Multi-Modal Information Kiosk (MMIK) Project

Task 3:
High Level Requirements and System Architecture

Technical Memorandum

Final
June 9, 2003
## Revision History

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1. Introduction

This document outlines the high-level requirements and physical system architecture for the Multi-Modal Information Kiosk (MMIK) system under development by the Regional Transportation Authority (RTA) in conjunction with its three service boards.

As envisioned in the RTA’s Regional Transit ITS Plan (RTIP), the MMIK system will consist of a centralized transit database (a.k.a. Illinois Transit Hub, ITH) that consolidates static and real-time transit information from the RTA, the Chicago Transit Authority, Metra, and Pace.

The vision for the MMIK system, as well as a project timetable, high-level conceptual architecture and data requirements, is outlined in the MMIK Concept of Operations (January 6, 2003).

The physical system architecture defines the components of the MMIK system and the linkages among these components. The high-level requirements describe in a functional sense the operational capabilities and characteristics of the system.

This document does not represent commitment by the service boards to provide the proposed data highlighted in this task, nor does it imply the service boards will provide the information to the level specified.

1.1. Note on Short-Term Versus Long-Term Approaches

These requirements and system architecture form the functional basis for the detailed design and deployment of the system in later tasks. All requirements refer to the Short-Term implementation unless explicitly noted to the contrary. Since a constrained budget design-build process is being utilized to develop the MMIK system, final decision on what will be implemented in the short-term system will be made in the final design.

Implementation of the MMIK system in the short term will require special data access and modification techniques due to the limited availability of data. For example, in the short term it is necessary to pull data and files from the service board websites until an alternate source of data is made available through the service board hubs. Other data may require special formatting or manipulation to meet the standards of the MMIK system. As data sources evolve and mature, the MMIK will migrate away from these short-term strategies until there is a single point-of-interface for each service board (the service board hubs) and all data is compliant with NTCIP, Gateway, and MMIK standards.
1.2. Intent of this Document

This document focuses on the functional system requirements required to design and implement the Short-Term Objectives of the MMIK project. It compliments and expands upon, but does not attempt to duplicate, other documents describing functional requirements for the Illinois Transit Hub or other components of the region’s ITS architecture.

This document has been developed with reference to the RTA Regional Transit ITS Plan Project, Task 3 Report, ITH Functional Requirements (May 4, 2001). That document outlines detailed long-term functional specifications for the Illinois Transit Hub system, including its relationship to the Illinois Hub (IH), Gateway Traveler Information System (Gateway TIS) and the Multimodal Traveler Information System (MMTIS.)

The MMIK system is the first phase of the Illinois Transit Hub (ITH). The Illinois Transit Hub is a part of an integrated regional system envisioned in the Gary-Chicago-Milwaukee (GCM) ITS Priority Corridor to permit interagency data sharing and support regional traveler information. Specifically, the ITH consolidates transit information from the RTA, its service boards, and other transit providers in the State of Illinois. Through the ITH, this data is made available to various regional transit ITS applications and a broader network of regional transportation agencies and traveler information systems via the Illinois Hub. This upward consolidation and standardization of information makes possible regional traveler information and transportation management systems of far greater scope and complexity than is otherwise possible.

1.3. Document Organization

The document is organized into the following sections:

- Physical System Architecture
- System Requirements
- Data Requirements
- Central Software Requirements
- Central Hardware Requirements
- Communications Requirements
- Kiosk GUI Requirements

2. System Physical Architecture

The MMIK Concept Plan includes a short-term conceptual architecture indicating data inflows and outflows for the MMIK system. The following Figure 2-1 shows a conceptual physical architecture for the central MMIK system hardware.
The MMIK hardware shall be located at the RTA headquarters and shall utilize a dedicated secure LAN to link its various components. The MMIK LAN shall be connected to the RTA’s principal network, though a firewall shall be implemented between the two networks to prohibit unauthorized access and protect their integrity.

**Figure 2-1: MMIK Physical Architecture**

Hardware components residing on the MMIK LAN shall include:

- A central server, hosting the MMIK database, web server, and application server functions;
- A Redundant Array of Inexpensive Disks (RAID) storage device for MMIK data and applications;
• An external backup drive to permit backup of MMIK data onto removable media;
• An MMIK workstation for system administration and enhancement;
• Network peripherals such as printers;
• A modem for remote dial-up access; and
• Firewalls to ensure the security and integrity of the MMIK system.

Connectivity to the Service Boards and other future data providers or recipients (e.g. Illinois Hub) shall be achieved through dedicated connections to the respective hubs (or surrogate hubs in the short term) residing at each location. The connections shall possess sufficient bandwidth and availability to support the functionality described in this document.

The central MMIK LAN shall also be connected to the Internet to allow for downloading of certain content from various websites of participating entities. The Internet is also the method for accessing manually entered service bulletins and events using the web-based tools to be developed for this purpose. Finally, communication with the MMIK kiosks themselves shall also occur using the Internet with the possible exception of certain kiosks with direct access to an RTA or Service Board network.

3. System Requirements

This section outlines general system requirements that are applicable to all or several aspects of the Multi-Modal Information Kiosk System.

3.1. General Requirements

• The MMIK shall establish a core, internet-based data storage and retrieval system to support the consolidation of transit traveler information and operations data from the RTA and its Service Boards, as well as the dissemination of this information among these agencies, to the traveling public, and to other regional ITS systems.

• The system shall be designed for unattended operation under normal circumstances, exclusive of manual data entry, public user access, and routine administrative functions.

3.2. Availability and Reliability

• The system shall be designed to achieve persistent (“always on”) availability (>98%), 24 hours per day, 7 days per week, 365 days per year.

• The system shall be designed such that administrative and maintenance activities that require the system to be taken off line can occur at periods of lowest public
utilization (e.g., overnight) to maintain maximum system availability for public users.

- The system shall be designed with adequate storage, processing, and communications capabilities to respond to 90% of user queries within 10 seconds, while supporting up to ten (10) simultaneous kiosk users and four (4) RTA/service board operators and administrators under peak real-time upload conditions.

3.3. Expandability and Scalability

- The system shall be designed with an open architecture intended to facilitate expansion of the functionality and/or scale of the MMIK system as new data sources, functionalities, standards, and/or technologies emerge in the future.

- The system shall utilize an object-oriented design to facilitate replacement or modification of individual components of the MMIK system without impacting the overall system.

- Any exceptions to these requirements necessary to facilitate short-term implementation of the system shall not prohibit the implementation of these requirements as outlined as soon as it is feasible to do so.

3.4. Architecture and Standards Compliance

- The system shall be developed in a manner consistent with the current version of the RTA Regional Transit ITS Plan (including its Functional Requirements) as well as the relevant aspects of the Gary-Chicago-Milwaukee (GCM) ITS Priority Corridor Architecture.

- The system shall adhere to the current guidelines and principles set forth in the National ITS Architecture developed by the U.S. Department of Transportation ITS Joint Program Office.

- The system shall adhere to all applicable national and international ITS data and communications standards (e.g. NTCIP/TCIP) to ensure consistency and interoperability. Recognizing that many national standards are still under development and subject to change, the system shall adhere to standards to the extent possible based on their status and applicability to the MMIK project at the time of implementation.

- In the short term, MMIK will convert data received from external sources so that it is compatible with MMIK project standards. In the long term, data provided to
the MMIK system by external sources shall be provided in a format that is consistent with MMIK standards.

- The precedence for applying system standards shall be as follows:
  
  1. National ITS Architecture/NTCIP Standards (highest precedence)
  2. GCM Gateway ITS Architecture Standards
  3. RTA Regional Transit ITS Architecture Plan Standards
  5. Service Board/Data Source Defined Standards
  6. Individual ITS Application Standards (Lowest Precedence)

- Service Board or External Data that is not compliant with applicable standards in the short term shall be converted into the standard format through customized conversion algorithms developed for the MMIK project before it is stored in the MMIK database in a standard format. These customized modules shall be created as part of the MMIK short-term implementation based on the specific input and output formats of the MMIK and data sources, respectively.

3.5. Service Board and External Interfaces

- The MMIK system shall use three methods to interface with service board hubs and external systems:
  
  o **Direct Interface** to service board hubs or similar portals;
  o **Manual Data Recording** via password-protected web pages; and
  o **Web Page Retrieval** of information and files available through Service Board or external web sites.

- The MMIK Direct Interfaces shall provide a single point of contact (using redundant communications where possible) with the central database of each Service Board to simplify the establishment and upkeep of these interfaces.

- The interface to other systems (e.g. ATSS, BusInfo) shall be provided through the respective Service Board Hub direct interfaces.

3.6. Security and Privacy

- The MMIK database, hardware, software, communications, and kiosks shall be designed in accordance with state-of-the-art security precautions to guard against intentional and un-intentional threats to the integrity of the system arising from unauthorized access, computer viruses and worms, system abnormalities or faults, and other sources of potential harm.
• All administrative and operational systems, hardware, software, tools, and communications designed to support system operation or data entry shall utilize adequate protection mechanisms (e.g., logon authentication) to prevent access to or manipulation of the system by unauthorized users.

• The system shall accommodate multiple tiers of data security to allow variable privileges to access data based on a user’s classification (e.g. public user, administrator, RTA personnel, external agency, service board, etc.).

• The system shall be designed to preserve the privacy of individual public users who enter custom database inquiries or email submissions to the system administrator containing personal identification information.

3.7. Redundancy

• The MMIK system shall incorporate system redundancies to the extent practical to guard against failure of individual hardware, software, network, or communications components and ensure maximum system availability.

3.8. Error Detection and Monitoring

• The system shall incorporate tools to allow for automatic detection and, to the extent practical, resolution of system abnormalities, faults, and errors.

• The system shall automatically notify the System Administrator when abnormal circumstances have occurred through on-screen warning messages.

• Definition of abnormal system parameters shall be configurable by the System Administrator. These include:

  o Inability to communicate with remote service boards (for more than a given number of polls or minutes);
  o Inability to communicate with remote web sites (for more than a given number of polls or minutes);
  o Inability to extract data from remote web sites (invalid data format);
  o Inability to communicate with central database; and
  o Invalid record(s) from service boards.

• All system errors, warnings, and self-correcting actions shall be recorded in an exportable ASCII text file system log.

• The system shall incorporate automatic shut down and restart features that preserve system integrity and minimizes potential damage in the event of power failures.
4. Data Requirements

This system outlines the Data Requirements for the Multi-Modal Information Kiosk system. It expands upon the data requirements discussion contained in the *MMIK Concept of Operations* (January 6, 2003).

4.1 General Data Requirements

4.1.1. Web data retrieval

- Data to be retrieved from service board web pages shall be collected automatically on a periodic basis defined by the system administrator for each data type and service board.

- The web data retrieval processes shall validate data for completeness and accuracy using parameters of retrieved data size, and by detecting attributes of the retrieved data including the headings, presence of particular fields or links and expected formatting elements.

- Data that does not meet the defined criteria for a particular page capture shall be saved in an error log and an administrator alert generated by email.

- To improve reliability of web data capture and to allow for improved data presentation format options, service board web sites will incorporate non viewable data marker tags using agreed data id or name attributes.

- The MMIK shall perform daily background verification of all external web links and provide immediate notification to the system administrator if any external link fails based on configurable numbers of repeated attempts and periods.

4.1.2. Data Transfer Requirements

- In the short term, certain data will be pulled from the web sites of the respected service boards. In the long term, the system shall migrate away from web site retrieval and access all data through the service board hubs (as this data becomes available).

- Web data retrieval shall use the standard HTTP protocol for transferring data.
• Manual data entry forms shall utilize the standard HTTP protocol for retrieving data entry forms and submitting completed form data.

• The direct interface used for real-time data generated by service board systems shall use an incremental pull mechanism where possible. The incremental pull mechanism shall run on the MMIK server and pull data as needed.

• The MMIK data server shall be able to request updated real-time data from the service board hubs in the event of loss of data from the central system when the source systems are capable of doing so.

• All data communications shall use message numbering or other tracking mechanism to ensure complete data transfer between systems.

4.2 MMIK Detailed Data Requirements

Sections 4.2 and 4.3 describe the MMIK data requirements to support the short term operation defined by the concept of operations. The data requirements shall be confirmed in the detailed design phase under Task 4. The data requirements are presented for each service board separately. Each section presents the National ITS Architecture data flow identified as applicable to that service board. The data requirements to support this architecture flow are defined in terms of a general description, the source of the data and the individual data elements that make up this flow.

4.2.1. CTA

4.2.1.1. CTA Data Flow: Transit_fare_data

Description: General information of full fares, reduced fares, transfers etc.

Source: CTA web site

Data requirements: Text/HTML fare description

Update frequency: Daily

4.2.1.2. CTA Data Flow: Transit_services_for_guidance

Static schedule data

Bus and rail

Description: Static schedule information describing normal operations.
Source: Quarterly exports from Hastus. Files will be placed in common directory. Files will include start date or be named based on start date for this schedule.

Data requirements:

**Schedule data**
- Start Date
- Route ID
- Route description
- Variant ID
- Variant description
- Vehicle group
- Block ID (for cross reference to other systems)
  - Trip ID
  - Direction name
  - Operating days
  - Timepoint IDs
  - Timing point note code reference (public)
  - Passing times for each Trip ID and stop

**Notes data**
- Note code
- Note text

**Timepoint data**
- Timepoint ID
- Timepoint Description

Update frequency: Check for new files daily

**Map data**

*Bus and rail*

Description: Links to existing PDF files which contain map data

Source: Parse information from existing web pages

Data requirements: Route ID
- HTML link to existing maps

Update frequency: Verify and update links daily

4.2.1.3. CTA Data Flow: Transit_vehicle_deviations_details

Current performance
Bus

Description: Current status in terms of delay minutes for each monitored bus

Source: Businfo

Data requirements: Time stamp
Route ID
Variant ID
Trip start time or block ID
Current delay

Update frequency: 2 minutes

Rail

Description: Current status in terms of delay minutes for each train

Source: RSMS via surrogate database (data is also available from ATSS in XML format)

Data requirements: Time stamp
Route ID
Trip ID
Status

Update frequency: 2 minutes

4.2.1.4. CTA Data Flow: Transit_incident_data

Incidents

Bus only (rail future)

Description: Incidents include accidents and resource shortages that cause cancellation or delays on certain routes.

Source: Tables extracted from CTA Incident recording system to CTA Hub.

Data elements: Start time and date
Route and run number
Disposition
Delay
Event Type

Update frequency: Poll for new data every two minutes

Bulletins
Bus

Description: Bulletins would be manually created when changes occur. The changes may be short term disruptions due to weather or longer term changes to routes due to construction. A web page will be provided to allow entry of bulletin information throughout the service boards.

Source: Bulletin manual data entry form provided by MMIK server

Data elements:
- Bulletin ID
- Earlier bulletin ID if update
- Distribution level (e.g. in agency only, all agencies, public)
- Start and end time and date for bulletin
  - Absolute date/time or start time and duration
  - Recurring times (optional)
- Route IDs affected (include special shuttles or services)
- Trips affected
- Stops/segments or destinations affected (optional)
  - Direction
  - Start timepoint ID
  - End timepoint ID (optional)
- Coded high level description of occurrence including quantification (e.g. length of delay)
- Priority
- Description
- Image links (optional)
- HTML links (optional)

Update frequency: As events occur

Rail

Description: Bulletins would be manually created when changes occur. The changes may be short term disruptions due to weather or longer term changes to stops due to construction. A web page will be provided to allow entry of bulletin information throughout the service boards.

Source: Bulletin web entry form provided by MMIK server

Data elements:
- Distribution level (e.g. in agency only, all agencies, public)
- Start and end time and date for bulletin
  - Absolute date/time or start time and duration
  - Recurring?
- Lines affected (include special shuttles or services)
- Trips affected
- Stations/segments or destinations affected (optional)
  - Direction
  - Start timepoint ID
  - End timepoint ID (optional)
- Coded high level description of occurrence
- Priority
- Description
- Image links
- HTML links
Update frequency: As events occur

4.2.1.5. CTA Data Flow: Other static and service data relating to transit services

Accessibility information

Description: General information on the accessibility of CTA services
Source: CTA web site
Data Requirements: Text/HTML describing accessibility
Update frequency: Daily

4.2.2. PACE

4.2.2.1. Pace Data Flow: Transit_fare_data

Description: General information of full fares, reduced fares, transfers etc.
Source: Pace web site
Data requirements: Text/HTML fare description
Update frequency: Daily

4.2.2.2. Pace Data Flow: Transit_services_for_guidance

Static schedule data

Description: Static schedule information describing normal operations.
Source: Periodic as needed exports from Hastus. Files will be placed in common directory. Files will include start date or be named based on start date for this schedule.
Data requirements: Schedule data
   Start Date
   Route ID
   Route description
   Variant ID
   Variant description
   Vehicle group
   Block ID (for cross reference to other systems)
### Trip ID
- Direction name
- Operating days
  - Timepoint IDs
  - Timing point note code reference (public)
- Passing times for each Trip ID and stop

### Notes data
- Note code
- Note text

### Stop data
- Stop ID
- Timepoint ID (optional)
- Stop Description

### Route data
- Route
- Route Variant
- Direction
- Stop IDs

#### Update frequency:
Poll for new files daily

### Map data
**Description:** Links to existing PDF files which contain map data

**Source:** Parse information from existing web pages

**Data requirements:** Route ID
- HTML link to existing maps

#### Update frequency:
Validate links daily

### Special services information
**Description:**
High level description of special event services offered by Pace in addition to the scheduled service.

**Source:**
Captured from web site – requires additional tags to be added to Pace pages to identify useful data.

**Data Requirements:**
- Event service name
- Event service dates
- Service Hours
- Cost
- Other information
Update frequency: Daily

4.2.2.3. Pace Data Flow: Transit_vehicle_deviations_details

Schedule adherence

Schedule adherence data will not be available during the short term MMIK implementation

Passenger Notices

Description: Changes to routes or schedules that are temporary in nature or are between official schedule updates. This information is formatted for the Pace web pages.

Source: Pace web page source database

Data requirements: Route affected
Description & Links
Links to revised maps

Update frequency: Poll for changes twice per day

Bulletins

Description: Bulletins would be manually created when changes occur. The changes may be short term disruptions due to weather or longer term changes to routes due to construction. A web page will be provided to allow entry of bulletin information throughout the service boards.

Source: Bulletin manual data entry form provided by MMIK server

Data elements: Bulletin ID
Earlier bulletin ID if update
Distribution level (e.g. in agency only, all agencies, public)
Start and end time and date for bulletin
  Absolute date/time or start time and duration
  Recurring times (optional)
Route IDs affected (include special shuttles or services)
Trips affected
Stops/segments or destinations affected (optional)
  Direction
  Start timepoint ID
  End timepoint ID (optional)
Coded high level description of occurrence including quantification (e.g. length of delay)
Priority
Description
Image links (optional)
Update frequency: As events occur

4.2.3. Metra

4.2.3.1. Metra Data Flow: Transit_services_for_guidance

Static schedule data

Description: Regular schedule data describing operation of the Metra trains.
Source: Exported text files from Metra’s scheduling system.
Data Elements: Line
               Day of week
               Direction
               Station #
               Station Name
               Train #
               Time points for each station
Update frequency: Poll for changed files daily

4.2.3.2. Metra Data Flow: Transit_vehicle_deviations_details

Bulletins

Description: Bulletins would be manually created when changes occur. The changes may be short-term disruptions due to weather or longer term changes to stops due to construction. A web page will be provided to allow entry of bulletin information throughout the service boards.
Source: Bulletin web entry form provided by MMIK server
Data elements: Distribution level (e.g. in agency only, all agencies, public)
               Start and end time and date for bulletin
               Absolute date/time or start time and duration
               Recurring?
               Lines affected (include special shuttles or services)
               Trips affected
               Stations/segments or destinations affected (optional)
               Direction
               Start timepoint ID
               End timepoint ID (optional)
               Coded high level description of occurrence
               Priority
               Description
               Image links
4.2.3.3. Metra Data Flow: Transit_fare_data

Description: Fare data including zone definitions, time definitions, route applicability, cost, reduced fares, transfer fares, passes, and discounts.

Source: Metra web site

Data elements: Text/HTML fare description

Update frequency: Daily

4.2.3.4. Metra Data Flow: Other static and service data relating to transit services

Station information

Description: Information on station location and facilities.

Source: Existing internet web page

Data Elements: Station name, Station zone, Station address, Station phone, Links for to existing map for each station

Update frequency: Daily

4.3 Data transfer bandwidth requirements

The following section presents estimated data flows and bandwidth requirements for each of the data categories described above. Bandwidth calculations include a factor 2 overhead loading estimate, for control and header information.

4.3.1. CTA

4.3.1.1. CTA Data Flow: Transit_fare_data
Minimal data transfer – no impact on bandwidth requirements

4.3.1.2. CTA Data Flow: Transit_services_for_guidance

Static schedule data

200 MB periodic. Download overnight. Complete update should take less than 2 hours. Bandwidth required: approx 500kbps

Map data

Minimal data transfer – no impact on bandwidth requirements

4.3.1.3. CTA Data Flow: Transit_vehicle_deviations_details

Current performance

Bus

Updates for 2500 buses each 2 minutes. 100 bytes per update requires bandwidth of approx 31.3 kbps

Rail

Updates for 100 trains each 2 minutes. 100 bytes per update requires bandwidth of approx 1.25kbps

4.3.1.4. CTA Data Flow: Transit_incident_data

Incidents

Periodic (<250 per day). Less than 1k per incident. Minimal impact on bandwidth

Bulletins

Assume page size of 100k. System should be able to server 2 users simultaneously within 5 seconds. Requires bandwidth of approx 80kbps.
4.3.1.5. CTA Data Flow: Other static and service data relating to transit services

Accessibility information

Minimal data transfer – no impact on bandwidth requirements

4.3.2. PACE

4.3.2.1. Pace Data Flow: Transit_fare_data

Minimal data transfer – no impact on bandwidth requirements

4.3.2.2. Pace Data Flow: Transit_services_for_guidance

Static schedule data

100 MB periodic. Download overnight. Complete update should take less than 2 hours. Bandwidth required: approx 250kbps

Map data

Minimal data transfer – no impact on bandwidth requirements

Special services information

Minimal data transfer – no impact on bandwidth requirements

4.3.2.3. Pace Data Flow: Transit_vehicle_deviations_details

Schedule adherence

Only partial fleet will be equipped with AVL initially – assume 10% of 1000 vehicle fleet. Updates for 100 buses each 2 minutes. 100 bytes per update requires bandwidth of approx 1.25kbps

Service updates

Minimal data transfer – no impact on bandwidth requirements

Bulletins

Assume page size of 100k. System should be able to server 2 users simultaneously within 5 seconds. Requires bandwidth of approx 80kbps.
4.3.3. Metra

4.3.3.1. Metra Data Flow: Transit_services_for_guidance

Static schedule data

10 MB periodic. Download overnight. Complete update should take less than 2 hours. Bandwidth required: approx 25kbps

4.3.3.2. Metra Data Flow: Transit_vehicle_deviations_details

Schedule adherence

Updates for 100 trains each 2 minutes. 100 bytes per update requires bandwidth of approx 1.4kbps

Bulletins

Assume page size of 100k. System should be able to server 2 users simultaneously within 5 seconds. Requires bandwidth of approx 80kbps.

4.3.3.3. Metra Data Flow: Transit_fare_data

Minimal data transfer – no impact on bandwidth requirements

4.3.3.4. Metra Data Flow: Other static and service data relating to transit services

Station information

Minimal data transfer – no impact on bandwidth requirements

4.3.4. Summary of Bandwidth Requirements

Table 4-1 summarizes short-term MMIK bandwidth requirements for each source. Bandwidth requirements shall be confirmed and refined through the detailed design phase.

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<thead>
<tr>
<th>Source</th>
<th>Bandwidth Requirement</th>
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<tr>
<td>CTA Data Flow: Transit_fare_data</td>
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<tr>
<td>CTA Data Flow: Transit_services_for_guidance</td>
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<tr>
<td>Static Schedule Data</td>
<td>200 MB periodic. Download overnight. Complete update</td>
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<th>Source</th>
<th>Bandwidth Requirement</th>
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<tbody>
<tr>
<td>Map Data</td>
<td>Minimal data transfer – no impact on bandwidth requirements</td>
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<tr>
<td><strong>CTA Data Flow:</strong> Transit_vehicle_deviations_details</td>
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</tr>
<tr>
<td>Current Performance-Bus</td>
<td>Updates for 2500 buses each 2 minutes. 100 bytes per update requires bandwidth of approx 31.3 kbps</td>
</tr>
<tr>
<td>Current Performance-Rail</td>
<td>Updates for 100 trains each 2 minutes. 100 bytes per update requires bandwidth of approx 1.25kbps</td>
</tr>
<tr>
<td><strong>CTA Data Flow:</strong> Transit_incident_data</td>
<td></td>
</tr>
<tr>
<td>Incidents</td>
<td>Periodic (&lt;250 per day). Less than 1k per incident. Minimal impact on bandwidth</td>
</tr>
<tr>
<td>Bulletins</td>
<td>Assume page size of 100k. System should be able to server 2 users simultaneously within 5 seconds. Requires bandwidth of approx 80kbps.</td>
</tr>
<tr>
<td><strong>CTA Data Flow:</strong> Other static and service data relating to transit services</td>
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<td><strong>Pace Data Flow:</strong> Transit_vehicle_deviations_details</td>
<td></td>
</tr>
<tr>
<td>Schedule Adherence</td>
<td>Only partial fleet will be equipped with AVL initially – assume 10% of 1000 vehicle fleet. Updates for 100 buses each 2 minutes. 100 bytes per update requires bandwidth of approx 1.25kbps</td>
</tr>
<tr>
<td>Service Updates</td>
<td>Minimal data transfer – no impact on bandwidth requirements</td>
</tr>
<tr>
<td>Bulletins</td>
<td>Assume page size of 100k. System should be able to server 2 users simultaneously within 5 seconds. Requires bandwidth of approx 80kbps.</td>
</tr>
<tr>
<td><strong>Metra Data Flow:</strong> Transit_services_for_guidance</td>
<td></td>
</tr>
<tr>
<td>Static Schedule Data</td>
<td>10 MB periodic. Download overnight. Complete update should take less than 2 hours. Bandwidth required: approx 25kbps</td>
</tr>
<tr>
<td><strong>Metra Data Flow:</strong> Transit_vehicle_deviations_details</td>
<td></td>
</tr>
<tr>
<td>Schedule Adherence</td>
<td>Updates for 100 trains each 2 minutes. 100 bytes per update requires bandwidth of approx 1.4kbps</td>
</tr>
<tr>
<td>Bulletins</td>
<td>Assume page size of 100k. System should be able to server 2 users simultaneously within 5 seconds. Requires bandwidth of approx 80kbps</td>
</tr>
<tr>
<td><strong>Metra Data Flow:</strong> Transit_fare_data</td>
<td></td>
</tr>
<tr>
<td><strong>Metra Data Flow:</strong> Other static and service data relating to transit services</td>
<td></td>
</tr>
</tbody>
</table>
Table 4-1: MMIK Bandwidth Requirements by Source

4.4 NTCIP Standards requirements

There are a number of NTCIP standards that are being developed to support exchange of information within the transit industry. Particularly the Transit Communications Interface Profiles (TCIP) have been developed by and for the transit industry for exchanging data between various control and information systems. Once the standards development is complete each standard is mapped against the ITS architecture, specifically identifying which data flows particular standards or elements of the standards apply to. Discussion with members of the architecture team that are participating in the MMIK project indicated that since the applicable standards in this area are still in flux, this direct mapping was not yet possible. In fact, identifying the data requirements as architecture data flows is sufficient for architecture compliance at this stage.

However, the TCIP aspects of the NTCIP standards have been reviewed for applicability to this project. The most applicable standards to this project are NTCIP 1401:2000 TCIP Standard Common Public Transportation Objects and NTCIP 1403:2000 TCIP Standard on Passenger Information Objects. Each of these standards has been reviewed for messages relevant to the Service Board data requirements outlined above. The following messages have been identified as relevant to this project for consideration as part of the detailed design.

MMIK NTCIP Messages:

PiAmenity – describes the attributes of amenities at a fixed location or facility

\[
\text{PiAmenity} ::= \text{SEQUENCE} \{
\text{amenityID} \text{ OPTIONAL},
\text{stopAttribute} \text{ OPTIONAL},
\text{location} \text{ OPTIONAL},
\text{name} \text{ OPTIONAL},
\text{stopID} \text{ OPTIONAL},
\text{infoType} \text{ OPTIONAL},
\text{footnote} \text{ OPTIONAL},
\text{startDate} \text{ OPTIONAL},
\text{startTime} \text{ OPTIONAL},
\text{endDate} \text{ OPTIONAL},
\text{endTime} \text{ OPTIONAL}
\}
\]

PiParkingFacility [pi 6] – describes the attributes associated with a transit parking facility

\[
\text{PiParkingFacility} ::= \text{SEQUENCE} \{
\text{parkingFacID} \text{ OPTIONAL},
\text{stopID} \text{ OPTIONAL},
\text{entrances} \text{ OPTIONAL},
\text{owner} \text{ OPTIONAL},
\text{phone} \text{ OPTIONAL}
\}
\]
type
spacesTotal
spacesAvailable
modes
rates
operatingHours
fillTime
footnote
}

piPublishedSchedule {pi 8} - The text of the published schedule. This message does not contain formatting.
piPublishedSchedule ::= SEQUENCE {
  agencyID
  schedule-hdr
  trip-times
  routeID
  routeDirection
  dayType
}

piSchedAdherenceCountdown {pi 10} – the estimated time until the arrival of the next transit vehicle serving a particular trip.
PiSchedAdherenceCountdown ::= SEQUENCE {
  routeID
  routeName OPTIONAL
  tripID
  vehicleID
  stopID
  nextArrivalCountdown
  tolerance
}

PiScheduleAdherenceOffSched {pi 11} – number of minutes of variance of a trip from a scheduled trip
PiScheduleAdherenceOffSched ::= SEQUENCE{
  routeID
  routeName OPTIONAL
  tripID
  vehicleID
  stopID
  arriveTimeScheduled
  vehicleLocation
  offScheduleTime
}

PiScheduleAdherenceRange {pi 12} – estimated delay from schedule of next transit vehicle serving a particular trip
PiScheduleAdherenceRange ::= SEQUENCE{
  routeID
  routeName OPTIONAL
  tripID
  vehicleID
  stopID
estimatedArrivalRange
tolerance
}

CptAgency {cpt 2} – name and information for a transit agency
CptAgency ::= SEQUENCE {
   agency
   agencyName
   headquarters
   hdqt telephone
}

cptStopPoint {cpt 16} – boarding or alighting location
cptStopPoint ::= SEQUENCE{
   stopPointID
   stopPointName OPTIONAL
   stopPointDesc OPTIONAL
   pointLocation
   level OPTIONAL
   side OPTIONAL
   padType OPTIONAL
   platformType OPTIONAL
   stopPtAttributes OPTIONAL
   distance OPTIONAL
   agencyID OPTIONAL
   startDate OPTIONAL
   endDate OPTIONAL
   modes OPTIONAL
   entrances OPTIONAL
   shelterIDs OPTIONAL
   parkingFacIDs OPTIONAL
   shelterType OPTIONAL
   fareZoneID OPTIONAL
   access OPTIONAL
   footnote OPTIONAL
}
5. Central Software Requirements

This section describes the requirements for the central software of Multi-Modal Information Kiosk system. Note that Kiosk Software Requirements have been provided in the *MMIK Concept of Operations* (January 6, 2003).

5.1. General Requirements

- When available, Commercial Off-the Shelf (COTS) software product shall be used provided they meet the requirements of the MMIK system.

- The most recently available versions of COTS software shall be used for the MMIK system unless a valid technical reason exists for doing otherwise (e.g., lack of desired functionality, software bugs, lack of compatibility with other COTS).

- All software shall be delivered new and registered in accordance with all applicable licensing procedures.

- The choice of software products, languages and operating systems should support compatibility and integration of the different pieces of the MMIK system and other pragmatic considerations, including:
  - Compatibility with external, related systems
  - Existing RTA software licenses
  - Compliance with industry standards
  - Vendor support
  - Error and exception handling
  - Multi-threading and multi-tasking
  - Object-oriented design and modularity

- Development of custom software and database elements shall adhere to industry standard software development practices regarding software design, “look and feel,” quality assurance, version control, interface control, source code management, and testing.

5.2. Software Components

- Major components of the MMIK central software system include:
  - Operating System (Windows or Unix Based, COTS)
  - MMIK Database Software (COTS)
- Web Application Server Software (COTS)
- Remote Network Access Software (COTS)
- Anti-Virus Software (COTS)
- Manual Data Entry (MDE) Software (Custom)
- Direct Service Board Interface (DSBI) Software (Custom)
- Web Data Retrieval (WDR) Software (Custom)
- Data Conversion and Fusion (DCF) Software (Custom)
- Data Retrieval and Format Software (Custom)

5.3. Operating System

- MMIK shall utilize a COTS operating system capable of supporting the current and future anticipated requirements of the system.

- The operating system shall consist of Microsoft Windows 2000 or later version as directed by the RTA.

- The operating system manufacturer shall provide ongoing and readily-available technical support, including updates and patches to rectify identified security and performance flaws.

- The operating system shall record system activities and errors in a system log file.

- The operating system shall be compatible with all devices and hardware on the MMIK network.

5.4. MMIK Database Software

- The MMIK system shall include a relational database application to store, organize, and access data contained within the system.

- The database software shall be scalable and expandable to accommodate future enlargement of the MMIK system.

- The database software shall support multiple simultaneous queries by the maximum number of simultaneous users, responding to 90% of queries within 10 seconds.

- The database software shall be designed for 24/7 operation and not require daily downtime of more than 5 minutes to maintain stability or perform backups.
• The database software shall include data analysis, procedure development, and debugging tools.

• The database software shall include development tools and licenses necessary to build and maintain the MMIK database application.

• This software component shall be procured as a Commercial Off-the-Shelf (COTS) item.

5.5. Web Server Software

• MMIK shall include a web server software suite to support creation, maintenance and operation of dynamic web-based elements of the system, such as the administrative tools and Kiosk GUI.

• The software shall support current web development languages and methods and permit the implementation of web modules consistent with the functional requirements of those modules.

• This software component shall be procured as a Commercial Off-the-Shelf (COTS) item.

5.6. Remote Network Access Software

• The Remote Network Access Software shall allow an authorized System Administrator to log into the MMIK system from a remote location utilizing a dial-up or Internet network connection.

• The software shall provide secure password protection to prevent unauthorized remote access to the MMIK system.

• The software shall allow the remote user to emulate all software controls and commands available to a user at an on-site workstation.

• The software shall allow for execution of system commands and software changes and updates given sufficient user authority.

• This software component shall be procured as a Commercial Off-the-Shelf (COTS) item.

5.7. Anti-Virus Software

• The System shall include an anti-virus software package designed to protect MMIK from harmful computer and network born viruses and worms.
• The Anti-Virus Software shall be supported and updated to ensure that the protection remains current.

• The software shall be upgradeable through periodic automated updates as well as manual downloads from the software supplier.

• This software component shall be procured as a Commercial Off-the-Shelf (COTS) item.

5.8. Manual Data Entry System

• The Manual Data Entry (MDE) software shall allow service boards and other authorized external users to enter real-time and static data, such as event information, into the MMIK system. The MDE system shall utilize web forms served from the MMIK server.

• The MDE shall be Web-based and password protected to prohibit access by unauthorized users.

• The MDE shall feature customized GUI screens for each user and/or data type using a combination of text fields, check boxes, and drop-down boxes relevant to the type of information being entered.

• The MDE shall validate the data submitted and require completion of a minimum data set before the data is saved to the MMIK database.

• Data entered into the MDE shall be exported to the MMIK system formatted according to the applicable MMIK data standards.

• The MDE shall prompt users for an expiration date for data that is manually entered through the MDE.

• The MDE shall be capable of supporting at least six (6) multiple simultaneous users.

• MDE user activity and errors shall be recorded in a system log.
5.9. Direct Service Board Interface Software

- The Direct Service Board Interface (DSBI) software shall automatically retrieve data from Service Board Hubs according to a pre-determined schedule and upload it to the MMIK database.

- The DSBI shall support security and authentication functions necessary to gain access to the Service Board Hubs.

- The DSBI shall allow the System Administrator to configure the frequency between downloads for various types of data.

- The DSBI shall be robust enough to support frequent and complete downloads of real-time transit information from the Service Boards on the order of once per 2 minutes.

- The service board hubs shall have adequate performance capabilities to support the interface requirements of the DSBI.

- The DSBI modules shall be capable of screening incoming data to detect missing or extraneous entries.

- The DSBI shall include fault and error detection features to detect download problems and failures. The DSBI shall re-attempt a download following a failed transmission.

- Following a loss of communications or other system failure, the DSBI shall provide a method for ensuring that a full current data set is available to the MMIK system.

- DSBI activity and errors shall be recorded in a system log.

5.10. Web Data Retrieval Software

- The Web Data Retrieval (WDR) software shall automatically retrieve data from Service Board websites according to a pre-determined schedule, and upload it to the MMIK database.

- The WDR shall allow the System Administrator to specify the file names, location, time of day, and frequency of downloads for various types of data.

- The WDR shall be capable of screening incoming data to detect missing or extraneous entries.
• The WDR shall include fault and error detection features to detect download problems and failures. The WDR shall re-attempt a download following a failed transmission.

• WDR activity and errors shall be recorded in a system log.

5.11. Software Testing

• Software testing shall be performed in accordance with a Software Testing Plan (developed under Task 4) approved by the RTA before software development commences. The plan shall include the following elements:
  
  • Component (Module) Testing;
  • Integration Testing;
  • Pre-Acceptance Testing (simulated testing environment); and
  • 30-Day Acceptance Testing

• Software testing shall be based upon functional and performance requirements under standard and extraordinary operating conditions.

• Internal testing shall be accomplished on new versions of the software. Formal acceptance testing will be conducted on the final version only.
6. Central Hardware Requirements

This section describes the requirements for the central hardware of Multi-Modal Information Kiosk System. Note that Kiosk Hardware Requirements are provided in the *MMIK Concept of Operations* (January 6, 2003).

6.1. General Requirements

- All hardware provided for the MMIK system shall be new, of a current generation, and functioning perfectly.

- All hardware components shall include a minimum one (1) year on-site warranty against manufacturing defects or material flaws.

- Components shall be commonly and commercially available, and scalable to accommodate future growth of the MMIK system.

- Central hardware components shall be networked together using a secure local area network (LAN) with a speed of 100Mbps or greater.

6.2. Hardware Components

- Major MMIK central hardware components shall include:
  - Application Server
  - Database Server
  - Web Server
  - Internal and External Firewalls
  - Modem (dial in administrative access)
  - Workstations
  - Peripherals (printers, mouse, keyboards, etc.)
  - Routers
  - Switches

6.3. Storage

- RAID storage shall be provided to accommodate anticipated current needs as well as significant capacity for future expansion of the system.

- An additional, off-line backup storage system shall be in place to support weekly full back-ups and daily incremental back-ups.
6.4. Redundancy and Reliability

- System hardware, including processing, networking, and data storage equipment, shall be designed to include the maximum practical level of redundancy to ensure system availability in the event of a component failure. This includes the use of backup servers and RAID data storage.

- System components shall be selected to provide the highest practical Mean Time Between Failures (MTBF).

6.5. Power

- All central hardware shall be provided with an adequate supply of continuous, redundant source of “clean” AC power (i.e., protected from spikes and surges).

- An Uninterruptible Power Supply (UPS) shall be provided for all central system hardware to ensure continued operation in the event of a moderate power failure, and ensure adequate time for proper system shut-down in the event of a major power failure.

- The system power supply shall be installed in accordance with national and local electrical codes.

6.6. Environmental

- System hardware shall be installed and operated within the environmental parameters recommended by the equipment manufacturers.

- Adequate ventilation shall be provided to prevent overheating of central hardware.

- Hardware shall be protected from environmental perils during transport, storage, installation, and operation such as moisture, humidity, weather, dust, smoke, heat, static electricity, magnetic fields, and vibration.

- Equipment shall be oriented and installed in a manner consistent with applicable workplace safety and ergonomics guidelines.

6.7. Physical Security

- All portions of the system hardware shall be installed in a locked, secured location to minimize the risk of tampering or damage by unauthorized individuals.
6.8. Testing

- All hardware shall undergo testing procedure as outlined in a System Test Plan (developed under Task 4) to be submitted to and approved by the RTA. This plan shall include:
  - Factory Acceptance Testing;
  - Installation Testing; and
  - Performance Testing.

7. Communications Requirements

This section describes the communication requirements for the Multi-Modal Information Kiosk System, including the central LAN, kiosk communications, communications with service boards, and communications with other external entities and systems.

7.1. General Requirements

- The MMIK system shall utilize existing communications linkages where possible for the MMIK LAN as well as connections to the RTA network, Service Board networks, and External entities.

- Private, dedicated communications, to the extent that they are available, are preferable to 1.) private communications links shared by other systems and 2.) public networks.

- In the short-term, all communications links shall possess adequate bandwidth and availability to perform the functionalities described within this document, and shall not preclude a migration to high-speed (>256k), persistent (“always on”) connections in the long term.

- The MMIK communications system shall at a minimum provide connectivity among the following internal and external system components:
  - MMIK Central Database
  - MMIK Remote Administrators
  - MMIK Public Information Kiosks
  - RTA Network and Website
  - CTA Service Board Hub and Website
  - Metra Service Board Hub and Website
  - Pace Service Board Hub and Website
  - External Data Provider Hubs (if applicable)
7.2. Reliability and Redundancy

- Communications links shall have an average availability of 99.0% or higher for private dedicated links.

- To the extent practical, in the long term, the MMIK communications links should have redundant back-ups to maintain overall system availability despite the failure of an individual communications link or network hardware item.

- The failure of one communications link shall not impact the operation or performance of the remainder of the MMIK system.

7.3. Security

- The MMIK Communications Network shall be designed with an appropriate, state-of-the-art security infrastructure to protect against a wide variety of potential system security hazards.

- The system shall incorporate network firewalls to prevent unauthorized access from outside the MMIK network.

- The communications integrity of communications links shall be ensured through mechanisms such as password authentication.

- The physical communications hardware shall be in locked secured locations.

- The system shall provide for multiple layers of security privileges to distinguish different user types, e.g. public users, system administrators, and service board staff.

- The system shall support the implementation and use of future security enhancements.
8. Kiosk GUI Requirements

This system describes the requirements for the public Graphical User Interface (GUI) for the MMIK system employed on the public information kiosks.

8.1. General Requirements

- The MMIK Graphical User Interface (GUI) shall allow transit customers to access data contained in the MMIK database such as schedule information, static service information (e.g. fares), trip planning information, real-time service information, transit bulletins, and maps.

- The GUI shall allow customers to view information on the kiosk screen, and allow printing of selected information through the kiosk’s built-in printer.

- GUI content and format shall be configurable to support kiosk profiles for different operating locations and kiosk functionality:
  - attended locations;
  - unattended locations;
  - printing/non-printing kiosks; and
  - location ‘awareness’ (customize queries default to geographic location of kiosk).

- The GUI shall utilize a commercial off-the-shelf Kiosk Operating System (KOS) that resides on top of the PC Operating System (Windows 2000 or higher), in accordance with the Software Requirements outlined elsewhere in this document.

- The public GUI interface shall prohibit unauthorized users from accessing the PC Operating System or any GUI, kiosk, or network controls or settings.

- The GUI shall support a unique identifier for each kiosk to permit diagnosis of system malfunctions as well as customization of content by kiosk location (location ‘awareness’).

- The GUI shall be designed to withstand intentional or unintentional misuse (e.g., repeated tapping of keys) without system malfunction.

- The GUI and its controls shall conform to the applicable accessibility requirements of the Americans with Disabilities Act (ADA).

8.2. Scalability and Expandability
• The GUI shall be designed with utmost flexibility to permit enlargement or functional expansion of the MMIK system as new software tools, data sources, or needs emerge in the future.

• System scalability and expandability issues include, but are not limited to, the following issues: (discussed further in the remainder of this section):
  o Expansion in the scale or type of real-time information, manually-entered, or static information available in the database;
  o Integration of third-party data sources;
  o Integration of new GUI software functionality (e.g., dynamic mapping)
  o Integration with electronic mail features, PDAs, Cellular phones, or other communications devices

• GUI design elements and page designs shall be conducive to alterations or additions to kiosk content as the quantity, source, and/or type of information available evolves over time. This includes:
  o Use of HTML text as opposed to text in image form
  o Use of design templates controlling color schemes, fonts, etc.
  o Use of modular graphics and backgrounds; and
  o Implementation of web development best practices, version control, notation, and documentation.

8.3. GUI Content

• The GUI shall provide access to a wide variety of information and data from the MMIK database, transit websites, and external sources that is of interest and benefit to the traveling public, as illustrated in Table 8-1.

• GUI content shall include static and real-time traveler information to the extent that each is available.

• The GUI shall not permit access to elements of the MMIK Database that are deemed to be confidential or inappropriate for public use.

• The GUI shall provide custom database look-ups, for certain types of information, such as schedule information, service bulletins, and map retrieval, to the extend possible;

• Where source data is not available in an alternative format, the GUI shall utilize .pdf files available on RTA and/or service board websites in the short term.
• GUI content shall be provided in a web-compatible format such as HTML, XML, or PDF;

• Selected GUI content shall be available in a printer-friendly format so that Kiosk Users may generate hard copies of information at print-enabled kiosks.

• Printed content shall be compact and resemble traditional printed material produced by the RTA and its service boards, including format, language, logos, symbols, abbreviations, notations, etc.

• Data obtained from external sources shall be customized to ensure harmony in presentation, design, and navigation with the MMIK system, to the extent possible.

• GUI content in drop-down menus of multiple-choice lists shall be directly linked to the MMIK database for automatic update following changes to the data.
### Table 8-1: MMIK GUI Content and Major Functionality

<table>
<thead>
<tr>
<th>Kiosk Information Type</th>
<th>Static Info</th>
<th>Automated Real-Time Info</th>
<th>Manually-Entered Events/Bulletins</th>
<th>Printable Content</th>
<th>User Custom Queries*</th>
<th>Potential External Links</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTA General Info</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>RTA Website (Short Term Data Source)</td>
<td>Some information pulled from web sites in S/T; L/T expansion of content and migration to service board hubs</td>
</tr>
<tr>
<td>CTA General Info</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>CTA Website (Short Term Data Source)</td>
<td>Some information pulled from web sites in S/T; L/T expansion of content and migration to service board hubs</td>
</tr>
<tr>
<td>Metra General Info</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>Metra Website (Short Term Data Source)</td>
<td>Some information pulled from web sites in S/T; L/T expansion of content and migration to service board hubs</td>
</tr>
<tr>
<td>Pace General Info</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>Pace Website (Short Term Data Source)</td>
<td>Some information pulled from web sites in S/T; L/T expansion of content and migration to service board hubs</td>
</tr>
<tr>
<td>CTA Bus Schedule</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Display full schedules or customized user queries</td>
<td></td>
</tr>
<tr>
<td>CTA Rail Schedule</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Display full schedules or customized user queries</td>
<td></td>
</tr>
<tr>
<td>Metra Rail Schedule</td>
<td>X</td>
<td>A</td>
<td>?</td>
<td>X</td>
<td>X</td>
<td>Display full schedules or customized user queries</td>
<td></td>
</tr>
<tr>
<td>Pace Bus Schedule</td>
<td>X</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Display full schedules or customized user queries</td>
<td></td>
</tr>
<tr>
<td>CTA Bus Maps</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td>L</td>
<td>External Mapping Source (Long-Term)</td>
<td>.pdf route maps (Short-Term); Graphic/geocoded map data (Long-Term)</td>
</tr>
<tr>
<td>CTA Rail Maps</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td>L</td>
<td>External Mapping Source (Long-Term)</td>
<td>.pdf route maps (Short-Term); Graphic/geocoded map data (Long-Term)</td>
</tr>
<tr>
<td>Metra Rail Maps</td>
<td>X</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>L</td>
<td>External Mapping Source (Long-Term)</td>
<td>.pdf route maps (Short-Term); Graphic/geocoded map data (Long-Term)</td>
</tr>
<tr>
<td>Pace Bus Maps</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td>L</td>
<td>External Mapping Source (Long-Term)</td>
<td>.pdf route maps (Short-Term); Graphic/geocoded map data (Long-Term)</td>
</tr>
<tr>
<td>Other Service Maps</td>
<td>X</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>L</td>
<td>External Mapping Source (Long-Term)</td>
<td>e.g. City, Region, Loop maps (Short-Term); Graphic/GIS map data (Long-Term)</td>
</tr>
<tr>
<td>RTA Trip Planner</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td>RTA Trip Planner Website (Touch Screen Version)</td>
<td>Direct MMIK link to RTA Trip Planner Website</td>
</tr>
<tr>
<td>MMIK Info</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MMIK System</td>
<td>e.g. Kiosk Location, Project Info</td>
</tr>
<tr>
<td>Context-Specific Info</td>
<td>X</td>
<td>A</td>
<td>A</td>
<td></td>
<td>A</td>
<td>Airport, Tourism, etc. Websites; RTIK System</td>
<td>Airport, Tourism Info</td>
</tr>
</tbody>
</table>

*User search queries database to retrieve specific information (e.g., Next four buses at certain location)

X = Short-Term Objective  A = Short-Term Objective; subject to data availability  L = Long-Term Objective
8.4. GUI Components

The GUI shall be organized in a hierarchical fashion containing the following components (Figure 8-1):

- **Carousel Mode:** The Carousel (Standby) Mode is a static or animated screen or series of screens that is displayed when the kiosk is not in use (as determined by a preset timeout period of inactivity. The carousel screen may incorporate a demonstration of the use of the screen, general information, and/or animation. Users shall exit the carousel mode by touching the screen or activating any other kiosk controls.

- **Start Page (Home Page):** The Start Page is the first screen that a user will encounter once the kiosk is brought out of carousel mode. The Start Page shall provide links to various Sub-Menus and Content Pages that allow the user to reach all information contained within the system. The Start page shall also display any current system-wide or other alerts that describe events having a significant impact on transit services (e.g., weather emergency).

The Start Page shall include the following categories:

- Link to Schedules Sub-Menu
- Link to Maps Sub-Menu
- Link to Trip Planner (Touch Screen Kiosk Version)
- Link to Service Bulletins Sub-Menu
- Link to Context-Specific Content (e.g., airport/tourism information; Sub-Menu, External and/or Content Pages)
- Link to User Query Page (Schedule, Map, Bulletin Queries and Keyword Search)
- Link to RTA/MMIK Contact Information
- Scrolling Display of High Urgency Events

- **Sub-Menu Page:** Sub-Menu Pages allow the user to select further sub-categories of information within a single menu choice displayed on the preceding page.

The following sub-menus shall be included in the GUI:

- **Schedules Sub-Menu:**
  - Link to Bus Schedules Sub-Menu:
    - CTA Bus Schedules (Content Page)
    - Pace Bus Schedules (Content Page)
  - Rapid Transit Schedules (Content Page)
  - Commuter Rail Schedules (Content Page)
  - Link to Schedules Query Form
o **Maps Sub-Menu:**
  - Link to Regional Maps (RTA)
  - Link to **Bus Maps Sub-Menu:**
    - Link to CTA Bus Maps (Content Page)
    - Link to Pace Bus Maps (Content Page)
  - Link to Rapid Transit Maps (Content Page)
  - Link to Commuter Rail Maps
  - Link to Map Query Form

o **Service Bulletin Sub-Menu:**
  - Link to **General Service Bulletins Sub Menu:**
    - Link to RTA Bulletins
    - Link to CTA Bulletins
    - Link to Metra bulletins
    - Link to Pace Bulletins
  - Link to **Bus Bulletins Sub-Menu:**
    - Link to CTA Bus Bulletins
    - Link to Pace Bus Bulletins
  - Link to Rapid Transit Bulletins
  - Link to Commuter Rail Bulletins
  - Link to Service Bulletin Query Form

o **Context-Specific Sub-Menu(s)**
  - As Required

- **Content Pages:** Content Pages display information from the MMIK database and allow user input and printing of selected content. Content pages shall also include integrated query capabilities where applicable.

- **External Pages:** External Pages provide content to Kiosk users by linking to Websites outside of the MMIK system (e.g., RTA website Trip Planner). Internet links off of external pages may be disabled to prevent users from browsing extraneous content from the Kiosks.
8.5. Display of Static Information

- The GUI shall display static information available in the MMIK database.

- Where applicable and available, data expiration shall be displayed with all static information.

- Where applicable, the GUI shall provide links among related Schedule, Map, and Real-Time bulletin information so that users can access this related information about a particular service in ‘one click.’

- The GUI shall allow custom user database queries for MMIK content using a combination of the following filters:
  - Schedule Information
    - By Individual Route/Service;
- By Date (today, tomorrow, calendar date, weekday, weekend, special event);
- By Time (between start time and end time or within the next N hours/minutes);
- By Run;
- By Trip;
- By Direction (Inbound, Outbound, Directional)
- By Facility, Station, or Stop (one location only; point-to-point searches are accommodated through the RTA trip planner)

**Example:** Search all inbound buses on CTA Route 20 at the United Center between 6:00 and 7:00 pm.

- Service Bulletin Information
  - By Service Board affected;
  - By Route/Service affected;
  - By Date (today, tomorrow, calendar date, weekday, weekend, special event);
  - By Time (between start time and end time or within the next N hours/minutes);
  - By Run affected;
  - By Trip affected;
  - By Direction (Inbound, Outbound, Directional)
  - By Facility, Station, or Stop

**Example:** Identify any Service Bulletins pertaining to the Metra Electric South Shore Line outbound service over the next three hours today.

- The GUI schedule and map display functionality shall support future upgrades to include additional location parameters, as data becomes available:
  - Block number;
  - Landmark
  - Street;
  - Neighborhood/City;
  - Geocoded map location;

### 8.6. Display of Real-Time Information

- The GUI shall incorporate a mechanism for displaying real-time service information (i.e., schedule adherence information or current system bulletin) affecting the subject of the User’s search, e.g., a particular route, stop location, service board, date, etc.
• The GUI shall allow the user to search for all active events at the present data and time, or at a future date or time, filtering according to criteria such as Route, Run, Stop, Landmark, etc.

• Where applicable, a data expiration date (determined by the data provider and/or system-defined parameters) shall be displayed with all real-time information.

8.7. Display of Manually Entered and Planned Events

• The MMIK System shall support the display of manually-entered real time event or planned event information entered through MMIK’s web-based administrative tools.

• Service bulletins/announcements shall be classified according to their impact on the transit system, for example:
  
  o Urgency Level (as defined by data provider)
  o Service Boards Affected
  o Routes Affected
  o Run(s) Affected
  o Stop(s)/Station(s) Affected
  o Date(s)/Time(s) Affected
  o Reference Location(s)/Facility(ies) Affected

• The GUI shall incorporate rules to display active events that are relevant to a particular User inquiry whose parameters match those of the event:

  1. High Urgency Level (display on Start Page);
  2. RTA General Bulletin (display for all inquiries); AND/OR
  3. Service Board General Bulletin (display for all service board inquiries); AND/OR
  4. Same DATE as active event; AND/OR
  5. Same TIME as active event; AND/OR
  6. Same ROUTE as active event; AND/OR
  7. Same RUN as active event; AND/OR
  8. Same TRIP as active event; AND/OR
  9. Same LOCATION as active event (Facility, Stop, Station, Landmark, Street)
8.8. User Queries

- The GUI shall support a query function that allows users to seek specific information contained within the MMIK database.

- User queries shall be accomplished by each of the following mechanism:

  o **Web Page Navigation**: The user navigates hierarchical website links to reach information of interest within the content pages;  
    *Example: Navigate to the Bus Schedules page and select route of interest*

  o **Drop-Down Menu Filters**: The user searched the MMIK database based on criteria selected from drop down list(s) on a query or content page;  
    *Example: Search bus schedules by selecting route, date, and time of day.*

  o **Keyword Queries**: The user searches the content of the MMIK database by keyword.  
    *Example: Search MMIK for ‘Metra Fare Information.’*
8.9. Navigation

- The kiosk shall be designed so that a user may navigate all features of the site using an integrated kiosk mouse/trackball OR a touch screen. Kiosk navigation shall meet the unique needs of touch-screen navigation and control (e.g. button sizing).

- The GUI shall provide a mechanism for user entry of text (e.g., for entering addresses or email comments) by supporting both integrated kiosk keyboards as well as on-screen touch screen virtual keyboards.

- Virtual keyboard shall conform to the general appearance of the kiosk GUI and hardware.

- The GUI shall be designed in accordance with common and easy-to-understand navigation features based on standard kiosk and web GUI protocol. Example features include buttons; text fields for manual data entry; scroll bars, drop-down menus, and toggle boxes.

- Each GUI screen shall contain a “Start Over” feature that allows the user to return to the Start Page.

- Each GUI screen shall contain a “Back” feature that allows the user to return to the last previously viewed screen.

- The GUI shall revert to the Carousel feature or the Start Page (as configured by the System Administrator) after a pre-set, configurable timeout period (determined by the system administrator).

8.10. Printing Feature

- The GUI shall enable the user to print hard copies of selected content from the kiosk through the kiosks’ built-in printer when the user activates an on-screen “Print” button.

- The GUI shall acknowledge the receipt of a print command with a pop-up message to the User.

- The GUI shall incorporate a configurable delay period that temporarily disables the print command after a successful print command has been received.
8.11. Email Features

- The GUI shall provide for a future functionality that permits sending of selected Kiosk content (e.g., .pdf files, service bulletins) to an email address provided by the user.

- The GUI shall provide a “Contact Us” feature allowing the user to submit text messages to the System Administrator to provide comments or report problems as well as a return email address. Messages shall be appended to a text file on the server, and also forwarded by email to an address configured by the system administrator.

- The system shall accommodate a future functionality that allows users to register to receive notification of schedule changes or service bulletins for user-selected routes.

8.12. Map Display

- The GUI shall support display of transit system, regional, and route maps as .pdf or graphic image files.

8.13. GUI Security

- The GUI interface shall operate on a Kiosk Operating System platform that prevents a Public User from accessing the kiosks’ PC operating system and all administrative, network, and system controls.

- The GUI shall restrict users from accessing Internet sites that are not explicitly included as part of the MMIK system as an External Page. This includes all unauthorized links directly from authorized External Pages.

- The GUI shall incorporate an inconspicuous and non-obvious combination of ‘hot spots’ combined with passwords, that allow an authorized user to exit the Kiosk Operating System and public GUI screen to access administrative features and the kiosk PC desktop.

8.14. Administrative Functions

- The GUI shall incorporate a suite of password-protected, internet-based Administrative Tools to support the following functions:
  - Usage logging and tracking;
  - Configuration of system parameters;
  - Configuration of security features.
• The GUI shall send a notification to the MMIK whenever a kiosk has entered administrative mode.

• The system shall be configured such that Public Users or other unauthorized persons cannot view, access, or alter the Administrative Tools.

• The GUI shall automatically record usage metrics and error logs to support evaluation and diagnosis of the kiosk system, specifically:
  o Number of requests (“hits”) for various pages and links within the GUI;
  o Number and type of user printing requests;
  o Utilization of other system features; and
  o System errors, failures, and reboots.

• GUI metrics shall be stored in an ASCII text log file accessible only by authorized site administrators and exportable from the kiosks via a network connection or portable media.

9. Conclusion

This document has described the functional requirements for the optimal short-term implementation of the MMIK system. These requirements shall be used as a basis for the design of the MMIK and test plans in subsequent tasks. The results of the design phase will be used to finalize the actual features and functions that will be made available during the next phase of implementation based on budget constraints.

The next task in this process is the **Detailed System Design and Specification** task, which includes:
  o Refinement of the system architecture;
  o Finalization of the software and hardware approaches and design;
  o Confirmation of service board data provision roles and responsibilities;
  o Development of a prototype GUI architecture; and
  o Preparation of testing plans.

Parallel efforts shall be undertaken to finalize interagency agreements as well as evaluate hardware and locations for the remaining Short Term Kiosk locations.
## Appendix: List of Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADA</td>
<td>Americans with Disabilities Act</td>
</tr>
<tr>
<td>ASCII</td>
<td>American Standard Code for Information Interchange</td>
</tr>
<tr>
<td>ATSS</td>
<td>Active Transit Station Signs</td>
</tr>
<tr>
<td>AVL</td>
<td>Automatic Vehicle Location</td>
</tr>
<tr>
<td>COTS</td>
<td>Commercial Off-the-Shelf</td>
</tr>
<tr>
<td>CTA</td>
<td>Chicago Transit Authority</td>
</tr>
<tr>
<td>DSBI</td>
<td>Direct Service Board Interface Software</td>
</tr>
<tr>
<td>Gateway TIS</td>
<td>Gateway Traveler Information System</td>
</tr>
<tr>
<td>GCM</td>
<td>Gary-Chicago-Milwaukee Corridor</td>
</tr>
<tr>
<td>GUI</td>
<td>Graphical User Interface</td>
</tr>
<tr>
<td>HTML</td>
<td>Hyper-Text Mark Up Language</td>
</tr>
<tr>
<td>HTTP</td>
<td>Hyper-Text Transfer Protocol</td>
</tr>
<tr>
<td>IH</td>
<td>Illinois Hub</td>
</tr>
<tr>
<td>ITH</td>
<td>Illinois Transit Hub</td>
</tr>
<tr>
<td>ITS</td>
<td>Intelligent Transportation Systems</td>
</tr>
<tr>
<td>KOS</td>
<td>Kiosk Operating System</td>
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<tr>
<td>LAN</td>
<td>Local Area Network</td>
</tr>
<tr>
<td>MDE</td>
<td>Manual Data Entry Software</td>
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<tr>
<td>MMIK</td>
<td>Multi-Modal Information Kiosk</td>
</tr>
<tr>
<td>MMTIS</td>
<td>Multi-Modal Traveler Information System</td>
</tr>
<tr>
<td>MTBF</td>
<td>Mean Time Between Failures</td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
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<tr>
<td>NITSA</td>
<td>National ITS Architecture</td>
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<tr>
<td>NTCIP</td>
<td>National Transportation Communications for ITS Protocols</td>
</tr>
<tr>
<td>PDA</td>
<td>Personal Digital Assistant</td>
</tr>
<tr>
<td>PDF</td>
<td>Portable Document Format</td>
</tr>
<tr>
<td>RAID</td>
<td>Redundant Array of Inexpensive Disks</td>
</tr>
<tr>
<td>RTA</td>
<td>Regional Transportation Authority</td>
</tr>
<tr>
<td>TCIP</td>
<td>Transit Communications Interface Profiles</td>
</tr>
<tr>
<td>TCP/IP</td>
<td>Transmission Control Protocol/Internet Protocol</td>
</tr>
<tr>
<td>UPS</td>
<td>Uninterruptible Power Supply</td>
</tr>
<tr>
<td>WDR</td>
<td>Web Data Retrieval Software</td>
</tr>
<tr>
<td>XML</td>
<td>eXtensible Markup Language</td>
</tr>
</tbody>
</table>