

To: Operations and Scheduling Committee

Date: February 27, 2014

From: Anne Muzzini, Director of Planning & Marketing

Reviewed by:

Subject: Time Synchronization and Accuracy

Summary of Issues:

At the February Board meeting a driver reported that the time displayed inside the bus and the times showing on the Clever Devices Bus Tracker system were inaccurate. In response, staff has done an extensive examination how different systems obtain the time and how the systems are coordinated. A detailed explanation by the IT staff about the source of time and synchronization is included below.

The Director of Maintenance has personally boarded 60 buses to ensure that the time showing on the bus is accurate and synchronized. The Customer Service complaint files have been analyzed and there has not been an increase in complaints about ontime performance, or BusTracker. It may be that the driver concerns about time accuracy and synchronization stem from disciplinary measures taken for tardiness and use of the Clever CAD system by dispatch to identify drivers running "hot" (leaving timepoint early).

After ensuring that the time sources used and synchronization procedures in place are functioning correctly staff can assure the Board that the time used by the agency is consistent and synchronized with the National Institute of Standards and Technology.

IT Report on Time:

Source of Time and Synchronization

All systems at County Connection synchronize their time to one internal source the Network Time Protocol (NTP), and that internal source is synchronized externally to an official government source, the National Institute of Standards and Technology (NIST). This provides consistent time within the agency.

The NIST is the same source that Cell Phone Networks and other service providers use to set their time therefor County Connection time matches the time on passenger's cell phones. The NTP Server updates its clock with NIST every 10 minutes. All County Connection Servers, Desktop PC's, Phones, and other devices are synchronized to the internal NTP Server. This includes the Clever Devices Server which provides the time to the Dispatch center CAD/AVL system, and the buses.

Clever CAD/AVL, Bus, and Bus Tracker Time

The onboard Clever Devices computer system displays the time in the front of the bus and sends time and location information to the CAD/AVL system used by dispatch and the BusTracker used by passengers to predict arrivals.

The Clever Devices main server (called the DCC) requests the time from our NTP Server every 30 minutes. Whenever a Bus is started, Clever Device's on-board computer (IVN) requests the current time from the DCC over the cellular network. Once the IVN has the time, it requests it again from the DCC every four hours, unless the bus is shut off and turned back on, in which case it will request the time immediately.

In addition, the IVN receives its location from GPS Satellites every 15 seconds and time-stamps those locations based on the time it synchronized from the DCC. It does NOT use the GPS satellite time. The IVN then uploads this telemetry data every 30 seconds to the DCC over the cellular connection. This information is used by the DCC for schedule adherence in Dispatch and also for Bus Tracker arrival prediction calculations.

Bus Tracker will always show where the bus currently is, based on uploaded GPS information. The Bus Tracker arrival prediction times ARE based on an algorithm that uses the current location and speed of the bus and estimates when the bus will arrive at the next stop. This estimate is updated every 30 seconds when the bus uploads its GPS location, time, and speed.