AZTech™ Stakeholder Agreement

AZTech™ Transportation and Public Safety Center-to-Center Project

January 6, 2006

This document serves to formalize the agreement of the AZTech™ stakeholders with the development and implementation of the Traffic Management System (TMS) and Dynamic Message Sign (DMS) components of the AZTech™ Center-to-Center (C2C) System. The C2C System approach for these components is described briefly below, and in greater detail in the following documents:

1. *AZTech™ Transportation and Public Safety Center-to-Center Needs Assessment and Concept of Operations*, May 27, 2005.

2. *AZTech™ Transportation and Public Safety Center-to-Center – Dynamic Message Sign (DMS) and Traffic Management System (TMS) Functional Requirements*, January 3, 2006.

Additional discussion is also provided in the following document:

3. *AZTech™ Transportation and Public Safety Center-to-Center – Disposition of Comments on Draft Functional Requirements*, December 8, 2005.

1. Project Background

The AZTech™ Center-to-Center (C2C) System is intended to provide common communications protocols, and the associated software interfaces, to permit the exchange of data among existing software platforms deployed by AZTech™ stakeholders throughout the region. As described in the above reports, the system architecture which has been developed for this project continues the current practice of having the local field devices (signal controllers, DMS controllers, etc.) communicate directly and only with the existing proprietary software packages already deployed in each jurisdiction. Requests for data or control are passed from the requesting system to the receiving system in a common C2C protocol, which may require modifications to each software package or the addition of a software interface module to translate between the C2C protocol and the software's proprietary input/output format.

This process is represented in Figure 1 for the DMS component and Figure 2 for the TMS component. Each figure illustrates the existing proprietary systems in the boxes down the left side, the new C2C interface modules to their right, and, shown as a cloud, the common C2C

protocol for communication between systems. Other data streams using the protocol, but not tied to typical control systems, are shown on the right side, such as for RADS and HCRS.

Additional background regarding the system architecture is provided in the first report listed above, which is also available on the AZTech™ website (www.aztech.org).

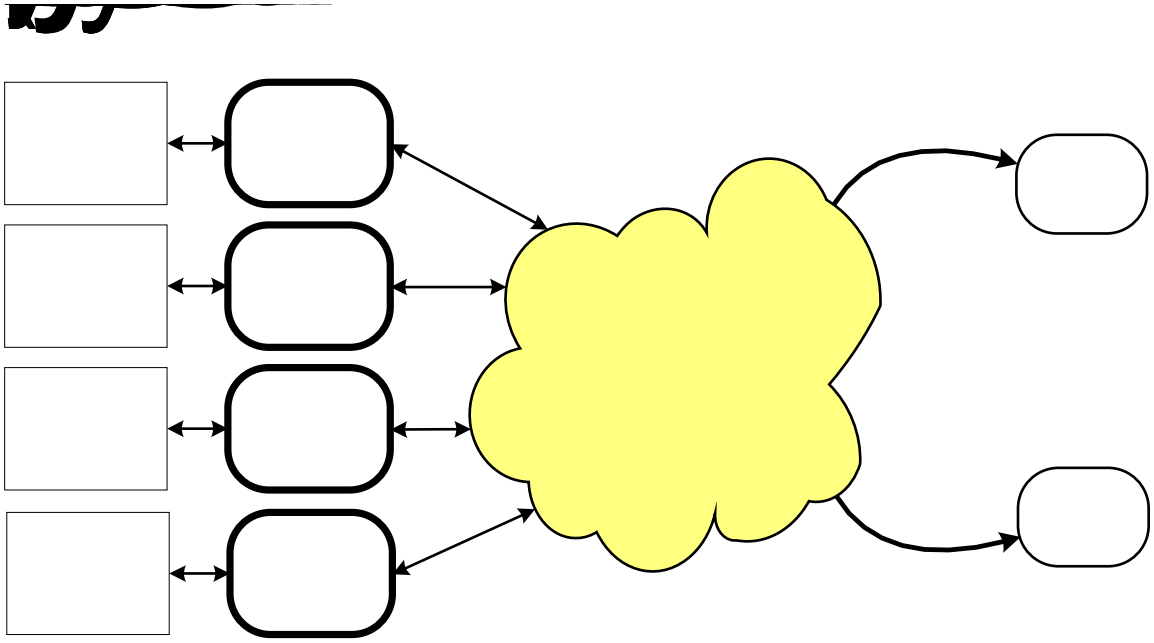

Figure 1 - DMS Component Architecture

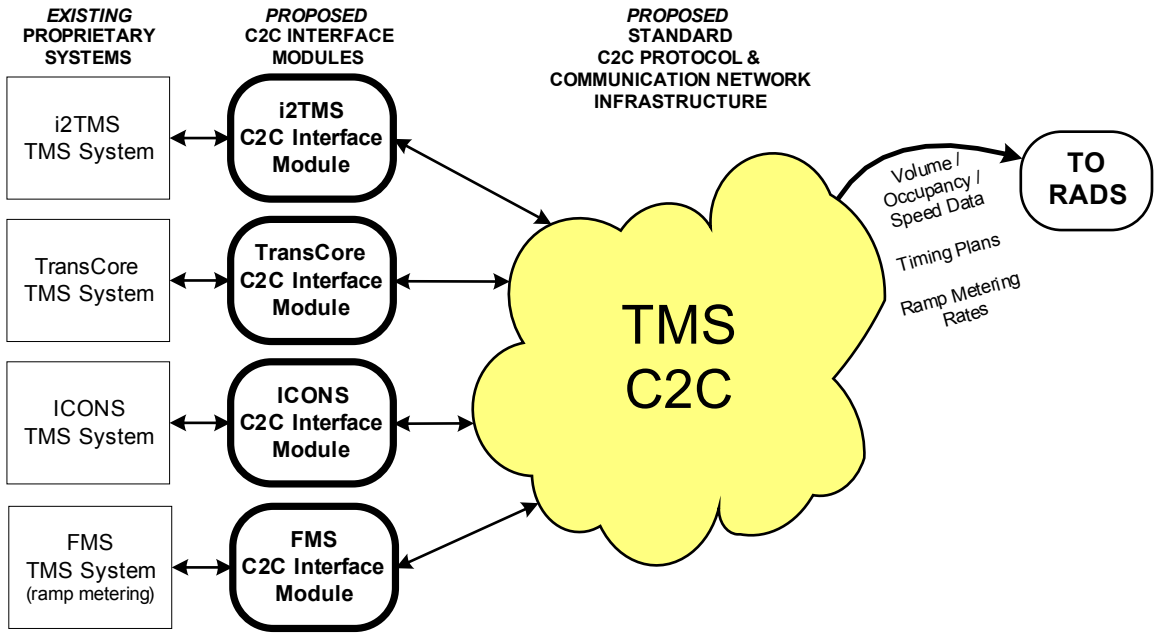

Figure 2 - TMS Component Architecture

2. C2C Applications and Benefits

The system architecture described above is centered on common protocols for each of the two systems: DMS and TMS. The functional requirements for each of these two protocols, as well as for the software interface modules which interface with the existing software systems, are described in detail in the second report listed above. The following table also briefly summarizes the envisioned application of each function.

It is important to note that the protocols are being developed to provide the greatest reasonable level of flexibility, and that the extent to which the functions made possible by the C2C System are actually utilized by participating agencies following deployment will be determined by regional and local policies and regulated using the security permission scheme which is to be incorporated into each message type. It is recognized that further discussion and development of policies to govern inter-jurisdictional data exchange are necessary, and, although beyond the scope of the protocol development portion of the project, it is recommended that such discussions occur in concert with the software implementation.

It is envisioned that the primary use of the C2C System will be to allow centers to post messages on DMS devices or change signal timing plans in response to incidents, although the protocols will be developed to provide the flexibility for greater interaction as use of the system evolves over time. The primary benefit of such a system is that the large investment in traffic control and ITS infrastructure that each jurisdiction has made can be more fully realized during normal business hours, and, in particular, during off-peak hours when many local centers are not staffed and the capabilities of their systems are often not fully utilized.

It should be noted that most information request functions described in the table below include provisions to make a one-time request, as well as to subscribe to updates, which will then occur whenever the subject information changes (e.g., new device added to inventory, new message posted on device, etc.).

C2C Functional Requirement	Application
Dynamic Message Sign (DMS)	
Provide DMS Control to Remote Agencies	• Allows an agency to post messages on a remote agency's DMS, based on the appropriate security authorization. • When the remote agency is staffed, such as during business hours, the control message can be displayed as a request and then approved for implementation by the remote agency's operator. • When the remote agency is not staffed, the control message can be automatically implemented based on the permissions set by the remote agency's system administrator.
Provide DMS Inventory Information	• Allows an agency to obtain an inventory of the DMS devices deployed by a remote agency, including locations, to update their database and maps for future control requests.

C2C Functional Requirement	Application
Provide DMS Status Information	• Allows an agency to query the status of a specific DMS device, including viewing of the message currently being displayed. • It is expected that the status of a DMS device would be checked before an agency issues a control request.
Provide Environmental Sensor Information	• Allows an agency to query an environmental sensor which may be co-located with a DMS device. • Note that such sensors are not presently deployed in the Phoenix metro area, although they are used in rural areas and in other metro areas. As such, this function is being considered to ensure maximum applicability of the protocol outside the metro area, and to allow the additional future capability to be used within the region. The inclusion of this function will also be reevaluated after the cost to implement it has been determined.
Archive Status Information Subscription	• Allows a center to request a remote center to archive its status information for all DMS devices on its system and to transmit that information at a specified time (i.e., off-peak). • It is expected that such archive requests will be used only for regional archiving purposes, and that local centers would likely not make such requests to other local centers. This could be regulated by each local center using the security permissions scheme.
Provide Subscription Cancellation	• Allows a center to cancel an earlier subscription request.
Traffic Management System (TMS)	
Provide TMS Inventory to Remote Agencies	• Allows an agency to obtain an inventory of traffic signals or ramp meters deployed by a remote agency, including locations, to update their database and maps for future control requests.
Provide Intersection Information to Remote Agencies	• Allows an agency to obtain more detailed information about a specific traffic signal or ramp meter deployed by a remote agency, including lists and descriptions of timing plans/metering rates.
Provide Timing Plan Details to Remote Agencies	• Allows an agency to obtain the details of a specific timing plan for a specific intersection on a remote agency's system.
Provide Intersection Control to Remote Agencies	• Allows a center to request a change in timing plans at a specific intersection. • Note that intersection control is limited changing among pre-defined timing plans based on the security permission scheme. The changing of individual timing parameters is not supported by the C2C System regardless of permissions.
Provide Intersection Status to Remote Agencies	• Allows a center to query a remote center to determine the status (e.g., coordination status, timing plan in effect, etc.) of a specific intersection.
Archive Status Information Subscription	• Allows a center to request a remote center to archive its status information for all traffic signals/ramp meters on its system and to transmit that information at a specified time (i.e., off-peak). • As with the DMS archiving function, it is expected that such archive requests will be used only for regional purposes and not by other local centers.
Provide Subscription Cancellation	• Allows a center to cancel an earlier subscription request.

C2C Functional Requirement	Application
Interface Module / Software (general items possibly requiring software modifications)	
Logging	• Each center shall log all C2C messages that it sends or receives. • The extent of the logging will be determined with the individual software vendors and the local center administrators.
Maps	• The databases and maps used by each center shall be extended, or be capable of being extended, to reflect the additional area and devices that the center may desire to interact with.
C2C Network	• Each center shall be assigned a unique ID (i.e., IP address) so that C2C messages can be routed only to the center for which they are intended. • Each center shall keep a list of the IDs of all other centers on the system, so the outgoing messages can be appropriately routed.
Security	• A user ID shall be required for each user of the C2C System. • Generic users for each facility may also be permitted (e.g., "Phoenix TMC Operator"). • Access shall be granted by remote centers as determined appropriate by their individual system administrators according to three access categories: Inventory, Status, and Control.
Requesting, Responding, and Listening for Messages	• Each center shall include the appropriate identifying information in all outgoing messages so that messages and responses may be correlated and tracked. • Each center shall acknowledge all received messages and indicate its corresponding action (e.g., accepted, rejected, queued).
Connectivity	• Each center shall identify devices on its system which are not in communication with the central system and shall relay that status when queried regarding such devices.

3. Development Process Overview

Based on the system architecture summarized above, there are several general areas of new work required to implement the C2C System, as described in the following sections.

3.1 C2C Protocol

The common protocol for the exchange of data and control requests, represented above by the clouds connecting the various systems, must be defined in detail so that software vendors can adapt their software or develop interfaces to utilize it. Since a separate protocol is required for the TMS and DMS components, two independent C2C protocols are needed.

In order to define these protocols, the development process has been broken into two major steps.

1. First, the functional requirements for each component were defined by focus groups representing the AZTech™ stakeholders. All stakeholders were provided the opportunity to review and comment on the draft requirements. Comments received were incorporated into the functional requirements documents as appropriate, and final documents are now available for review and approval (Document 2 above).

2. Second, when the functional requirements documents have been accepted by the AZTech™ stakeholders, they will serve as the basis for the development of the detailed C2C protocols. It should be noted that stakeholders will also have the opportunity to participate in the review of the protocols as they are developed, but it is understood that this should relate to the details of particular functions, rather than the addition of new functions or significant changes to previously identified functions.

   In addition to the review by the stakeholders, there will be other participants in the protocol development process as well. Representatives of the national standards development organizations (IEEE and NEMA) will serve as the primary developers of the protocol, and will review the requirements and other materials generated by the project to ensure compatibility with national standards to the greatest extent practical. The vendors of the existing software platforms deployed in the region, as identified in the concept of operations and expanded upon in the recent Vendor Coordination meeting, will also be invited to participate in the protocol development in order to ensure that the resulting protocol is reasonable to implement.

3.2 Interface Module

Once the C2C protocols have been defined and sample files provided to the software vendors, it will be necessary for the software vendors to either modify their existing software to implement the protocol for the desired functions, or to develop a software interface module to translate between existing proprietary inputs and outputs and the appropriate C2C protocol.

Furthermore, there are some modifications to the individual systems that may be required in order to implement the desired C2C functionality beyond simply "speaking the protocol", and these are also described in second document (Section 6) listed above.

4. Stakeholder Approval

By agreeing to this summary document, AZTech™ stakeholders are accepting the following:

1. The TMS and DMS functional requirements, as outlined in the second report listed above, represent the C2C functionality that is expected by the stakeholder for each component system.

2. The Software Interface Module functional requirements, also outlined in the second report listed above, represents the functionality which is expected by the stakeholder to be included (either as an existing or added feature) in each stakeholder's existing system.

3. The stakeholder will participate in a review of the C2C protocols during the development process as requested by the project team.

4. The stakeholder will participate in discussions between the C2C project team and existing system software vendors regarding the implementation of the protocols and development of interface modules.

5. The stakeholder recognizes that there will be costs involved for each software vendor to implement the process described, and that these costs may be handled in one or more of the following ways:

    - Project Funding – The C2C project, utilizing federal grant funds, may partially fund the vendors' development and implementation effort.

    - Vendor Funding – The vendors of the existing software packages may partially fund their development and implementation effort as enhancements to their existing products. Note that the protocols will follow existing and emerging national standards to the greatest extent practical so as to minimize new software development work and maximize the potential for the protocol and interfaces to be used in other regions with minimal modifications.

    - Stakeholder Funding – The individual stakeholders may partially fund the vendors' development and implementation effort with regard to their specific software packages, particularly in cases where a jurisdiction may request additional features that are not needed for the basic C2C functionality in other jurisdictions.

    It is recognized that the extent of the costs and the source of funding them will need to be determined as the protocol development moves forward and more detailed discussions with the software vendors are possible. This agreement does not represent a commitment by any stakeholder to provide funding at any level, but is simply a recognition that further discussion of the funding will take place when costs are better defined.

6. After the software vendors develop the C2C interfaces to their system software, the stakeholder will participate in testing the C2C interface module that has been developed for their system.