



# **Time To Service(TTS)**

*A White Paper*

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## **1. Introduction**

This document gives a description and benefits of the “IP Endpoint Time-to-Service (TTS)” feature that was implemented in Avaya Communication Manager (CM), Release 4.0. In order for the benefits of TTS to be realized you must also have H323 phone FW that supports TTS. TTS is supported in FW 2.8 or greater on the 46xx H323 IP telephones and in FW 1.2.1 or greater on the 96xx H323 IP telephones. Enabling or disabling the TTS feature is controlled within CM and is on by default.

The TTS feature greatly reduces the time for IP endpoints to recover after long network outages and it also improves the time for the IP endpoints to come into service in cases where the system has a large number of IP endpoints trying to register which happens upon a CM reset of level 2 or greater. In general, the improved recovery times are achieved in two ways: 1) because re-registration is no longer required to recover a lost TCP socket which occurs after a loss of network connectivity lasting greater than 50 seconds and 2) after registration, the TCP socket setup maybe delayed until needed.

## **2. Basic Operation**

In order for an H.323 phone to come into service and be able to place or receive calls, there are two main events that must occur. First the phone must register so that CM knows what IP address the phone is using. This event is often referred to as "RAS". The second event is the establishment of a TCP socket and Q.931 signaling channel used as a unique communication path between CM and the phone. In general, TTS separates these two events in order to more efficiently recover after outages.

### **3. Non-TTS Operation**

In the non-TTS architecture, the two events previously mentioned (registration and TCP socket setup) are tightly coupled and any loss of the TCP socket requires a re-registration to re-establish the TCP socket. A loss of network connectivity greater than 50 seconds requires the TCP socket to be re-established and re-registration is then required to recover the closed TCP socket and Q.931 signaling channel. Any newly added phones or phones coming back into service after a system reset must also go through both events impacting the recovery time for the remaining IP phones because of system occupancy or other system limits.

In the non-TTS operation the TCP socket establishment is always initiated by the phone and simultaneous incoming TCP socket requests are limited to 5 per CLAN. This causes a bottleneck during mass registration events because TCP socket establishment is linked with registration. Registrations must be throttled if all CLAN's are already handling 5 socket requests.

### **4. TTS Operation**

#### **4.1 Overview**

With TTS, only the H.323 registration process is needed to bring an endpoint into service and establishing the TCP socket may be postponed until it is needed rather than when the endpoint registers. This reduces the demand on CM and allows for more endpoints to register over a given period of time. In addition, CM now initiates the socket setup which avoids the previous mentioned CLAN limitations of 5 simultaneous incoming socket requests. Note that if the phone needs a socket after registration, such as during an offhook, then the phone will request CM to establish the socket via a RAS message. If a user goes offhook when a phone is registered and there is no TCP socket then the phone will give a warning beep and display "connecting" as an indication that an attempt is being made to establish communication with CM to honor the user's request. Provided there is no network outage then the socket is established and normal feature and call process handling occurs.

The TCP socket will be established at registration time provided CM occupancy is below 50%. If it cannot be established at registration then it will be deferred until occupancy drops below 47%. Regardless of occupancy if a user attempts to use the endpoint or a call is placed to the endpoint and the TCP socket is down, then CM will establish the socket so that the user may originate the call or the inbound call can be completed.

During establishment of the TCP socket if the connection fails to the endpoint, then CM will attempt to establish the socket on a different CLAN (provided an available CLAN exists). A total of 3 CLANs may be attempted. If all 3 fail then CM stops trying until another request for service is made.

TTS does not require re-registration to recover a closed TCP socket provided the network outage is less than 10 minutes. IP endpoints will not need to re-register for loss of network connectivity that does not cause the IP endpoints to failover to an Enterprise Survivable Server (ESS) or Local Survivable Processor (LSP). Registration is required when IP endpoints failover to an ESS or LSP, because those servers do not have current registrations for the endpoints. In addition, registration is always required on the server after a CM reset of level 2 or above. When there is no ESS or LSP for the phone to failover to and the network outage is greater than 10 minutes then the phone will reboot which causes a re-registration. Note that the phone may appear to be registered on both the MAIN and on either the LSP or ESS in a failover situation.

## 4.2 TTS Administration

There are three new fields associated with TTS and all are found on page 2 of the ip-network-region form. By default, TTS is turned on in the system.

### TCP SIGNALING LINK ESTABLISHMENT FOR AVAYA H.323 ENDPOINTS

Near End Establishes TCP Signaling Socket? y

Near End TCP Port Min: 61440

Near End TCP Port Max: 61444

The first field allows you to enable/disable TTS on a per network region basis. The remaining two fields are used to specify/limit the TCP port range used during TCP socket establishment which may be necessary for firewall traversal.

Note: typically ports are opened on a firewall to allow entrance from the “untrusted” side of the firewall. The CLAN would normally be on the “trusted” side. Since TTS always establishes outgoing TCP sockets from the CLAN, no firewall changes would normally be necessary since outgoing connections from the “trusted” side of the firewall are allowed.

The range is provided for flexibility if needed in a particular customer firewall configuration.

## 4.3 TTS Maintenance

Page 1 of “**status station**” has a field “TCP Signal Status:”. This field will contain “on-demand” when the phone is registered but does not have a signaling socket.

The output of “**list registered**” contains a y/n column(TCP Skt) and indicates if the TCP signaling socket has been established.

The output of “**status socket-usage**” can be used to view the number of sockets associated with the Ethernet interfaces as well as a summary of the total registered endpoints and total registered endpoints with sockets.

“**monitor socket-usage**” can be used to monitor, at 15 seconds intervals, the total registered endpoints and the total TCP sockets established. Note that this same data is available via the “status socket-usage” mentioned above but without the automatic updates. Also note that the monitor commands, by design, will terminate your SAT session when you stop them.

## 4.4 Recovery Time Improvements

As previous discussed, there are two aspects of recovery that TTS impacts: 1) network outages of greater than 50 seconds and 2) recovery times after a CM system reset 2 or higher which requires the phone to reregister. There are many factors which influence the recovery of H.323 endpoints, it is not possible to cover every permutation in this document. The following data is solely intended to give the reader an indication of the impact that TTS has on the recovery time of IP phones compared to a non-TTS environment.

### 4.4.1 Network outages

#### 4.4.1.1 Network outages longer than 50 seconds

Non-TTS capable phones are required to re-register and the recovery time may be 10's of minutes for some endpoints. With 3,000 TTS endpoints and a 30,000 BHC rate, initial measurements indicate that the time to reliably get dialtone(< 3 second dialtone delay) is approximately **45 seconds** from the time the network was restored. Recall that network outages longer than 10 minutes cause the phone to either failover or reboot which then requires the phone to re-register when it does return to the main server.

#### 4.4.1.2 Network outages less than 50 seconds

This section is added for completeness only since TTS has no impact on network outages of less than 50 seconds because the TCP socket is not lost during outages of this timeframe. Obviously, until the network is restored, there would be an impact on service with a delay in signaling and a loss of audio during the network outage.

### 4.4.2 CM reset or re-registration

During a CM reset all IP endpoints are affected but the frequency of this event is typically very low. The benefits of TTS increase as the number of IP endpoints increase on a system. Since TTS was developed with a focus on customers with a large number of IP endpoints, the following data reflects the possible improvements in re-registration times for a customer with a 10,000+ endpoints. For configurations with only several thousand IP endpoints, the impact of TTS on recovery time is less noticeable.

#### 4.4.2.1 Without signaling channel encryption

Lab measurements indicate that the re-registration time is reduced by approximately 50%.

#### 4.4.2.2 With AnnexH signaling channel encryption

Lab measurements indicate that the re-registration time is reduced by approximately 30%.

## 4.5 Failover

Failover is mentioned in this document primarily because it is another method of "recovery" which is what TTS was designed to address. It should be noted that a phone can appear to be

registered on the LSP or ESS and on the MAIN at the same time due to the persistent registration on the MAIN.

#### **4.5.1 LSP**

IP endpoints will begin the discovery process (registration) at an LSP after TCP keepalive (KA) timer and the primary search timer (PST) have expired. These timers expire serially on the phone and have default values of 50 seconds and 75 seconds, respectively.

#### **4.5.2 ESS**

IP endpoints will begin the discovery process (registration) at an ESS after TCP KA timer and ESS no service timeout interval have expired. These timers expire serially on the phone and have default values of 50 seconds and 5 minutes, respectively.

#### **4.5.3 Call status effects**

If an IP endpoint is on a call, it is not allowed to register in failover scenario until the call has ended. The phone reports call status to CM at registration and if a call is present CM will block the registration. Once the phone goes idle the phone will register with CM.

### **4.6 Firewall Interactions**

See section 4.2, TTS Administration, for firewall interactions.

### **4.7 Feature Interactions**

#### **4.7.1 Alternate Gatekeeper (GK) List (AGL)**

The AGL was expanded to 72 GKs. In CM4.0, CM can now support up to 106 CLAN's. Care must be taken to ensure that there cannot be more than 72 eligible GKs for use for any network region. Possible GKs include CLANs, Processor Ethernet, LSPs, and survivable GKs. If an IP endpoint is in the IP network map then this count must also include CLANs in directly connected regions. If this number exceeds 72, then it is possible that CM may select a CLAN that was not sent to the endpoint in the AGL. If this happens then the phone will not accept the TCP socket request. This will result in CM unregistering the endpoint.

#### **4.7.2 Load Balancing**

Load balancing is a feature that attempts to distribute load (TCP sockets) across CLANs, so that no one CLAN becomes overloaded. TTS employs load balancing whenever CM establishes the TCP socket to the phone with one exception. If a phone user attempts to originate call when the TCP socket is down, then the phone sends a UDP RAS message known as an Admission Request (ARQ) to CM to inform it of the request. The CLAN where CM receives the ARQ is chosen (provided it is not full) to establish the TCP socket. There is no load balancing for this case. This is done to provide the highest probability that the socket can be established on the 1<sup>st</sup> try and thereby provide the user with service as fast as possible.

## **5. Conclusion**

TTS greatly improves the recovery time and redistributes the network traffic in large IP H.323 system configurations when lots of endpoint are recovering after a network outage. TTS is on by default in CM but to realize the benefits of TTS you must also have the associated phone FW as described in section 1.