuously evolved from time immemorial. One of the major aspects that has been experiencing much technological innovation is cooking, and in a broader sense, the kitchen. With lives of people becoming busier every day, the kitchen will certainly be the focal point of innovation in the near future.

With the emergence of the Internet of Things (IoT) technologies, the concept of ‘Smart Kitchen’ or ‘Connected Kitchen’ [1] is being developed. This concept has brought a wave of smart and connected devices that has transformed the way we cook and interact with our kitchen appliances. It facilitates many interesting and important applications that cater to the busy lifestyles of today, such as enabling the appliances to be controlled from smartphones, and cooking by uploading recipes from a remote location which saves time as compared to the conventional cooking methods.

An imminent technological development in the smart kitchen domain is the concept of ‘Cordless Kitchen’ [2]. This concept, introduced by the Wireless Power Consortium (WPC) [3], does not require the appliances to have power cords or batteries to operate. Instead, they are powered by inductive power sources (or power transmitters) that may be built into a kitchen counter, cooktop (hob), or a table. The appliance needs to be simply placed on top of the power transmitters and the user should be able to cook, interact and control the appliance remotely.

The Cordless Kitchen standard, also known as ‘Ki’, is based on the principles of ‘Qi’ wireless charging technology which is already prevalent in the market for charging smartphones. Ki, however, is designed for powering higher input wattage equipment. There are about 580 consortium members (as of March 2020) in WPC with many renowned Original Equipment Manufacturers (OEMs) such as Philips, Samsung and Robert Bosch. Some manufacturers are also extending this to charge laptops (e.g. Powermat Technologies).

As Ki does not deal with networking the appliances, this book focuses on getting these cordless kitchen appliances connected to the Internet with minimal changes on

the appliances (or devices) and networking stacks. In this chapter, we shall introduce the concept of cordless kitchens and technologies involved, and then give an overview of why connecting the appliances to the Internet is non-trivial.

The reader can learn about the ‘Ki’ cordless kitchen operation in detail in Chap. 2. We shall walk the reader through the complete design process: Chap. 3 shall discuss possible architectures to connect the appliances to the Internet; Chap. 4 shall describe the state of the art and present why this problem needs novel solutions; Chap. 5 details the challenges for providing Internet connectivity and describes how the TCP/IP protocol should be adapted to the cordless kitchen system. A thorough evaluation of the proposed solutions is presented in Chap. 6, along with few implementation recommendations. Other factors affecting the performance that a solution architect must consider are explained in Chap. 7.

1.1 Overview of the Cordless Kitchen Concept

The main goal of the cordless kitchen concept is to eliminate power cords in kitchen appliances. Connecting the appliances to the Internet would bring in ease of use. For example, users can upload recipes, monitor the dish and appliance and begin cooking when still on the way home. These goals together will provide the user with a truly wireless, smart-cooking experience.

1.1.1 *Benefits of Cordless Kitchen*

Ki is designed for cordless kitchen appliances that can be powered with a maximum of 2.2 kW. For heavy appliances, such as a refrigerator, that are stationary, the concept of a cordless kitchen is neither required nor efficient. Some of the benefits of the cordless kitchen are listed below.

- **Space efficient:**

- Better usage of limited kitchen counter spaces and tables as the same space can cater to food preparation, cooking and cleaning.
- Cordless appliances are easy to store.

- **Smart:**

- Two-way communication between the appliance and the power transmitter allows for intelligent features such as consistent and power-efficient cooking, as the amount of power transferred is equal to what the appliance expects.
- Adding Internet connectivity in the cordless kitchen would enable remote cooking, where users can control the appliances remotely, upload recipes and software updates, enable IoT communications, etc.