IEEE P802.11
Wireless LANs

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| Use Case Reference List for TGai |
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Abstract

The most current version of this document contains the descriptions of the use cases that will be used to evaluate submissions to TGai.

# Introduction

IEEE 802.11 devices are increasingly becoming more mobile devices. TGai project’s primary need comes from an environment where a large number of mobile users are constantly entering and leaving the coverage area of an access point (AP) in an extended service set (ESS). Every time the mobile device enters an ESS, the mobile device has to do an initial set-up to establish wireless local area network (LAN) connectivity. This works well when the number of new stations (STAs) in a given time period is small. It requires efficient mechanisms that scales well when a high number of users simultaneously enter an ESS. This requires the ESS to minimize the time the STAs spend in initial link setup, while maintaining secure authentication.

Discussion of pre-knowledge needs to be added: e.g. a database downloaded that might give clues to know which channels are available or different secure ID scheme. Shortcut to authentication (perhaps pre-cached credentials). [ACTION ITEM TO ASSIGN TEXT WRITING]

# Use Cases

The purpose of this document is to gather all use cases that will be considered in the evaluation of proposed updates to IEEE 802.11 that would decrease the link setup time. TGai may determine that some of the use cases contained in this document are required to be satisfied, while others may be desired but optional. In any case, no requirements for technical solutions are required to address issues other than those stated or implied by the use cases in the most current version of this document.

The basic use case methodology to be used by TGai is explained in 11-11-0191-00-01ai-Use-Case-Discussion.pptx. General use case methodology has four basic elements:

* Actor(s)
* Device sets
* Goal
* Scenario(s)

For TGai, the use cases are somewhat simplified because of the limited scope of the PAR.

Actors generally define unique characteristics of operators of the devices involved. For all cases considered by TGai, the initiator STA and the target AP are constant. The STA may be autonomous or operated by a human, but its relationship to the AP remains the same. If more than one device/person is present in the ESS, that difference should be noted in the description of the scenario. Other important factors, such as relationship between STA and the AP in terms of assumed level of trust and previous history are also best described in the scenario.

Device sets are the STA, AP, and any other relevant equipment needed to accomplish the intended tasks. For TGai, the device set of interest is always a STA and an AP. The scenarios section covers other participants in the ESS, which may be incumbent or vying for access to the ESS. This will vary by scenario and would also be best noted there as an **aggregate demand** for establishing links. Values for this attribute are in terms of users who wish to connect at virtually the same time:

* High: more than 25
* Medium: 5 to 25
* Low: 1 to 4

The goal in all use cases for TGai will be to minimize the time requires for link setup. The differences in the acceptable time allowed for this task is, again, dependent on the scenario. It will be defined by the **bandwidth occupation** by incumbents and the window of availability for the STA within the ESS. Values for bandwidth occupation are:

* High: More than 75%
* Medium: ESS is between 75 to 25% available bandwidth
* Low: Few users already associated with ESS

Values for window of availability for the STA within the ESS are expressed in tolerable time to establish a link:

* High: Users are highly intolerant of delay
* Medium: Users tolerate 5 to 10 seconds of delay
* Low: Users tolerate

In addition, scenarios will vary by what could be termed “**depth of association**”. A shallow depth may require only the reception of a broadcast with no security restrictions. For example, the reception of the ID of a train stop may need no authentication, but a financial transaction may require end-to-end authentication and encryption. Values for depth of association are:

* High: heavy burden of setup needed; for instance, end-to-end security
* Medium: light burden of setup; for instance, local authentication
* Low: virtually no setup/authentication needed

The scenarios in the following sections will contain a narrative of the expected interaction between the STA and the AP. Each will end with a summary describing:

* **Aggregate demand** for establishing links
* **Bandwidth occupation** used by incumbents
* Opportunity **window** link establishment
* **Depth** of association

## Use case categories

For the purposes of organization, the use cases below are gathered together in terms of the mobility of the STA. The AP is assumed to be fixed, unless otherwise stated.

### Pedestrian

Electronic Payment

For pedestrian use, the STA (the payee) will typically be located in a kiosk or at a retail store counter and the AP will be part of the retail infrastructure. After bringing purchases to the checkout counter, or at the pickup window of a drive-through store, the customer elects to pay electronically using their Wi-Fi capable smart phone or hand-held computer. The time-critical aspect of the transaction is that the mobile STA may not be within range of the fixed AP until moments (only a second or more) before the transaction is to be completed. In high traffic scenarios, conventional delays in establishing a link can cause unacceptable delays with long lines forming at the counter.

Aggregate demand: Low

Available bandwidth:

Window: 5 seconds

Depth: High

Traveller Information

A pedestrian walking down the street, opting to see tourist information about current location. Ability to get map, navigation directions, local attractions, restaurants, etc. Unlike things like the iPhone app “AroundMe”, the information provided would be even more site specific and could be interactive.

Aggregate demand:

Available bandwidth:

Window:

Depth:

Museum attendee –The person obtains information about an object on display as they walk up to the object. Instead of the current recorded voice guides currently in use, this service would be automatically activated by the current location, within a meter or two if necessary, of the user and could even take into account the direction the person is looking in. The information could be multimedia and be interactive.

Aggregate demand:

Available bandwidth:

Window:

Depth:

Internet Access

Mobile devices perform Internet access while walking. There is the possibility of the person running, not just walking, such as when a jogger is asking for streaming music.

Aggregate demand:

Available bandwidth:

Window:

Depth:

### Vehicle

Internet Access

A person in a car requesting Internet access at any time under any driving circumstances in which there is available coverage. This may be within a parking garage to obtain information about stores in the area or it could be along the roadside for Web access or to download files or streaming audio/video.

Aggregate demand:

Available bandwidth:

Window:

Depth:

Traveller Information

Special maps and directions being downloaded as needed. Such downloads could occur spread out over multiple APs to distribute the download time. For commercial trucks, this could include downloading special routing and delivery instructions from their dispatcher and automatically updating the dispatcher with their status and location.

Aggregate demand:

Available bandwidth:

Window:

Depth:

Car driver – The driver (or passenger) obtains information about upcoming road conditions and travel times from a roadside AP. Could be expanded into automatically diverting traffic to alternative routes and providing turn-by-turn directions while on these detours. Each vehicle would be assigned to a specific route and thus may be getting unique directions.

Aggregate demand:

Available bandwidth:

Window:

Depth:

Electronic Payment

Fuel payment – This is like the conventional gas station pump credit card payment except that the charge is being made electronically via a Wi-Fi connection. The only need for low latency in this scenario is the potential delays that would be objectionable to the driver before pumping can begin.

Aggregate demand:

Available bandwidth:

Window:

Depth:

Rental car processing – As a rental car drives through the gate upon returning, all relevant data is automatically transmitted to the office and the car “checked in”. The car’s diagnostic connector supplies key information such as the vehicle ID, mileage, fuel level, and any diagnostic codes that appeared. All electronic fees paid for by the on-board systems, such as tolls, parking, fuel, or retail sales, that were charged are added to the rental bill. This not only improves the check-in procedure, but also allows rental cars to use electronic toll collection and parking, which they cannot easily do today.

Aggregate demand:

Available bandwidth:

Window:

Depth:

Emergency Services

Traffic Signal preemption – Currently, many emergency vehicles are capable of causing a red traffic light to turn green via strobe light communication with the traffic signal controller. Using 11ai, this capability can be greatly expanded, not only in terms of the operating range, but also to take into account the navigation plan of the vehicle so that other lights in the area can be controlled to clear traffic in advance of the emergency vehicle’s arrival at the intersection, but to account for planned turns. This can include video of the scene they are going to and updated navigation directions to account for previously unknown problems.

Aggregate demand:

Available bandwidth:

Window:

Depth:

An extension of this application is the ability for the emergency vehicle to directly communicate with private sector vehicles ahead of it (and those approaching on cross streets) that they are approaching, from which direction they are approaching, and especially important in congested urban areas, if they desire the private vehicle to move to the right or the left depending on the needs for clearing the intended path.

Aggregate demand:

Available bandwidth:

Window:

Depth:

Ambulance interaction with hospital – an ambulance can upload vital patient information to the hospital they are going to (or to any other specialists that need to be consulted) while en-route. Such data may include video as well as instrument readings. If the AP is available, such data can be uploaded prior to leaving the scene, perhaps as a means of better defining the best course of action.

Aggregate demand:

Available bandwidth:

Window:

Depth:

On-site emergency services coordination – Establish a temporary IP network on-site to go beyond what can be done with simple voice-based systems. In addition to voice, text, and graphics (e.g. building plans), video from a variety of sources can be shared by all on-site responders and shared with fixed site control centers.

Aggregate demand:

Available bandwidth:

Window:

Depth:

Public Interaction – During an emergency situation, there is a need for improved communication between the emergency services agencies and the public, whether this is to on notice about a situation, to assist in looking for someone (e.g Amber alert) or to conduct an evacuation of an area. The public can be advised about actions that they should take that is specific to their location (don’t send out a city-wide evacuation when only a small specific area is involved) and manage the routing of cars and people to avoid grid-lock for either an evacuation or simply when temporarily rerouting traffic.

Aggregate demand:

Available bandwidth:

Window:

Depth:

Inspections

Vehicle safety – There are requirements for operators to not simply keep their vehicles in a safe condition, but to keep records and undergo occasional safety inspection. Using the capabilities of 11ai, the on-board records can be downloaded to a certified inspection station without the vehicle having to stop and physically hand over these records (electronic screening). This would expand on the currently implemented weight-in-motion systems, with the weigh-in-motion function being included in the same system.

Aggregate demand:

Available bandwidth:

Window:

Depth:

Hazardous Goods (HazMat) – This would enable the automated monitoring and tracking of shipments of hazardous goods (also known as Hazardous Materials or HazMat). Such shipments have prior approval, not only of the goods themselves, but the route to be taken, with considerable paperwork for the various aspects of the shipment. With the capabilities of 11ai and the existence of various roadside APs, the shipment can be tracked in real time, including monitoring the status of the goods and any on-board security systems.

Aggregate demand:

Available bandwidth:

Window:

Depth:

Border Crossing – All of the necessary paperwork, including driver information (which can include biometrics) can be transferred to the boarder inspection station as the vehicle is approaching the station. Many border crossings have periods of congestion that result in long backups which not only cause a waste in time, but also can cause traffic management problems.

Aggregate demand:

Available bandwidth:

Window:

Depth:

Resource Management

Vehicle tracking – All fleets attempt to keep track of all of their vehicles at all times. Widespread Wi-Fi hot spots along roadways and throughout urban areas can be used by trucking fleets to quickly link to their home office to not only indicate where they are located, but at the same time to download any necessary updates to the driver.

Aggregate demand:

Available bandwidth:

Window:

Depth:

Dynamic Load Allocations and Routing and fleet management – Currently, especially with Less Than Truckload (LTL) fleets, there is a need to provide dynamic rerouting of a truck to pick up a previously unscheduled load. This is currently done via cellular phones and satellite systems, but would be much more efficient using Wi-Fi. In doing so, with the additional bandwidth available, navigation updates can be made towards the new destination which take into account all other stops that will be required during that day (a capability that is beyond conventional navigation systems).

Aggregate demand:

Available bandwidth:

Window:

Depth:

### Transit

Station arrival

A train with no Wi-Fi access arrives at a station and the passengers want to connect to the AP. A small number (less than 25%) of the passengers will remain in the AP range when the train leaves, 90 seconds after arrival.

Aggregate demand:

Available bandwidth:

Window:

Depth:

Passenger In-transit access

The train is a mobile AP which the passengers connect to whilst travelling. The turnover of STAs accessing the AP will be about 25% every 3 to 5 minutes. Users will not log off when leaving the train.

Aggregate demand:

Available bandwidth:

Window:

Depth:

Station Lobby

STAs will arrive in a fairly constant rate and want instant access to schedules, status, and optimal transit routes. The transactions may include ticket purchase.

Aggregate demand:

Available bandwidth:

Window:

Depth:

### Switchover

Nokia presentation switch over via TGu. Social networking 0122.

Aggregate demand:

Available bandwidth:

Window:

Depth:

**References:**