PRELIMINARY
DRAFT

Strategic Plan
(PRELIMINARY DRAFT)

of the Management, Operations, and Intelligent Transportation Systems Technical Subcommittee
National Capital Regional Transportation Planning Board
Metropolitan Washington Council of Governments

September 5, 2008

PRELIMINARY
DRAFT

1. Executive Summary

To be written.

2 Overall Context

The National Capital Region Transportation Planning Board (TPB) of the Metropolitan Washington Council of Governments is the officially-designated metropolitan planning organization for the metropolitan Washington, D.C. area. Under this designation, TPB is required to develop the official surface transportation plan for the metropolitan area. TPB has developed two plans for the region. The financially constrained long-range transportation plan (CLRP) for transportation is the official plan for the region, identifying surface transportation projects that are expected to be built or expanded by 2030. The TPB has also developed a transportation "Vision" for the region, which addresses needs and goals beyond the CLRP's limitation of utilizing no more than currently identified funding sources. In fact, the CLRP contemplates relatively little expansion of the region's transportation system despite significant growth projected for the region's population, employment, trip-making, and traffic.

The context of surface transportation today has been by federal transportation legislation, the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) of 2005. Because of the ever-increasing difficulty and negative impacts of expanding the surface transportation system in metropolitan areas, SAFETEA-LU emphasized the better management and more efficient utilization of the existing transportation system. It includes a "planning factor" for metropolitan areas requiring "...consideration of projects and strategies that will...promote efficient system management and operation". Intelligent Transportation Systems (ITS) plays a pivotal role in improving management and operations.

The TPB is served by two major advisory committees regarding these topics. The Management, Operations, and ITS (MOITS) Policy Task Force advises the TPB on policy matters of the management and operations of the region's transportation system, and on policy matters of ITS, as well as identifying, developing, and building consensus on MOITS topic areas, recognizing individual state, local, and operating agency authority. The MOITS Technical Subcommittee of the TPB Technical Committee advises the TPB and the MOITS Policy Task Force on technical matters of the management and operations of the region's transportation system, and on ITS. The MOITS Technical Subcommittee also provides a forum for advice, information sharing, and coordination among TPB member agencies, implementers of ITS projects, and other interested parties regarding technical aspects of the management and operations of the region's transportation system.

2.1 Definition and background of MOITS

The "management and operations" of the transportation system may be defined as the day-to-day functions performed by, and the activities or events that occur on, the transportation system or infrastructure, and the direction, control, or handling of those functions, activities, and events by responsible parties. Responsible parties in the Washington metropolitan area include the state, county, and city departments of transportation, the public safety agencies of those jurisdictions, the Washington Metropolitan Area Transit Authority and other public transportation operators, the United States Park Service and other federal agencies, as well as a host of other stakeholders of the transportation system of the metropolitan area.

Intelligent Transportation Systems, or ITS, may be defined as the application of advanced or emerging computer or communications devices to the management and operations of the transportation system, including the careful integration of system functions. The Metropolitan Washington area is an ITS-rich deployment region among the states of Maryland and Virginia, the District of Columbia, local jurisdictions, and transit agencies.

This document also notes the interrelationship of TPB's long-range transportation planning activities, the shorter-range activities undertaken by the transportation agencies responsible for the management and operations of the region's transportation systems, and the role played by advancing ITS technology, both currently and in the future. Technologies have long been applied to transportation systems management, dating back at least to the first deployments of traffic signals in the early 20th Century, and especially throughout the 1970s, 1980s, 1990s, and now.

Now, emerging technologies and systems, particularly those based on the computer microprocessors and the Internet, provide added capabilities, services, and benefits. For public agencies, the state of the practice of managing and operations is evolving quickly because of the quick advancements occurring in high technology. The U.S. Department of Transportation has provided guidance that metropolitan areas should examine and plan to incorporate these advances, and particularly to ensure the effective integration and interoperation of transportation management systems. In developing this strategic plan for MOITS, we can achieve a larger benefit across the region through such integration.

MOITS activities are undertaken at all levels of jurisdiction: national, state, regional, local, corridor, private sector, and individual vehicle. As a TPB document, this strategic plan looks at those aspects of MOITS that are specifically and especially regional in nature. Many important aspects of MOITS topic areas are not primarily undertaken at the regional level, and are instead properly treated at the appropriate level (e.g., national equipment standards on private vehicles, or state-level policies for commercial vehicles). This document, therefore, looks strategically at several items that are specifically regional. Main focuses are on interoperability and interjurisdictional coordination.

2.2 National State of the Practice

Three major U.S. Department of Transportation initiatives set the national context for MOITS strategic planning:

- The National ITS Architecture
- Regional Transportation Systems Management and Operations (RTSMO) in Metropolitan Transportation Planning
- The Congestion Management Process.

These three initiatives are within the context of the national emphasis on Planning for Operations. The USDOT's Planning for Operations Web site states:

> *Planning for Operations is a joint effort between operations and planning that encompasses the important institutional underpinnings needed for effective Regional Transportation Systems Management and Operations. Planning for Operations includes three important aspects:*
>
> - *Regional transportation operations collaboration and coordination activity that facilitates Regional Transportation Systems Management and Operations,*
> - *Management and operations considerations within the context of the ongoing regional transportation planning and investment process, and*
> - *The opportunities for linkage between regional operations collaboration and regional planning.*

The Web site of the National ITS Architecture states:

> *The National ITS Architecture provides a common framework for planning, defining, and integrating intelligent transportation systems…The architecture defines:*
>
> - *The functions (e.g., gather traffic information or request a route) that are required for ITS*
> - *The physical entities or subsystems where these functions reside (e.g., the field or the vehicle)*
> - *The information flows and data flows that connect these functions and physical subsystems together into an integrated system.*

The National ITS Architecture framework sets the structure for statewide, regional, jurisdictional, or agency architectures. Architectures are intended to specify whether activities (particularly information exchange among ITS systems) will take place. They may not specify how such an exchange takes place, which can be determined in project engineering using a systems engineering process.

For the MOITS Strategic Plan, it is beneficial to have a basis in the National ITS Architecture to set the context and nomenclature of the strategic activities. It keeps the

focus on whether activities should take place, and may facilitate future discussions on how a data exchange will work.

A second context of the MOITS Strategic Plan is the federal emphasis area of Regional Transportation Systems Management and Operations (RTSMO) in Metropolitan Transportation Planning. Traditionally, Metropolitan Planning Organizations such as the TPB have focused on the long-range planning of major transportation capital improvements, such as new or expanded highways or transit lines. In the current era, however, there is also a great need to focus on making the existing transportation system function more safety, efficiently, and effectively. This leads to the need to effectively consider management and operations of the transportation system as part of metropolitan transportation plans. There is also a benefit to regional coordination of management and operations activities at the regional level in conjunction with regional planning. The region provides a forum for information exchange and collaboration on the decisions that individual agencies and jurisdictions make on their operations. Because the impacts of incidents and other transportation operational issues tend to be widespread or even regionwide in nature, it is beneficial to consider these at the regional level.

The third context activity of the MOITS Strategic Plan is that of the Congestion Management Process (CMP). The CMP is required of major metropolitan areas such as Washington in both the SAFETEA-LU legislation as well as its associated federal regulations issued by the USDOT. The TPB's CMP is part of the regional transportation plan and includes the following:

- Methods to monitor and evaluate system performance
- Objectives and performance measures
- Data collection and analysis
- Identification and evaluation of anticipated performance and expected benefits of Congestion Management strategies, including demand management, traffic operational improvements, public transportation improvements, ITS technologies, and additional system capacity, (where necessary)
- Assessment of the effectiveness of previously implemented strategies

Proposed single-occupant vehicle (SOV) capacity-increasing projects must show that congestion management strategies have been considered. In addition, the regional transportation plan will consider the results of the CMP.

Therefore, the CMP can help provide the regional congestion context of the activities envisioned in the MOITS Strategic Plan.

2.3 Review of State and Local Related Documents and Efforts

- The VDOT Northern Operations Region maintains a detailed ITS Architecture for the Northern Virginia region, with a particular focus on interactions with and within VDOT. See http://www.vdot-itsarch.com.

- Under the support of the Maryland State Highway Administration, a Maryland Statewide Architecture which describes a high-level framework for ITS for transportation agencies throughout the state. The architecture was developed with the assistance of expert consultants, and in conjunction with ITS Maryland and the University of Maryland. See http://www.itsmd.org/index.php?page_id=996.

- DDOT and WMATA have provided review and advice to TPB staff based upon internal documents and staff expertise.

- More to be added.

2.4 Strategic Plan Development Process

This plan was developed under the direction of the Management, Operations, and Intelligent Transportation Systems (MOITS) Technical Subcommittee of the National Transportation Planning Board (MPO). The MOITS Technical Subcommittee advises the National Capital Region Transportation Planning Board on matters of transportation operations and management, including considerations of Intelligent Transportation Systems (ITS) technologies in improving those operations. The Subcommittee also provides a regional forum for coordination among Transportation Planning Board member agencies and other stakeholders on these topics. The MOITS technical subcommittee represented a broad variety of stakeholders from the metropolitan area.

This plan was developed through a process of review of previous or relevant external documents, direct input from involved technical staffs, and active review by the MOITS Technical Subcommittee. TPB staff recommended and the MOITS Technical Subcommittee agreed to create a strategic plan with a structural basis in the National and Washington Regional ITS Architectures. These architectures provided a listing of potential focus areas, an agreed nomenclature, definitions, and structure for the plan. (See Section 2.7 for more information.)

Drafts of the plan were developed by TPB staff and reviewed at a series of regular MOITS meetings in 2008. MOITS held a workshop devoted to identifying the focus areas to be carried forward into the strategic plan on July 8, 2008.

[Add a section when able to explain the October – November inventory conducted in conjunction with development of the strategic plan.]

[Add a section on finalizing the plan when we get to that stage in the process.]

2.5 Interjurisdictional Collaboration and Systems Integration

The transportation agencies of the Washington region have successfully pursued and implemented ITS in the management and operations of their systems. A key strategy will be for these agencies to work collaboratively on integrating current and future systems. Many management and operations issues are irrespective of jurisdictional boundaries. Effects of major roadway incidents, for example, may spill well past boundary lines. Standards and interoperability issues also point to the need to work collaboratively.

It is recognized that there are political boundaries, sovereignty and authority associated with those boundaries, as well as differences in laws, funding priorities, and practices. However, there are instances when it will be advantageous to collaborate on a regional level, including:

1. large-scale issues where transportation impacts may cross jurisdictional boundaries;
2. boundary effects at edges of jurisdictions require collaboration, such as the coordination of traffic signals at a jurisdictional boundary;
3. operational efficiencies and improved customer service may be achieved through collaboration or strategic collaborative investments;
4. in cases where the service is best provided on a regionwide basis;
5. instances where it will be advantageous to share resources, such as a statewide traffic management center provide off-hours backup to a local center, or the sharing of fiber optic communications capacity.

This strategic plan, therefore, is structured to make recommendations from a multifunctional, interjurisdictional standpoint.

2.6 Relationship to TPB Vision, CLRP, and air quality conformity

While federal law and regulations drive much of the region's regular transportation planning activities, the TPB has also developed a policy framework—known as the Vision— that is intended to guide the region's transportation investments in the new century. Approved in 1998, the Vision is a long-range document laying out key goals and strategies that will help the region to develop the transportation system it needs to sustain economic development, environmental quality and a high quality of life. The agencies that implement transportation projects—the states, the District of Columbia, the regional transit authority and others—must show that the goals of their projects are consistent with the Vision.

Of particular importance to the MOITS Strategic Plan is the TPB Vision's Goal 4:

> *The Washington metropolitan region will use the best available technology to maximize system effectiveness.*

The Vision also lists a number of strategies for pursuit, including technologically advanced systems to monitor and manage traffic, improved incident management capabilities, advanced communications, and operating strategies.

This MOITS Strategic Plan identifies strategies and activities within the context of and consistent with the TPB Vision. This is an opportunity to further and amplify the technology and operations activities put forth in the TPB Vision, especially considering the ongoing advancements and available technologies in the field.

Consistent with the Vision, each year the TPB approves a Constrained Long Range transportation Plan (CLRP) and associated Transportation Improvement Program (TIP). The CLRP and TIP must also meet air quality targets, determined by an air quality analysis of what is proposed in the CLRP and TIP, with a finding of conformity with air quality targets. Projects and programs identified in the MOITS Strategic Plan, to be implemented, will have to be backed with proven resources (funding) to meet the financial constraint regulations of the CLRP, and will have to be consistent with air quality goals. MOITS strategies, in fact, may prove to be beneficial to air quality. Overall, the MOITS Strategic Plan is advisory to the CLRP and the overall regional planning process, and will rely on the identification of funding support for priority activities.

2.7Relationship to Regional ITS Architecture Development

The MOITS Strategic Plan identifies the key goals for the region in the area of ITS. Not included in this Strategic Plan, but currently been developed, is the Metropolitan Washington Regional ITS Architecture (MWRITSA). The MWRITSA document (consistent with National ITS Architecture) describes the interfaces necessary to support the region existing and planned ITS deployment.

The MWRITSA is a framework for describing and developing integrated transportation systems technology. The Regional Architecture is intended to provide a regional ITS framework for the foreseeable future, to define and validate ITS operations of regional significance, and to address national and statewide conformity in accordance with federal law and guidance. The architecture aims to ensure knowledge of ITS operations across the region, encouraging appropriate systems integration and enhanced technical systems interoperability.

While MWRITSA address more detail on what information exchange among the existing and planned interfaces among the systems in the region, the Strategic Plan will focus on both a short and a long-range strategy for implementing ITS strategies in the region. The MWRITSA identifies the Market Packages applied in the region in eight service areas. Market Packages represent slices of the Physical Architecture that address specific services like surface street control. The Strategic Plan will revisit all Market Packages and prioritize strategic Market Packages for the region.

The MOITS workshop held on July 8, 2008 considered the entire list of 91 market packages. Workshop participants used the long list to determine a short list of priority areas. Below are the 91 market packages, followed by nine (9) which were identified to move forward in this strategic plan.

The following ITS Service Areas and corresponding market packages reviewed for consideration:

Archive Data Management

- AD1 ITS Data Mart
- AD2 ITS Data Warehouse
- AD3 ITS Virtual Data Warehouse

Public Transportation

- APTS01 Transit Vehicle Tracking
- APTS02 Transit Fixed-Route Operations

- APTS03 Demand Response Transit Operations
- APTS04 Transit Fare Collection Management
- APTS05 Transit Security
- APTS06 Transit Fleet Management
- APTS07 Multi-modal Coordination
- APTS08 Transit Traveler Information
- APTS09 Transit Signal Priority
- APTS10 Transit Passenger Counting

Traveler Information

- ATIS01 Broadcast Traveler Information
- ATIS02 Interactive Traveler Information
- ATIS03 Autonomous Route Guidance
- ATIS04 Dynamic Route Guidance
- ATIS05 ISP Based Trip Planning and Route Guidance
- ATIS06 Transportation Operations Data Sharing
- ATIS07 Yellow Pages and Reservation
- ATIS08 Dynamic Ridesharing
- ATIS09 In Vehicle Signing
- ATIS10 VII Traveler Information

Traffic Management

- ATMS01 Network Surveillance
- ATMS02 Traffic Probe Surveillance
- ATMS03 Surface Street Control
- ATMS04 Freeway Control
- ATMS05 HOV Lane Management
- ATMS06 Traffic Information Dissemination
- ATMS07 Regional Traffic Management
- ATMS08 Traffic Incident Management System

- ATMS09 Traffic Forecast and Demand Management
- ATMS10 Electronic Toll Collection
- ATMS11 Emissions Monitoring and Management
- ATMS12 Roadside Lighting System Control
- ATMS13 Standard Railroad Grade Crossing
- ATMS14 Advanced Railroad Grade Crossing
- ATMS15 Railroad Operations Coordination
- ATMS16 Parking Facility Management
- ATMS17 Regional Parking Management
- ATMS18 Reversible Lane Management
- ATMS19 Speed Monitoring
- ATMS20 Drawbridge Management
- ATMS21 Roadway Closure Management

Vehicle Safety

- AVSS01 Vehicle Safety Monitoring
- AVSS02 Driver Safety Monitoring
- AVSS03 Longitudinal Safety Warning
- AVSS04 Lateral Safety Warning
- AVSS05 Intersection Safety Warning
- AVSS06 Pre-Crash Restraint Deployment
- AVSS07 Driver Visibility Improvement
- AVSS08 Advanced Vehicle Longitudinal Control
- AVSS09 Advanced Vehicle Lateral Control
- AVSS10 Intersection Collision Avoidance
- AVSS11 Automated Highway System
- AVSS12 Cooperative Vehicle Safety Systems

Commercial Vehicle Operations

- CVO01 Fleet Administration
- CVO02 Freight Administration
- CVO03 Electronic Clearance
- CVO04 CV Administrative Processes
- CVO05 International Border Electronic Clearance
- CVO06 Weigh-In-Motion
- CVO07 Roadside CVO Safety
- CVO08 On-board CVO and Freight Safety and Security
- CVO09 CVO Fleet Maintenance
- CVO10 HAZMAT Management
- CVO11 Roadside HAZMAT Security Detection and Mitigation
- CVO12 CV Driver Security Authentication
- CVO13 Freight Assignment Tracking

Emergency Management

- EM01 Emergency Call-Taking and Dispatch
- EM02 Emergency Routing
- EM03 Mayday and Alarms Support
- EM04 Roadway Service Patrols
- EM05 Transportation Infrastructure Protection
- EM06 Wide-Area Alert
- EM07 Early Warning System
- EM08 Disaster Response and Recovery
- EM09 Evacuation and Reentry Management
- EM10 Disaster Traveler Information

Maintenance & Construction Management

- MC01 Maintenance and Construction Vehicle and Equipment Tracking

- MC02 Maintenance and Construction Vehicle Maintenance
- MC03 Road Weather Data Collection
- MC04 Weather Information Processing and Distribution
- MC05 Roadway Automated Treatment
- MC06 Winter Maintenance
- MC07 Roadway Maintenance and Construction
- MC08 Work Zone Management
- MC09 Work Zone Safety Monitoring
- MC10 Maintenance and Construction Activity Coordination
- MC11 Environmental Probe Surveillance
- MC12 Infrastructure Monitoring

Among these 91 Market Packages, 9 of them were chosen as potential MOITS Strategic Areas:

Archive Data Management
- ITS Virtual Data Warehouse

Public Transportation

- Multi Multi-modal Coordination
- Transit Signal Priority

Traveler Information
- Interactive Traveler Information
- Transportation Operations Data Sharing

Traffic Management Traffic Management
- HOV Lane Management
- Regional Traffic Management
- Regional Parking Management

Maintenance and Construction Management Maintenance and Construction Management
- Maintenance and Construction Activity Coordination

[Definitions of the MOITS Strategic Areas from the National ITS Architecture and other descriptive information to be added.]

3 AREAS FOR COLLABORATION

[Overview to be added on the description of the service areas/focus areas and how they lead to recommendations.]

3.1 ITS Virtual Data Warehouse

In order to provide more and better information in managing and operating the transportation system in the region, it is necessary to archive operations data. Archived operations data can be used to predict when and where problems may occur again, as well as helping to evaluate alternative strategies for preventing or mitigating the problem.

ITS Virtual Data Warehouse provides the broad access to multimodal, multidimensional data from varied data sources using enhanced interoperability between physically distributed ITS archives that are each locally managed. Requests for data that are satisfied by access to a single repository are parsed by the local archive and dynamically translated to requests to remote archives which relay the data necessary to satisfy the request.

Figure 1 ITS Virtual Data Warehouse Conceptual diagram from National ITS Architecture [More explanatory information to be added.]

Figure 2 Detail version of ITS Virtual Data Warehouse conceptual diagram from Metropolitan Washington Regional ITS Architecture (MWRITSA) shows involved systems and stakeholders. [More explanatory information to be added.]

AD3 - ITS Virtual Data Warehouse

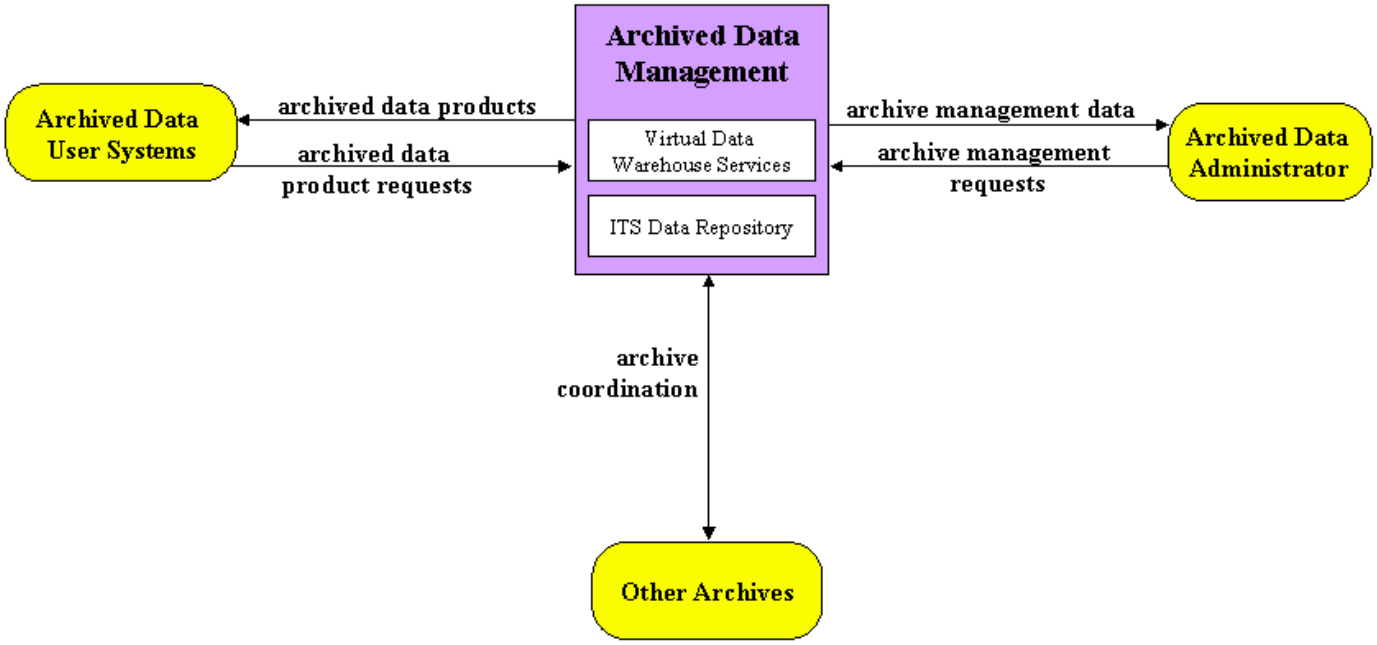

Figure 1

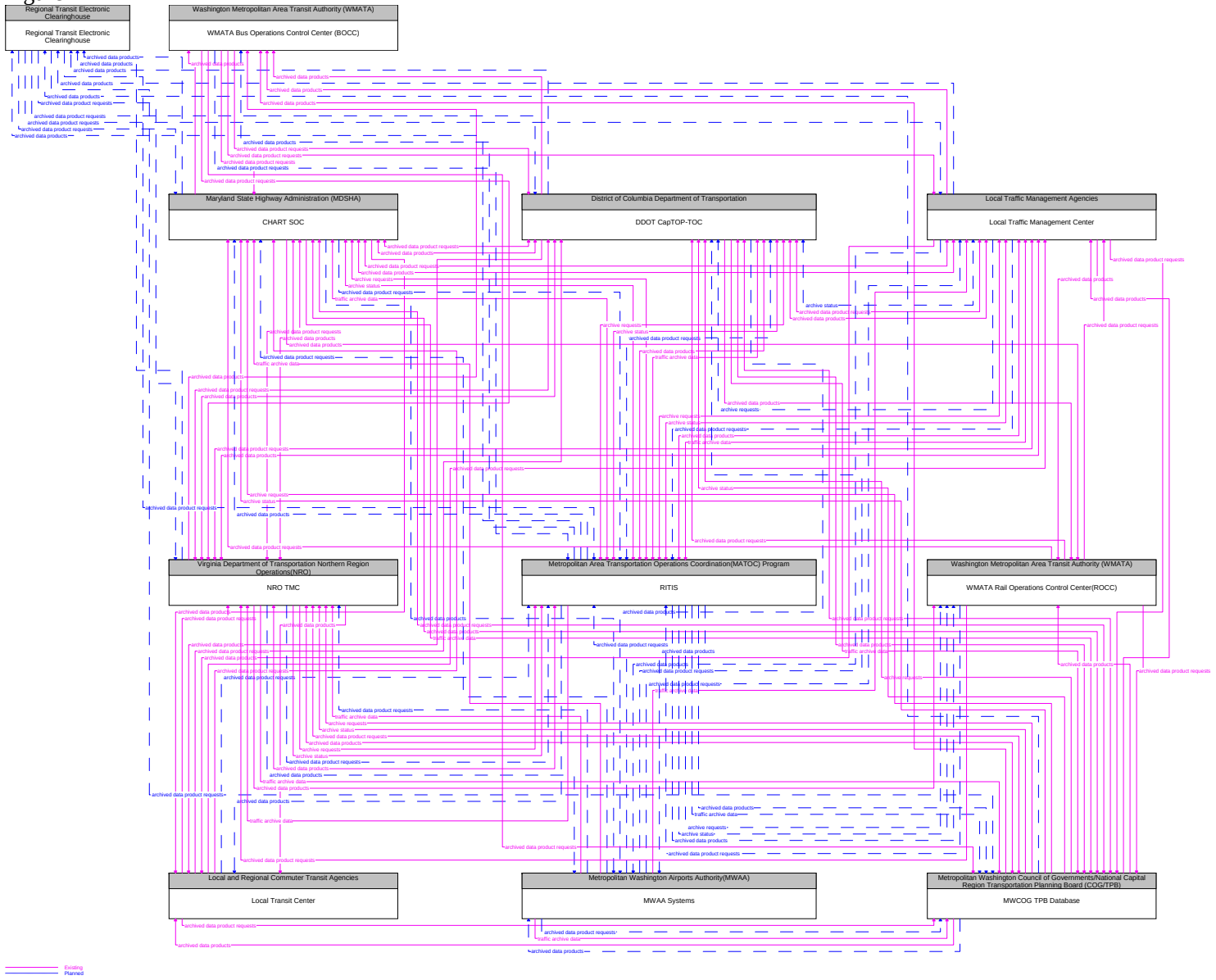

Figure 2

Currently, each Washington D.C. metropolitan area transportation agency maintains its own equipment and software for monitoring traffic and travel conditions and for making operational adjustments. This need for regional management of Washington, D.C.'s transportation system is impetus for the Regional Integrated Transportation Information System (RITIS). RITIS is a data fusion and dissemination system that will compile transportation data from each participating agency, standardize it, and make it available to other participating agencies through each agency's existing transportation management systems. RITIS will not collect data directly from field devices; rather, participating agencies will collect data from their field devices or enter information into their incident management system and make it available to RITIS. Figure 3 shows the concept of RITIS. The table below identifies RITIS user classes based on the method for accessing the data.

User Classes	**Method for Accessing RITIS Data**
Transportation Management Center Operators	• MD SHA CHART System • VDOT NOVA STC • DC DOT CapTOP System • Montgomery County ATMS • Prince George's County TRIP Center
Field and Center Based Law Enforcement Officers and Public Safety Personnel	• Capital Wireless Information Net System[1] • CAD Systems
Transit Management System Operators	• WMATA Rail System • WMATA Bus System • Montgomery County Ride-On • PRTC
Media Outlets	• Direct RITIS Feeds • Via 3rd Party Systems
Traveling Public	• Via Media Outlets • 3rd Party Information Service Providers • 511 Systems • Direct via RITIS Website

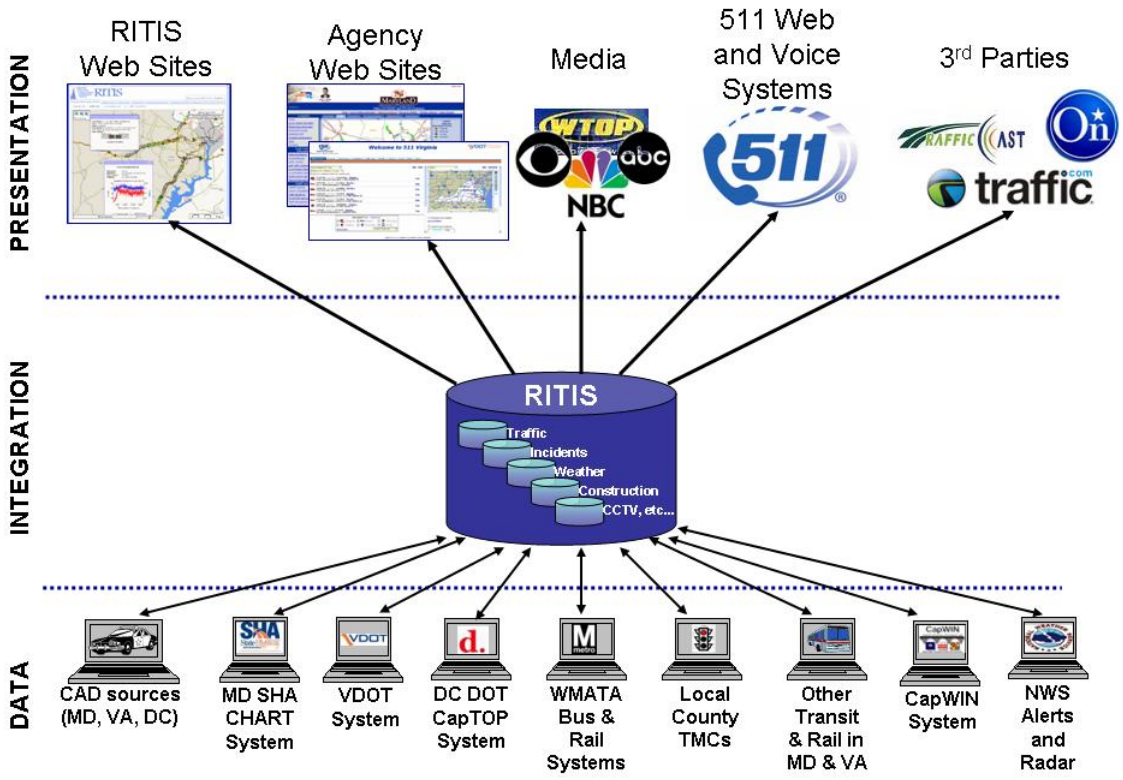

Figure 3: RITIS Concept

The RITIS system will archive all transportation-related operations data that is provided to RITIS, like incident locations, lane closures, responding agencies, and traffic detector data, which will be available for use in transportation studies and performance evaluations. Archived data can be used by agencies for quantitative analyses of system performance, proposed changes, and travel and air quality modeling. Researchers can use RITIS data to better understand travel conditions and behavior. It can also be used for longer-term planning for special events, evacuations, and emergencies, and especially for events of a regional scale that require cross jurisdictional or cross-modal plans.

RITIS will also store and use static information about roadways and transit service. Examples of static information for roadways include number of lanes, speed limit, and location of variable message signs (VMS); examples for transit include schedules, routes, and stops. This information will be displayed graphically, allowing agencies and the public to see the physical characteristics of roadway links, which is especially important for incident management.

As a repository for consolidated transportation information from the area's largest traffic and transit operations agencies, archived RITIS data will be valuable for transportation studies and research. This data will be accessible through a web site equipped with online query and reporting tools.

Ideas for MOITS Strategic Plan Projects/Programs

- Continued support and enhancement of RITIS to include serving as an ITS virtual data warehouse for the region, expanding from its role in sharing real-time information for operations purposes

3.2 Multi-Modal Coordination

The Metropolitan Washington Region has experienced rapid population growth and development in recent years and this growth is expected to continue. The demand for passenger travel has grown rapidly. The transportation system impacts almost every element of our lives, including the economy, the environment, our safety and security, and importantly, our overall quality of life. An efficient and seamless multimodal transportation system is needed to effectively meet these critical transportation demands and to efficiently move both passengers and goods. Multimodal coordination between transit agencies can increase traveler convenience at transit transfer points and clusters (a collection of stops, stations, or terminals where transfers can be made conveniently) and also improve operating efficiency.

The Metropolitan Washington Region has extensive transportation system providing the infrastructure for passenger and freight movement by car, truck, bus and bicycle.

Highways
The road network is the foundation of the transportation system in the Washington region. This network consists of freeways, principal arterials, minor arterials, collectors, and local streets, each designed to provide a specific type of service. A large portion of the monies available for the transportation system are used to maintain and utilize this infrastructure as efficiently as possible.

Metrobus/Metrorail
The Washington Metropolitan Area Transit Authority (WMATA) operates the Metrorail and Metrobus service in the region. The Metrorail system radiates out from the downtown core, and Metrobuses feed into the Metrorail stations, creating a comprehensive mass transit network covering more than 1,500 square miles.

The originally planned 103-mile Metrorail with a total of 83 stations, shown in Figure 2-4, was completed in 2001. Metrorail's hundreds of daily heavy-rail trains operate with three- to six-minute intervals between trains during peak periods and with six- to sixteen-minute intervals during off-peak periods.

WMATA operates well over 1,000 Metrobuses with routes in the District of Columbia, Alexandria, and Arlington, Fairfax, Montgomery, and Prince George's counties. Since 1975, the Metrobus system has been transformed from a predominantly radial system serving the District of Columbia to a feeder network serving the Metrorail system. Metrobus also provides regional route service for trips not served by the rail system. Each time a new segment of the rail system has been opened, bus routes in the affected corridor or corridors have been modified either to serve or to turn back at the new stations.

Other Bus Services

In addition to Metrobus service, several jurisdictions have their own local bus service. These include Montgomery County's Ride-On, Alexandria's DASH, Prince George's County's The Bus, Fairfax County's Connector, Loudoun Transit, and the City of Fairfax's CUE systems. In addition, the CommuteRide system operates within Prince William County, Manassas, and Manassas Park. Several private commuter bus companies exist as well.

Commuter Rail

Two commuter rail services operate within and beyond the region's boundaries, Virginia Railway Express (VRE) and Maryland Rail Commuter (MARC). The Virginia Railway Express provides commuter rail service to Union Station in Washington, D.C. on two routes, the Manassas and Fredericksburg lines. VRE runs trains each weekday on lines reaching from Washington Union Station to Manassas and to Fredericksburg, Virginia.

MARC also provides commuter rail service to Union Station. Its service operates three routes, the Brunswick, Camden, and Penn lines. Trains on these three lines provide morning, midday, and evening service weekdays to points in Maryland and West Virginia.

Airports

Three major commercial airports are located in the Washington region. Washington National Airport, located in the central core of the region, serves domestic travel needs, while Washington Dulles International Airport, located in Loudoun County, Virginia, serves both domestic and international routes. Baltimore/Washington International Airport, located in northern Anne Arundel County, Maryland, near the city of Baltimore, is also accessible to many area residents and provides access to domestic and international destinations. In addition to the major commercial airports, the region features a number of general aviation airports to serve non-commercial air activity such as corporate travel. The three major commercial airports also include general aviation facilities

There is a great potential for improving transportation system efficiency through improved connectivity between transportation networks and modes. Multi-Modal Coordination focuses on coordinated and effective use of all transportation assets. It establishes two way communications between multiple transit and traffic agencies to improve service coordination.

It supports transit service coordination between transit properties and coordinates with other surface and air transportation modes. As part of service coordination, it also shares schedule and trip information, as well as transit transfer cluster (a collection of stop points, stations, or terminals where transfers can be made conveniently) and transfer point information between Multimodal Transportation Service Providers, Transit Agencies. Furthermore, it supports center-to-center coordination between the Traffic Management Center and Transit Management Center and monitors transit operations and provides traffic signal priority for transit vehicles on request from the Transit Management Center as well.

Ideas for MOITS Strategic Plan Projects/Programs

- Continued support and enhancement of MATOC as the regional entity to strengthen multi-modal operations coordination
- Collaborative improvements to traffic management center and transit management center software on both an agency basis and a regional basis to strengthen integration and interoperability
- Collaborative improvements to traffic and transit standard operating procedures to strengthen coordination in general and during incidents
- Convene multi-disciplinary planning/engineering/operations teams on specific multi-modal corridors to enhance people and goods movement in those corridors

Figure 4 Multi-Modal Coordination Conceptual diagram from National ITS Architecture [More explanatory information to be added.]

Figure 5 Detail version of Multi-Modal Coordination conceptual diagram from the MWRITSA shows involved systems and stakeholders. [More explanatory information to be added.]

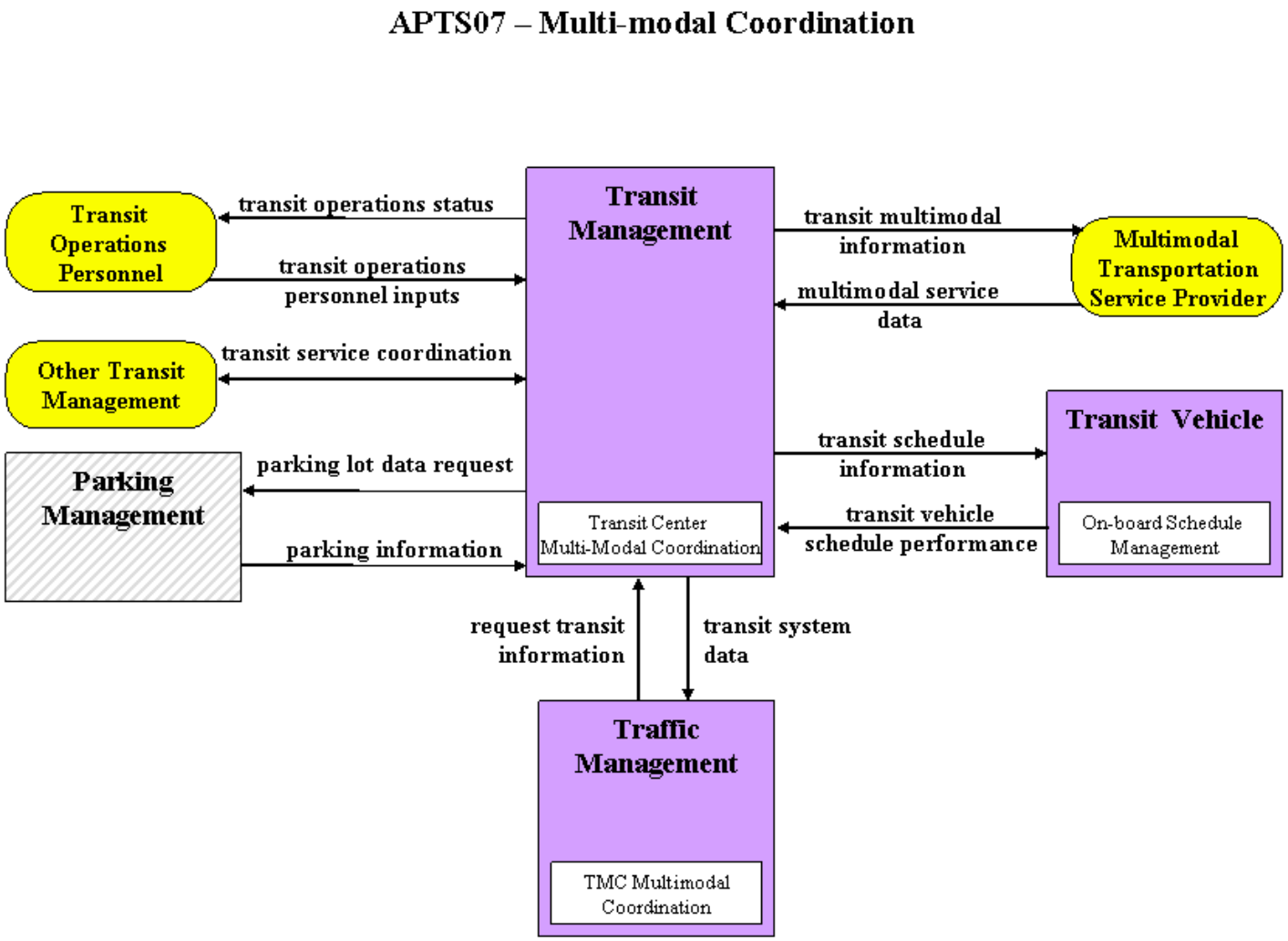
APTS07 – Multi-modal Coordination
Transit Operations Personnel
transit operations status
transit operations personnel inputs
Transit Management
transit multimodal information
multimodal service data
Multimodal Transportation Service Provider
Other Transit Management
transit service coordination
Transit Vehicle
transit schedule information
transit vehicle schedule performance
On-board Schedule Management
Parking Management
parking lot data request
parking information
Transit Center Multi-Modal Coordination
request transit information
transit system data
Traffic Management
TMC Multimodal Coordination

Figure 4

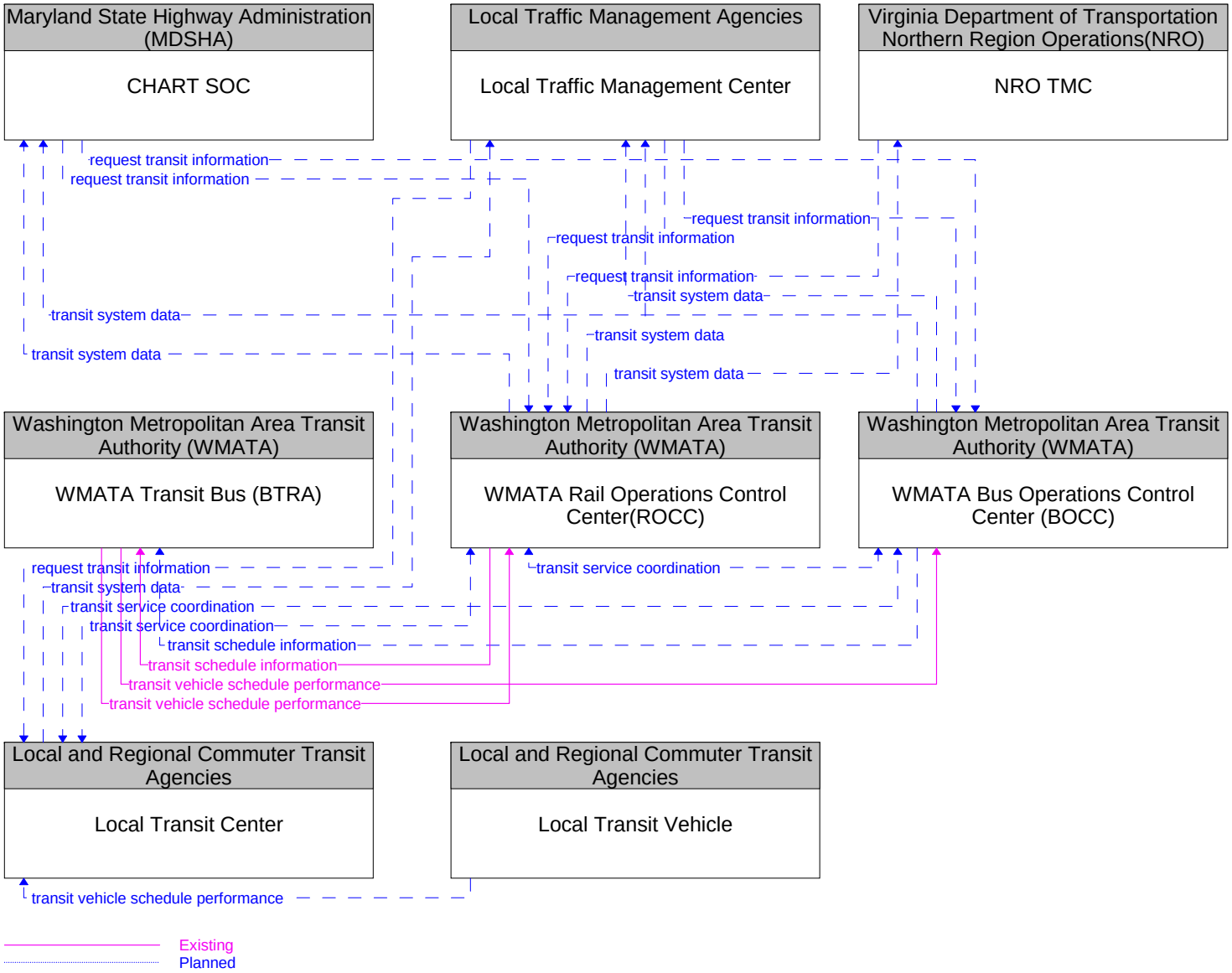
Maryland State Highway Administration (MDSHA)
CHART SOC
Local Traffic Management Agencies
Local Traffic Management Center
Virginia Department of Transportation Northern Region Operations(NRO)
NRO TMC
request transit information
request transit information
request transit information
request transit information
request transit information
transit system data
transit system data
transit system data
transit system data
transit system data
Washington Metropolitan Area Transit Authority (WMATA)
WMATA Transit Bus (BTRA)
Washington Metropolitan Area Transit Authority (WMATA)
WMATA Rail Operations Control Center(ROCC)
Washington Metropolitan Area Transit Authority (WMATA)
WMATA Bus Operations Control Center (BOCC)
request transit information
transit system data
transit service coordination
transit service coordination
transit service coordination
transit schedule information
transit schedule information
transit vehicle schedule performance
transit vehicle schedule performance
Local and Regional Commuter Transit Agencies
Local Transit Center
Local and Regional Commuter Transit Agencies
Local Transit Vehicle
transit vehicle schedule performance
Existing
Planned

Figure 5

3.3 Transit Signal Priority

Transit Bus service plays important role in Metropolitan Washington Region. As more and more traffic jam on the road and sky high gas price, more and more commuters select public transit as their major transportation. It becomes critical for the transit bus to run efficiently. In order to reduce delay at traffic signal, by increasing speed and reducing person delay, and reduce travel time variability, by improving bus on-time performance and reducing bus bunching, it is suggested to enable transit signal priority for buses.

Transit signal priority determines the need for transit priority on routes and at certain intersections and requests transit vehicle priority at these locations. The signal priority may result from limited local coordination between the transit vehicle and the individual intersection for signal priority or may result from coordination between transit management and traffic management centers. Coordination between traffic and transit management is intended to improve on-time performance of the transit system to the extent that this can be accommodated without degrading overall performance of the traffic network.

There are several approaches to archive transit signal priority. They can be categorized into three types: 'Smart Bus', 'Simple Request' and 'Centralized'.

Smart Bus

For Smart Bus, Automatic Vehicle Locating System (AVL) and schedule shall be integrated on the bus. AVL is an advanced method of remote vehicle tracking and monitoring. Each vehicle is equipped with an AVL unit that receives signals from the GPS satellites. The GPS receiver determines its current location, speed and heading. The bus requests priority at local controller, and priority is granted at local controller.

Simple Request

In this type of transit signal priority, the AVL and schedule are not integrated on bus. Local controller contains the schedule. Local controller detects bus and grants priority.

Centralized

Transit Management Center (TRMC) and Traffic Management Center (TMC) are connected. TRMC analyze the transit vehicle schedule performance to determine the need for the priority alone certain routes and at certain intersection. Then TRMC send requests for priority along routes or at intersections to TMC. TMC will make decision to grant priority depend on the current situation.

Ideas for MOITS Strategic Plan Projects/Programs

- Strategic improvements to traffic signal equipment on a agency-specific, as-needed basis to enable or enhance capabilities for transit signal priority
- Install or upgrade transit signal priority equipment on the region's transit buses

Figure 6 Transit Signal Priority Conceptual diagram from National ITS Architecture [More explanatory information to be added.]

Figure 7 Detail version of Transit Signal Priority Conceptual diagram from the MWRITSA shows involved systems and stakeholders [More explanatory information to be added.]

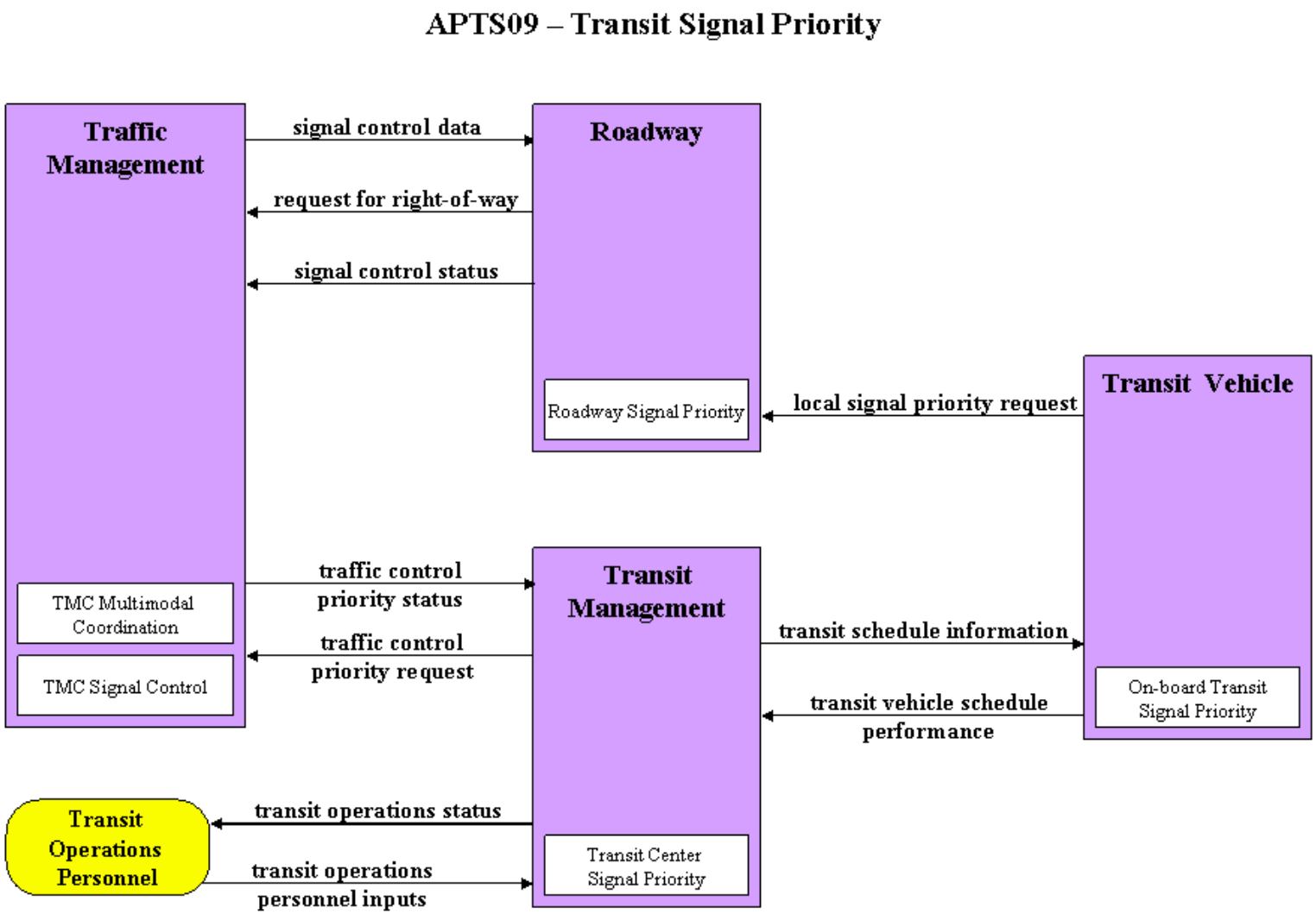
APTS09 – Transit Signal Priority
Traffic Management
TMC Multimodal Coordination
TMC Signal Control
signal control data
request for right-of-way
signal control status
Roadway
Roadway Signal Priority
local signal priority request
Transit Vehicle
On-board Transit Signal Priority
traffic control priority status
traffic control priority request
Transit Management
Transit Center Signal Priority
transit schedule information
transit vehicle schedule performance
Transit Operations Personnel
transit operations status
transit operations personnel inputs

Figure 6

PRELIMINARY

DRAFT

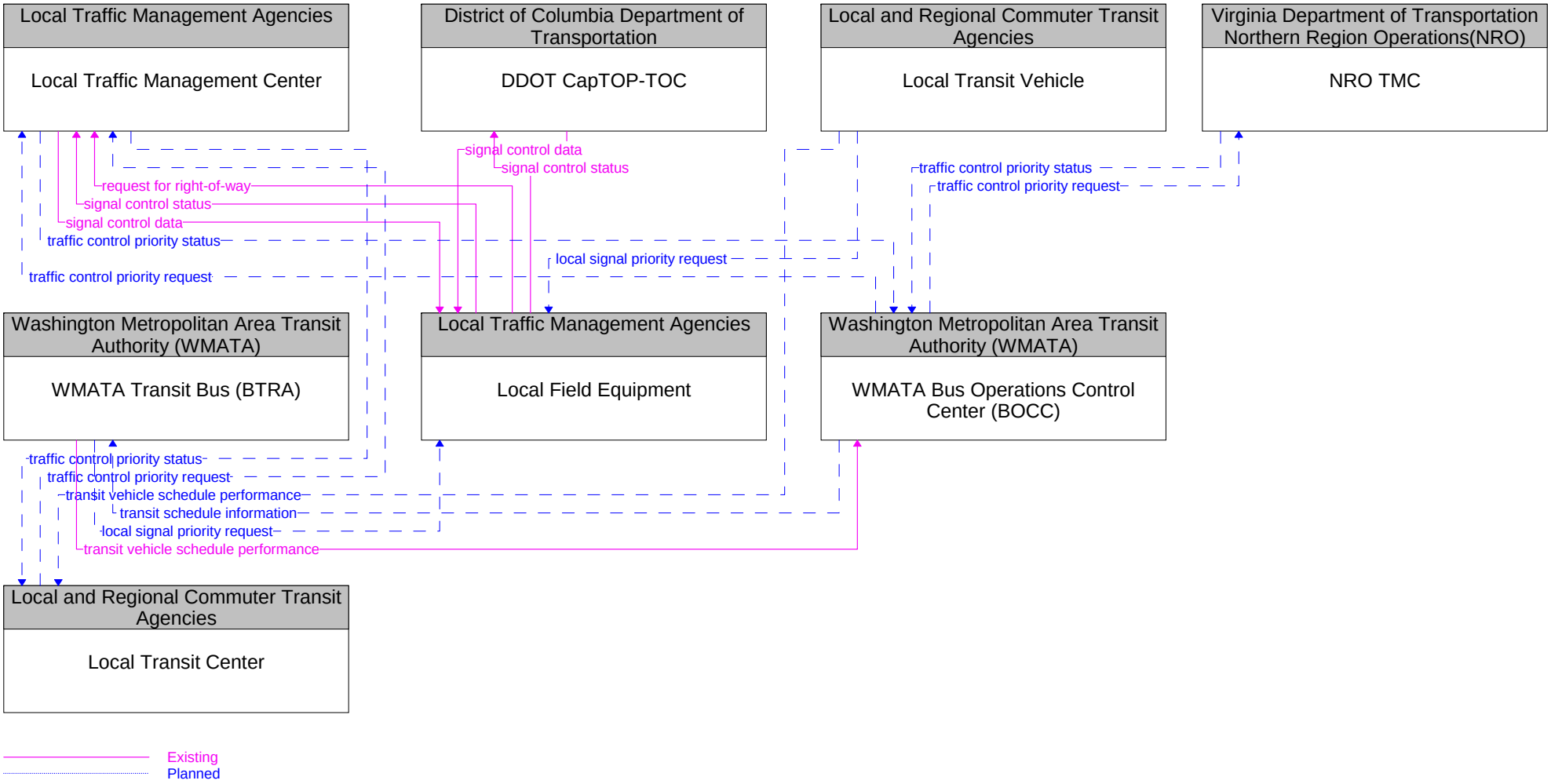

Figure 7

3.4 Interactive Traveler Information

Interactive Traveler Information provides tailored information in response to a traveler request. Both real-time interactive request/response systems and information systems that "push" a tailored stream of information to the traveler based on a submitted profile are supported. The traveler can obtain current information regarding traffic conditions, roadway maintenance and construction, transit services, ride share/ride match, parking management, detours and pricing information. Although the Internet is the predominate network used for traveler information dissemination, a range of two-way wide-area wireless and fixed-point to fixed-point communications systems may be used to support the required data communications between the traveler and Information Service Provider. A variety of interactive devices may be used by the traveler to access information prior to a trip or en route including phone via a 511-like portal and web pages via kiosk, personal digital assistant, personal computer, and a variety of in-vehicle devices. Interactive Traveler Information also allows value-added resellers to collect transportation information that can be aggregated and be available to their personal devices or remote traveler systems to better inform their customers of transportation conditions. Successful deployment of Interactive Traveler Information relies on availability of real-time transportation data from roadway instrumentation, transit, probe vehicles or other means.

511 is well accepted customer-focused, multimodal traveler information service system across the nation. Motorists can receive valuable traffic related information via phones, the internet and other personal communication devices.

In Metropolitan Washington Region, multiple traveler information systems, specifically, 511s are been developed and will be developed. Currently, 511 Virginia is a statewide web and phone service that disseminates traffic and weather information on 96 roads throughout the Commonwealth of Virginia. The service, sponsored by the Virginia Department of Transportation (VDOT), has been in operation statewide since February 2005. The Virginia Tech Transportation Institute (VTTI) has been involved with the development and operation of the service since its inception and currently serves as a data clearinghouse for 511. VTTI collects traffic and travel information from across the state via VDOT, state police sources, and quality controls. They then clean the data in the VTTI operations center, and send that data to designated VDOT contractors who are in charge of disseminating it via phone and web to the traveling public.

As part of the 511 data clearinghouse, VTTI began operating a free subscription email alert system that distributes 511 alerts to the general public. The purpose of this ITS Implementation Center project was to enhance the current email alert system in certain key respects so that it could be offered as a traveler information product to the public. These enhancements included an automated online subscription system, the ability to customize which sections of a particular road were of interest, and the ability to receive alerts formatted for the device that was receiving them.

Maryland State Highway Administration (MD SHA) is under developing Maryland Statewide 511 system. It will make reference to VA 511 and DC 511 while crossing jurisdictions.

MOITS Strategic Plan Projects/Programs

- Establishment of a District of Columbia 511 traveler information system complementary to the established Virginia statewide 511 system and the Maryland statewide 511 system under development
- Collaborative effort to improve integration of DC, Maryland, and Virginia 511 traveler information systems

Figure 8 Interactive Traveler Information Conceptual diagram from National ITS Architecture [More explanatory information to be added.]

Figure 9 Detail version of Interaction Traveler Information Conceptual diagram from MWRITSA shows involved systems and stakeholders [More explanatory information to be added.]

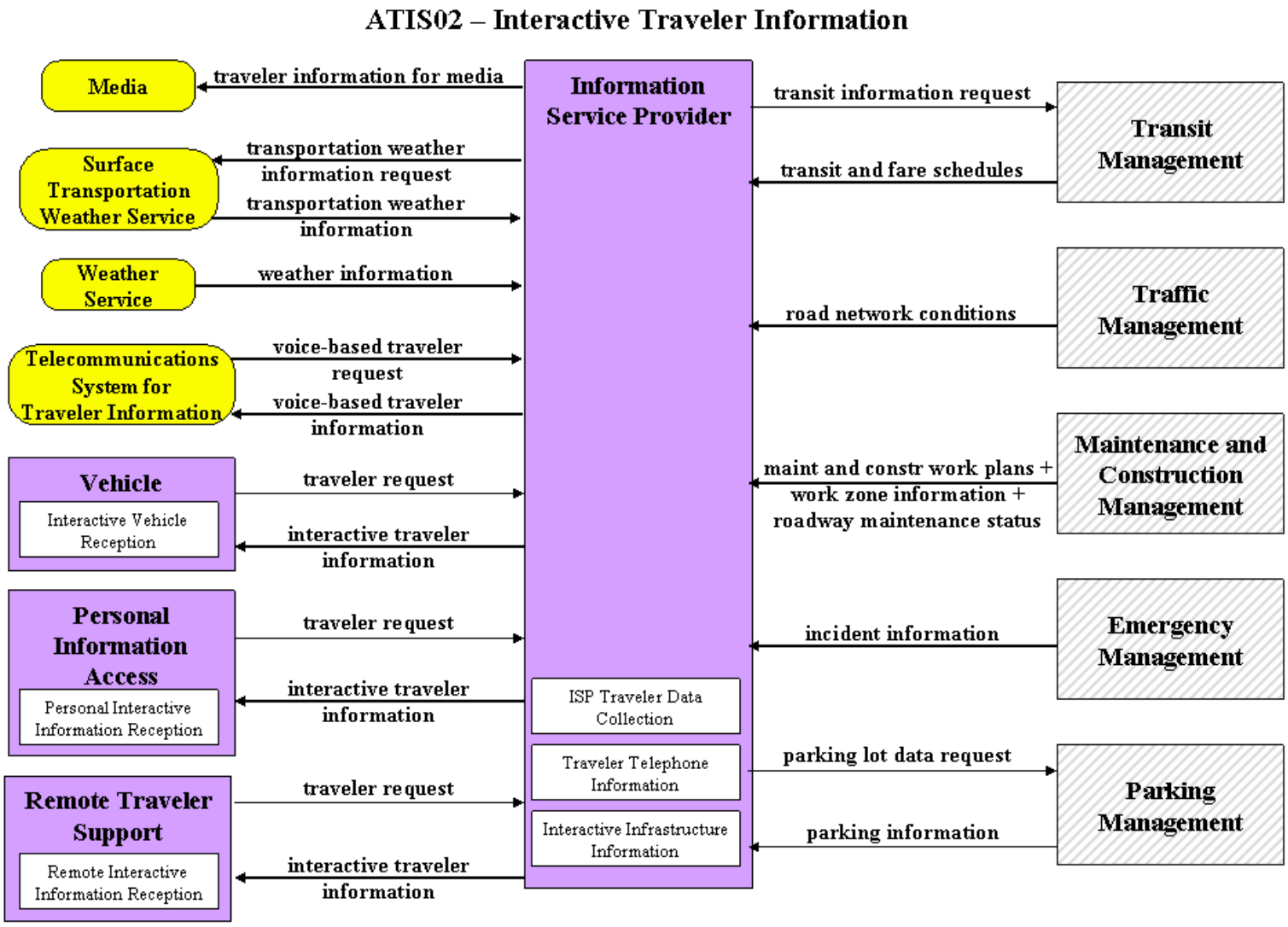
ATIS02 – Interactive Traveler Information
Media
traveler information for media
Surface Transportation Weather Service
transportation weather information request
transportation weather information
Weather Service
weather information
Telecommunications System for Traveler Information
voice-based traveler request
voice-based traveler information
Vehicle
Interactive Vehicle Reception
traveler request
interactive traveler information
Personal Information Access
Personal Interactive Information Reception
traveler request
interactive traveler information
Remote Traveler Support
Remote Interactive Information Reception
traveler request
interactive traveler information
Information Service Provider
ISP Traveler Data Collection
Traveler Telephone Information
Interactive Infrastructure Information
transit information request
transit and fare schedules
Transit Management
road network conditions
Traffic Management
maint and constr work plans + work zone information + roadway maintenance status
Maintenance and Construction Management
incident information
Emergency Management
parking lot data request
parking information
Parking Management

Figure 8

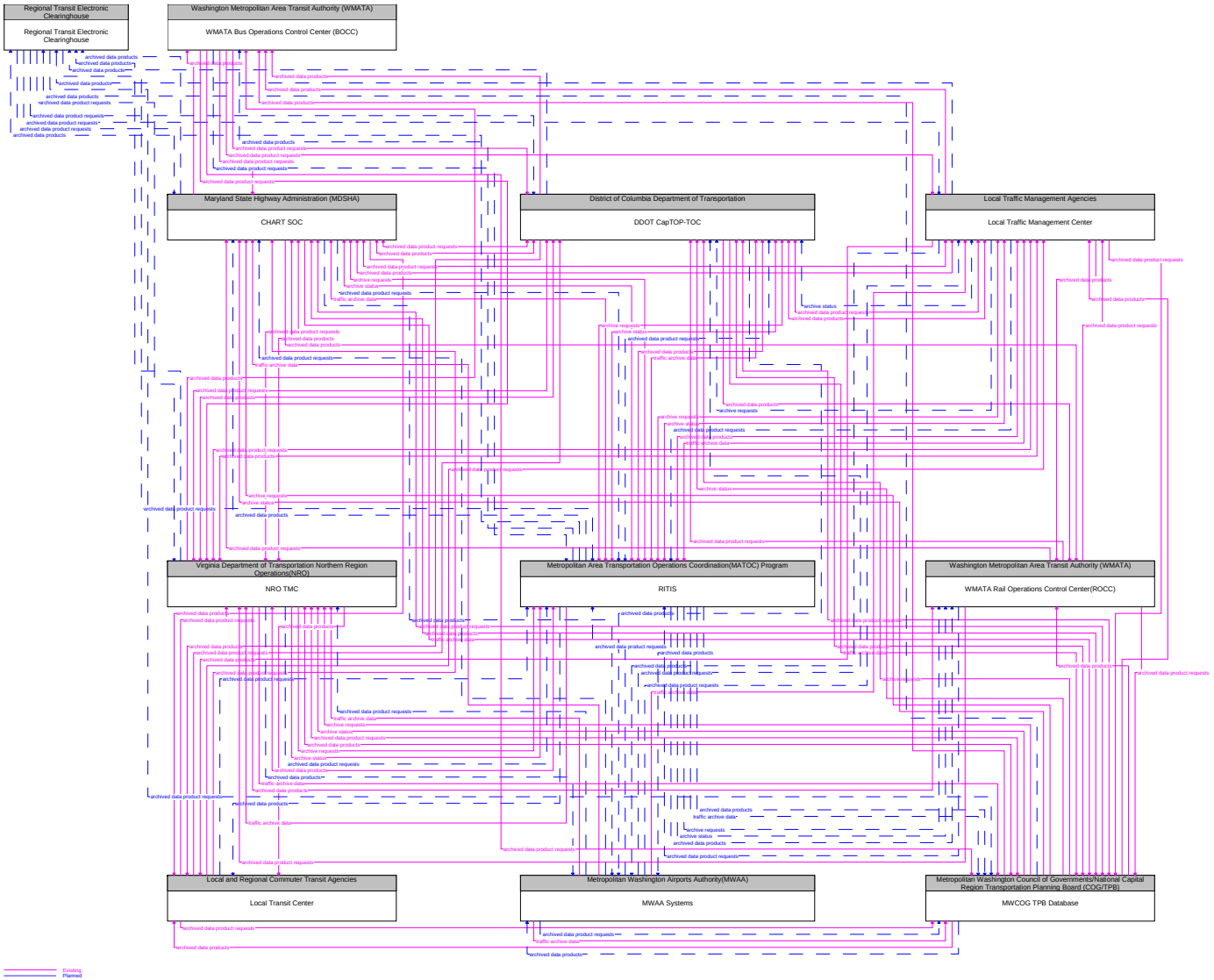
Regional Transit Electronic Clearinghouse
Regional Transit Electronic Clearinghouse
Washington Metropolitan Area Transit Authority (WMATA)
WMATA Bus Operations Control Center (BOCC)
Maryland State Highway Administration (MDSHA)
CHART SOC
District of Columbia Department of Transportation
DDOT CapTOP-TOC
Local Traffic Management Agencies
Local Traffic Management Center
Virginia Department of Transportation Northern Region Operations(NRO)
NRO TMC
Metropolitan Area Transportation Operations Coordination(MATOC) Program
RITIS
Washington Metropolitan Area Transit Authority (WMATA)
WMATA Rail Operations Control Center(ROCC)
Local and Regional Commuter Transit Agencies
Local Transit Center
Metropolitan Washington Airports Authority(MWAA)
MWAA Systems
Metropolitan Washington Council of Governments/National Capital Region Transportation Planning Board (COG/TPB)
MWCOG TPB Database
Existing
Planned

Figure 9

3.5 Transportation Operations Data Sharing

As one of the most congested regions in the nation, the Metropolitan Washington Region suffers the heavy congestion on the road. Currently, several agencies in the region have implemented stand-alone incident and traffic management programs to mitigate the efforts of incidents, management congestion, and improve emergency response. Each agency operates its systems separately, using its own data collection and processing system. However, conditions in one jurisdiction affect travel in others and sometimes throughout the entire region. Disruptions on one part of the network often have significant effects on one or more other jurisdictions on another part of the network. Such regional disturbances require a regional solution.

It is best interest to the region to have a regional transportation operations data sharing system. Such system makes real-time transportation operations data available to each transportation system agency in the region. Specifically, the system will compile transportation data from each participating agency, standardize it, and make it available to other participating agencies through each agency's existing transportation management systems. Using the provided information, each transportation system agency can manage their individual systems based on an overall view of the regional transportation system. Regional Integrated Transportation Information System (RITIS) will fulfill this purpose.

RITIS is a data fusion and dissemination system that will compile transportation data from each participating agency, standardize it, and make it available to other participating agencies through each agency's existing transportation management systems. RITIS will not collect data directly from field devices; rather, participating agencies will collect data from their field devices or enter information into their incident management system and make it available to RITIS. RITIS will also archive data for use in transportation-related studies and performance evaluations.

RITIS will not belong to any single agency. Rather, it will be managed collaboratively by the participating agencies. Concurrent with RITIS development, the Departments of Transportation of Virginia, Maryland, and the District of Columbia, along with the Washington Metropolitan Area Transit Authority and the Metropolitan Washington Council of Governments, are working to establish a coordinated program of transportation incident management, known as the Metropolitan Area Transportation Operations Coordination (MATOC). MATOC will provide coordination in the institutional, operational, systems, and public outreach areas. This consortium will eventually determine the organizational structure of RITIS management, operations, and maintenance.

RITIS has two primary capabilities: the exchange of real-time transportation-related information and the archiving of regional transportation-related data.

The real-time component consists of collecting, filtering, standardizing, and disseminating information for use in incident and emergency management to provide a current, regional view of traffic and transit conditions.

The RITIS system will archive all transportation-related operations data, like incident locations, lane closures, responding agencies, and traffic detector data, which will be available for use in transportation studies and performance evaluations.

MOITS Strategic Plan Projects/Programs

- Continued support and enhancement of RITIS as the region's platform for sharing transportation operations data on a real-time basis
- Continued support and enhancement of agency traffic and transit operations software systems to enable interagency data sharing and support regional operations coordination
- Transition of RITIS from university-based developmental project to a long-term "production" activity supported financially and institutionally

Figure 10 RITIS Architecture

Figure 11 Transportation Operation Data Sharing Conceptual diagram from National ITS Architecture [More explanatory information to be added.]

Figure 12 Detail version of Transportation Operation Data Sharing Conceptual diagram from the MWRITSA shows involved systems and stakeholders [More explanatory information to be added.]

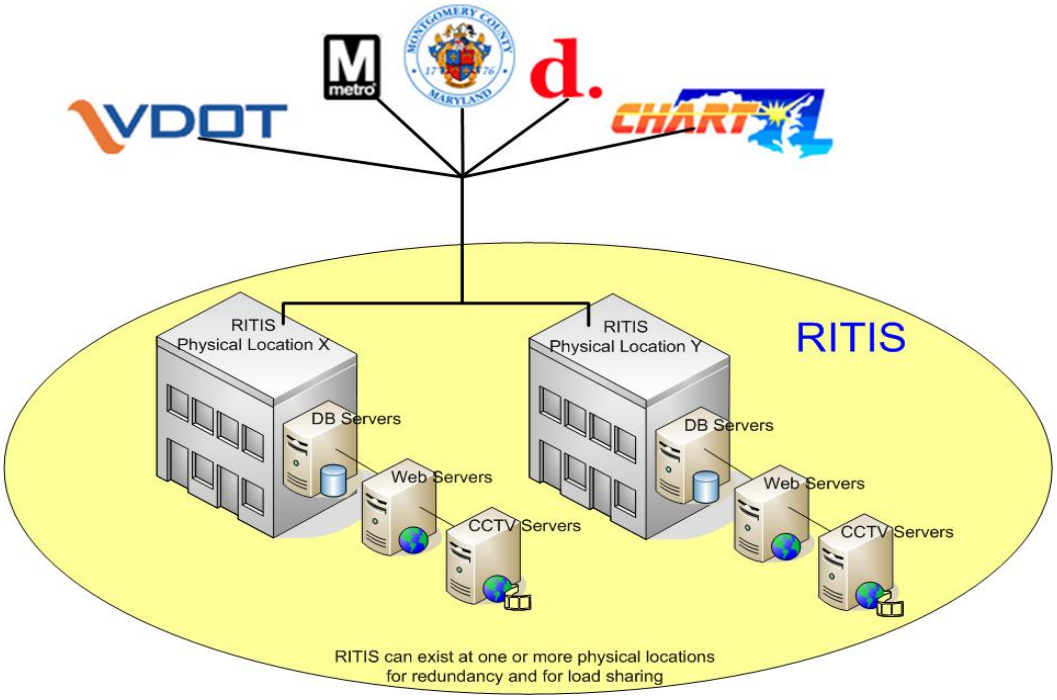

Figure 10 RITIS Concept

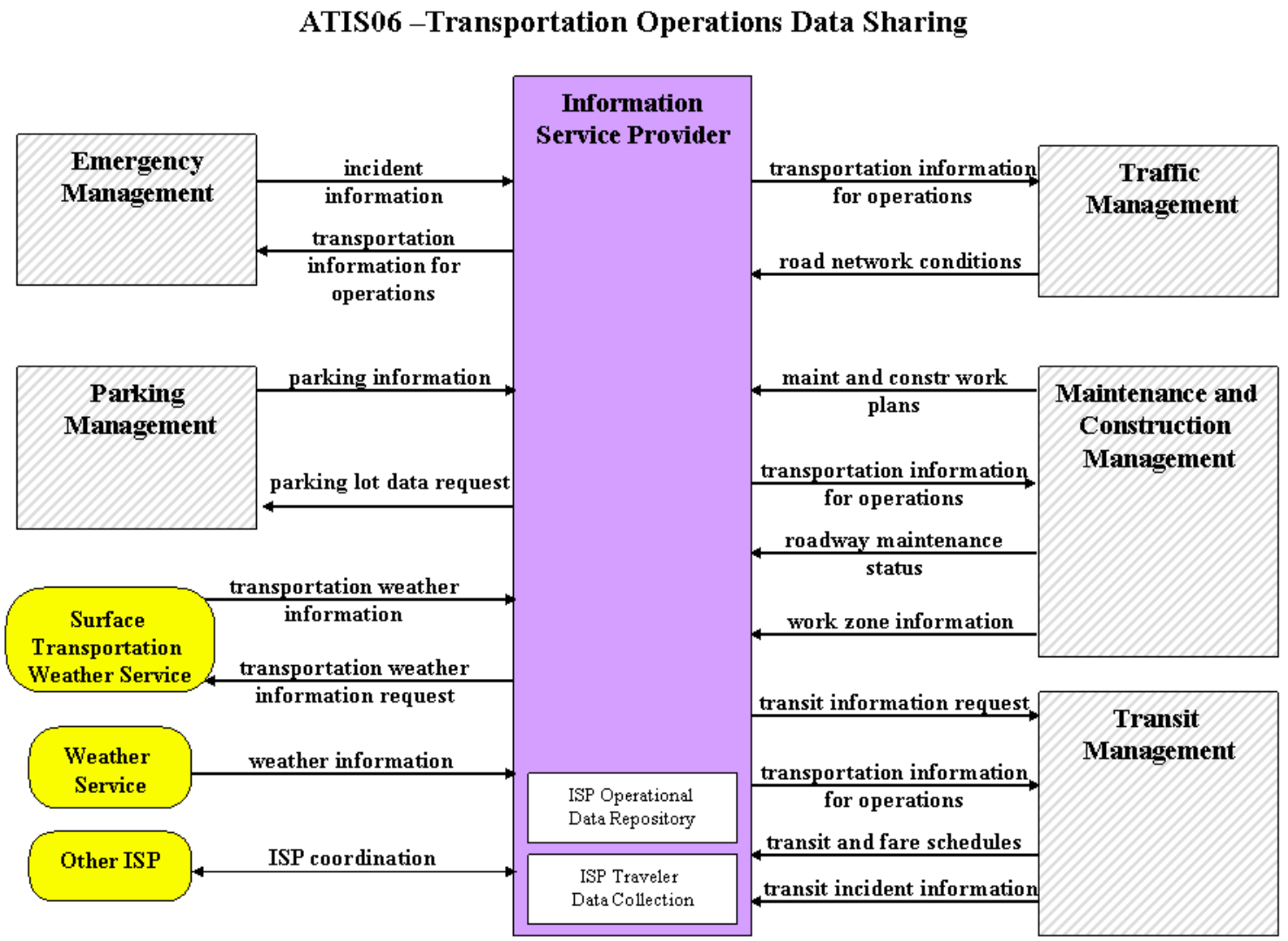
ATIS06 –Transportation Operations Data Sharing
Information Service Provider
Emergency Management
incident information
transportation information for operations
Traffic Management
transportation information for operations
road network conditions
Parking Management
parking information
parking lot data request
Maintenance and Construction Management
maint and constr work plans
transportation information for operations
roadway maintenance status
work zone information
Surface Transportation Weather Service
transportation weather information
transportation weather information request
Weather Service
weather information
Other ISP
ISP coordination
ISP Operational Data Repository
ISP Traveler Data Collection
Transit Management
transit information request
transportation information for operations
transit and fare schedules
transit incident information

Figure 11

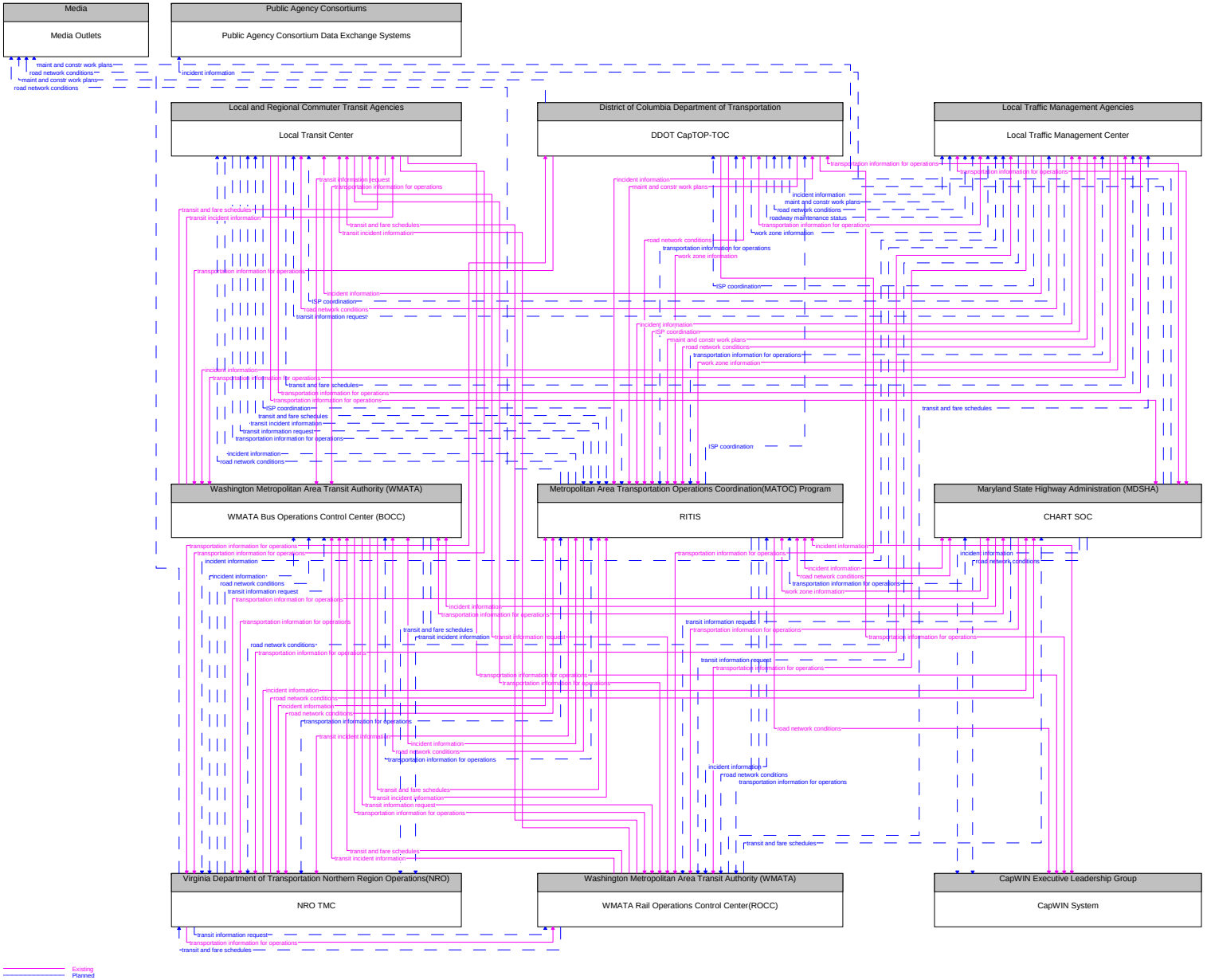
Media
Media Outlets
Public Agency Consortiums
Public Agency Consortium Data Exchange Systems
Local and Regional Commuter Transit Agencies
Local Transit Center
District of Columbia Department of Transportation
DDOT CapTOP-TOC
Local Traffic Management Agencies
Local Traffic Management Center
Washington Metropolitan Area Transit Authority (WMATA)
WMATA Bus Operations Control Center (BOCC)
Metropolitan Area Transportation Operations Coordination(MATOC) Program
RITIS
Maryland State Highway Administration (MDSHA)
CHART SOC
Virginia Department of Transportation Northern Region Operations(NRO)
NRO TMC
Washington Metropolitan Area Transit Authority (WMATA)
WMATA Rail Operations Control Center(ROCC)
CapWIN Executive Leadership Group
CapWIN System
Existing
Planned

Figure 12

3.6 HOV Lane Management

HOV Lane Management manages HOV lanes by coordinating freeway ramp meters and connector signals with HOV lane usage signals. Preferential treatment is given to HOV lanes using special bypasses, reserved lanes, and exclusive rights-of-way that may vary by time of day. Vehicle occupancy detectors may be installed to verify HOV compliance and to notify enforcement agencies of violations.

MOITS Strategic Plan Projects/Program

- Continued support and enhancement of technical systems to enable full, efficient use of HOV lanes by transit buses

3.7 Regional Traffic Management

Congestion is a persistent problem for the Metropolitan Washington region's freeway system, and our region is projected to continue growing in terms of total population and employment. In addition, the region has few opportunities to expand its highway facilities. To help address congestion, it is critical to have better Regional Traffic Management strategies which can maximize safety and traffic flow by dynamically managing and controlling traffic based on the prevailing traffic conditions.

These Regional traffic management strategies may include coordinating signal control in the region and coordination between freeway operations and arterial signal control within a corridor, dynamic re-routing, and traveler information, etc.

There are more than 4000 signalized intersections in the region. On July 31, 2002, the Transportation Planning Board adopted a regional signal optimization TERM, setting the goal of the optimization of approximately 900 additional traffic signals in the region by 2005. The departments of transportation and the participating local jurisdictions agreed to implement their portions of this TERM in addition to maintaining signals already optimized as of June 2002.

Signal optimization is a traffic engineering concept whereby traffic signals (often groups of signals in corridors) are (re-)timed to reduce delay for vehicles on the roadway system while ensuring safety. Engineers use a combination of traffic volume counts, in-car and in-field travel time observations, and computer analysis to determine signal timings given the complex interactions of traffic flows. Traffic signal optimization reduces delay and unnecessary stops at traffic signals. The benefit of traffic signal coordination is based on the relationship between the prevailing speed of vehicles on the main street, the spacing of/distance between traffic signals, the hourly traffic volume on a major street, hourly traffic volumes on the side streets, and number of non-signalized intersections along the roadway system.

There are two types of Coordination in Metropolitan Washington Region

- Coordinating potential ramp meters at interchanges with signal systems on arterial roadways crossing or parallel to the metered interchanges.
- Coordinating traffic signals along arterial roadways that cross jurisdictional boundaries.

Dynamic rerouting allows traffic flow operators to develop and provide detours, route restrictions, and other routing information based on current traffic, incident, emergency, and roadway conditions. This process may also request the initiation of control functions on the transportation network, including freeway, arterial, and other roadways as needed. Dynamic Message Sign (DMS) can be used to provide en route information on queues, major incidents and appropriate routes. Also, personal device such as personal computer, PDA, can also be able to receive such information.

MOITS Strategic Plan Projects/Programs

- Establishment of an ongoing regional interagency program for the optimization of traffic signal timing
- Collaborative development of multi-agency traffic and transportation management plans

Figure 13 Regional Traffic Management Conceptual diagram from National ITS Architecture [More explanatory information to be added.]

Figure 14 Detail version of Regional Traffic Management Conceptual diagram from the MWRITSA shows involved systems and stakeholders [More explanatory information to be added.]

ATMS07 – Regional Traffic Management

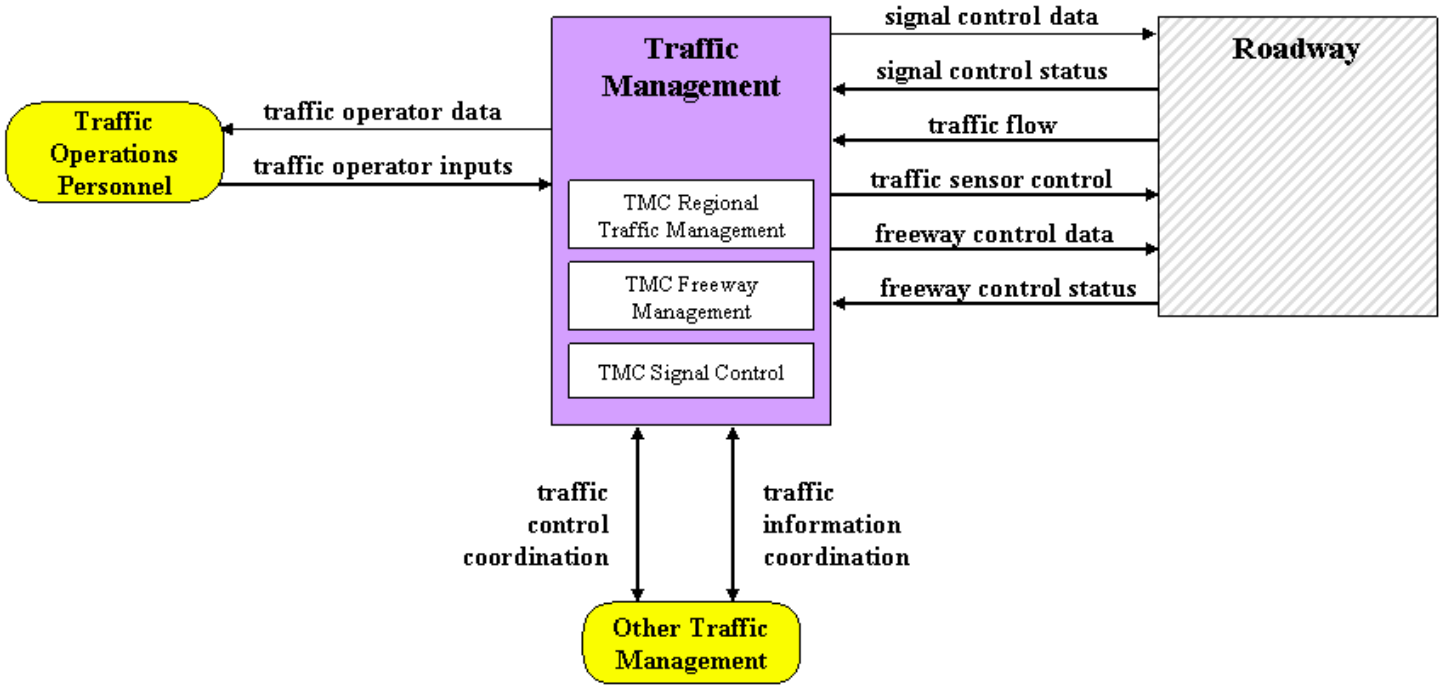

Figure 13

PRELIMINARY

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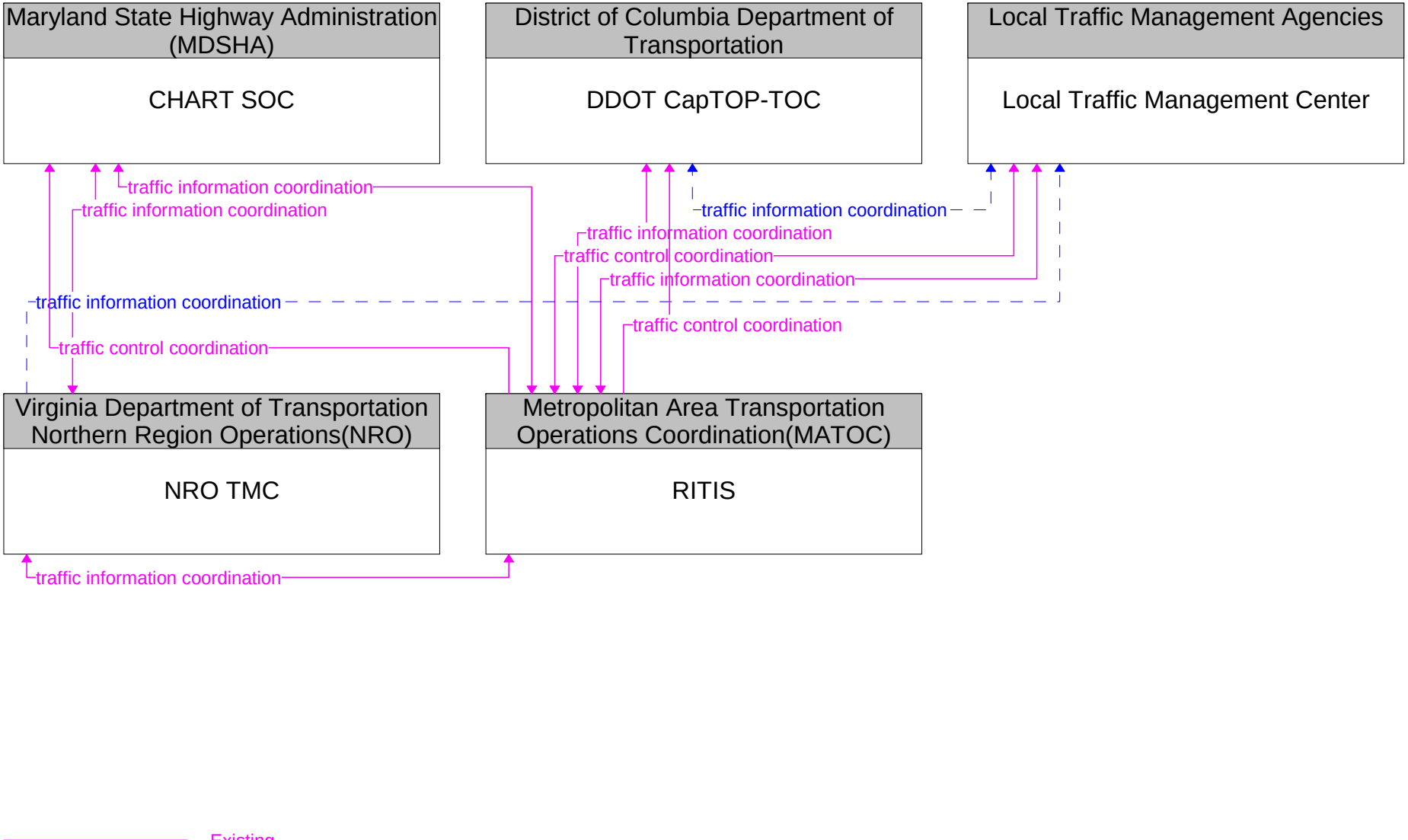

Figure 14

3.8 Regional Parking Management

Regional Parking Management (RPM) supports communication and coordination between equipped parking facilities and also supports regional coordination between parking facilities and traffic and transit management systems. RPM also shares information with transit management systems and information service providers to support multimodal travel planning, including parking reservations capabilities. Information including current parking availability, system status, and operating strategies are shared to enable local parking facility management that supports regional transportation strategies.
RPM first maintain and distribute static information about individual parking lots. This information includes hours of operation, rates, lot location, lot entrance locations, lot capacity (number of spaces), lot type (Open Lot, Covered Garage, Permit Parking, Contract Parking, Free Parking - include P+R lot, Paid Parking, other), lot constraints (heights, type of vehicles, etc.), and handicap accessibility features. RPM then continuously communicates and exchanges data with parking operators and systems. The exchange of data shall be triggered by either a request from a remote Parking Management facility for data from the operators or systems to which the Provide Electronic Payment function belongs, or because data needs to be sent from the local Parking Management facility to another remote Parking Management facility. This data shall include both static and dynamic parking lot data. RPM determines and distributes the dynamic status of individual parking lots. This dynamic status includes the current state of the lot (Open, Closed, Near Capacity) and number of available spaces. The process shall also calculate from sensor information the arrival rate (or number of arrivals in a given time period) as well as the departure rate (or the number of departures in a given time period). Last, the present parking information will deliver to drivers via information devices such as dynamic message signs that are located in and managed by parking facilities. The information presented shall include parking facility status, parking availability, locations of available spaces, current parking rates, and guidance to entrances and exits.

MOITS Strategic Plan Projects/Programs

- Establishment of a prototype or regional project to collect, share, and distribute information on real-time parking availability, especially at major transit stations, park-and-ride lots, and commercial centers.

Figure 15 Regional Parking Management Conceptual diagram from National ITS Architecture [More explanatory information to be added.]

Figure 16 Detail version of 15 Regional Parking Management Conceptual diagram from MWRITSA shows involved systems and stakeholders
[More explanatory information to be added.]

ATMS17 – Regional Parking Management

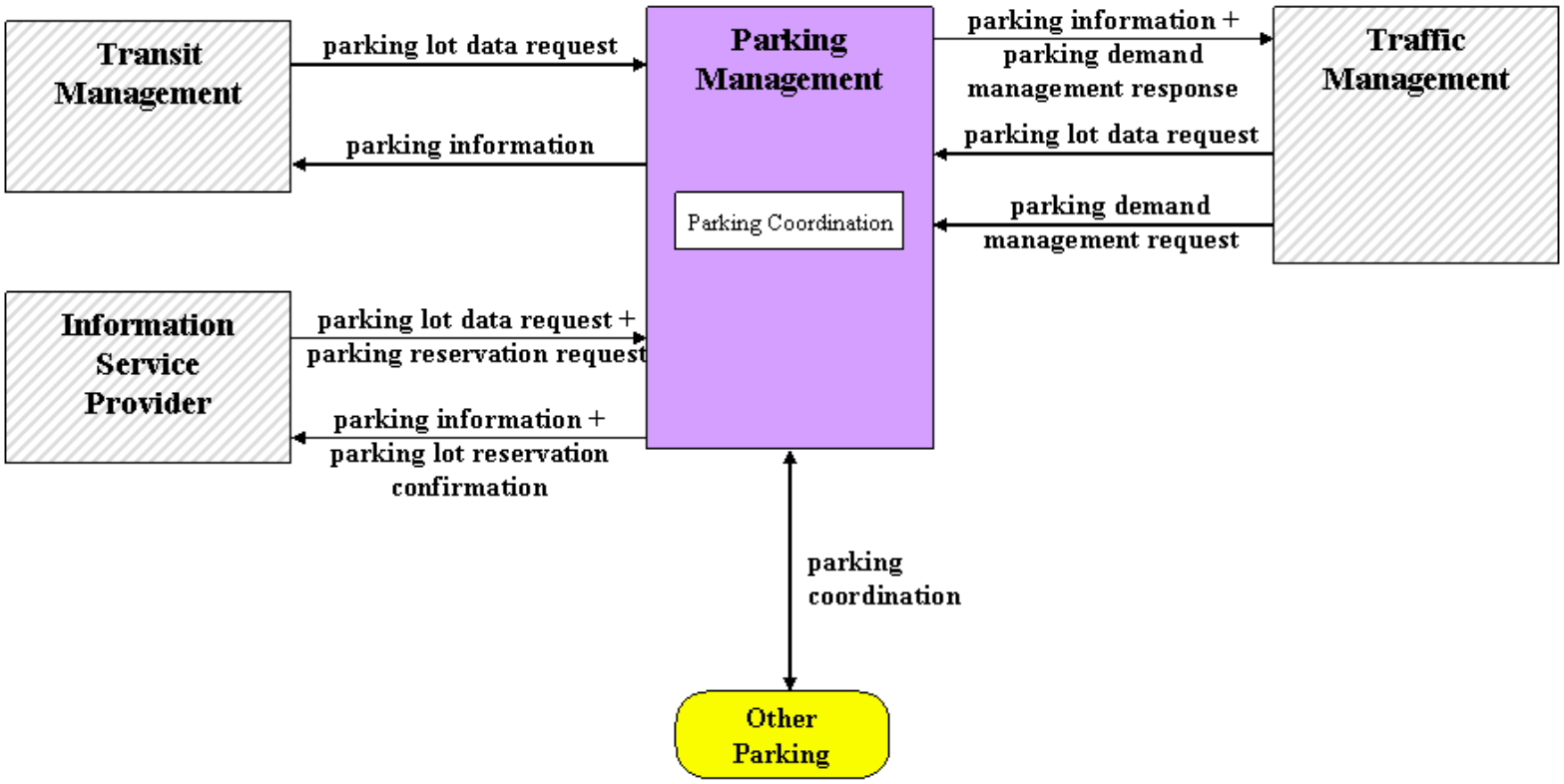

Figure 15

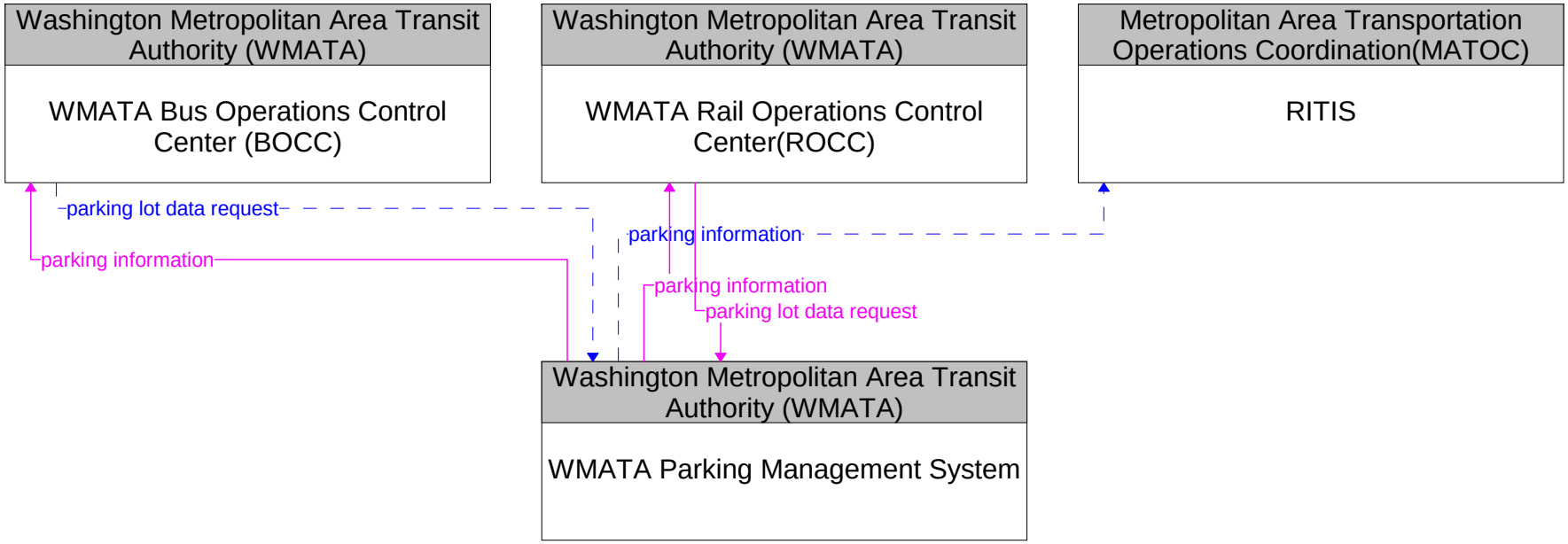

Figure 16

3.9 Maintenance and Construction (MC) Activity Coordination

Maintenance and Construction (MCM) Activity Coordination is easy overlook. As matter of fact, MCM information is very important for the traveler to choose route to commute and a better maintenance and construction activities coordination will eventually improve the safety and efficiency of the traffic in the region.

Maintenance and Construction (MCM) Activity Coordination disseminates work activity schedules and current asset restrictions to other agencies. Work schedules are coordinated with operating agencies, factoring in the needs and activities of other agencies and adjacent jurisdictions. Work schedules are also distributed to Information Service Providers for dissemination to the traveling public.

MOITS Strategic Plan Projects/Programs

- Establishment of a regional computer-based process to share information on maintenance and construction activity, and to facilitate interagency collaboration of the scheduling of such activities to aid traffic and transit management.

Figure 17 MC Activity Coordination Conceptual diagram from National ITS Architecture
[More explanatory information to be added.]

Figure 18 Detail version of MC Activity Coordination Conceptual diagram from MWRITSA shows involved systems and stakeholders
[More explanatory information to be added.]

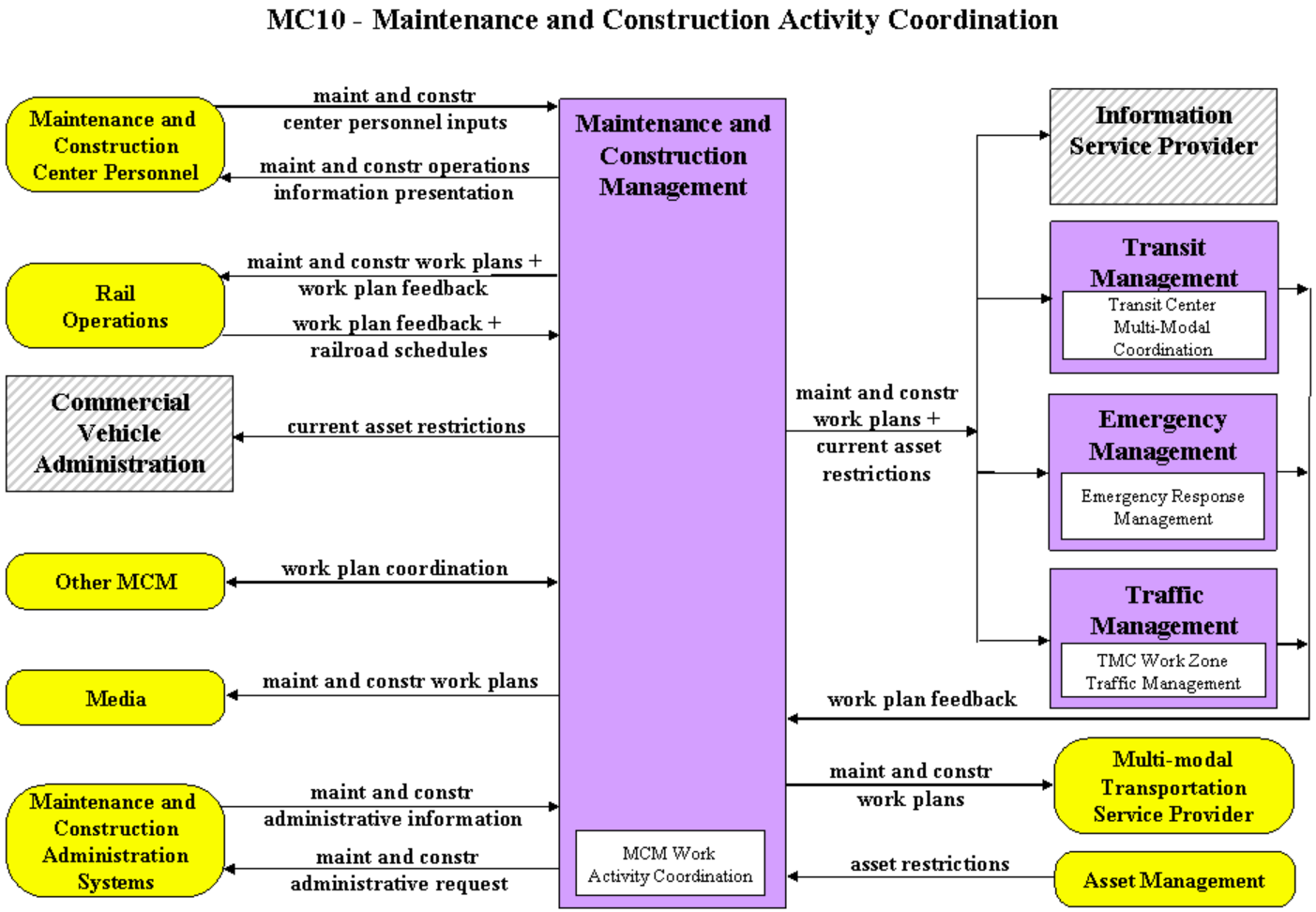
MC10 - Maintenance and Construction Activity Coordination
Maintenance and Construction Center Personnel
maint and constr center personnel inputs
maint and constr operations information presentation
Rail Operations
maint and constr work plans + work plan feedback
work plan feedback + railroad schedules
Commercial Vehicle Administration
current asset restrictions
Other MCM
work plan coordination
Media
maint and constr work plans
Maintenance and Construction Administration Systems
maint and constr administrative information
maint and constr administrative request
Maintenance and Construction Management
MCM Work Activity Coordination
maint and constr work plans + current asset restrictions
work plan feedback
maint and constr work plans
asset restrictions
Information Service Provider
Transit Management
Transit Center Multi-Modal Coordination
Emergency Management
Emergency Response Management
Traffic Management
TMC Work Zone Traffic Management
Multi-modal Transportation Service Provider
Asset Management

Figure 17

PRELIMINARY

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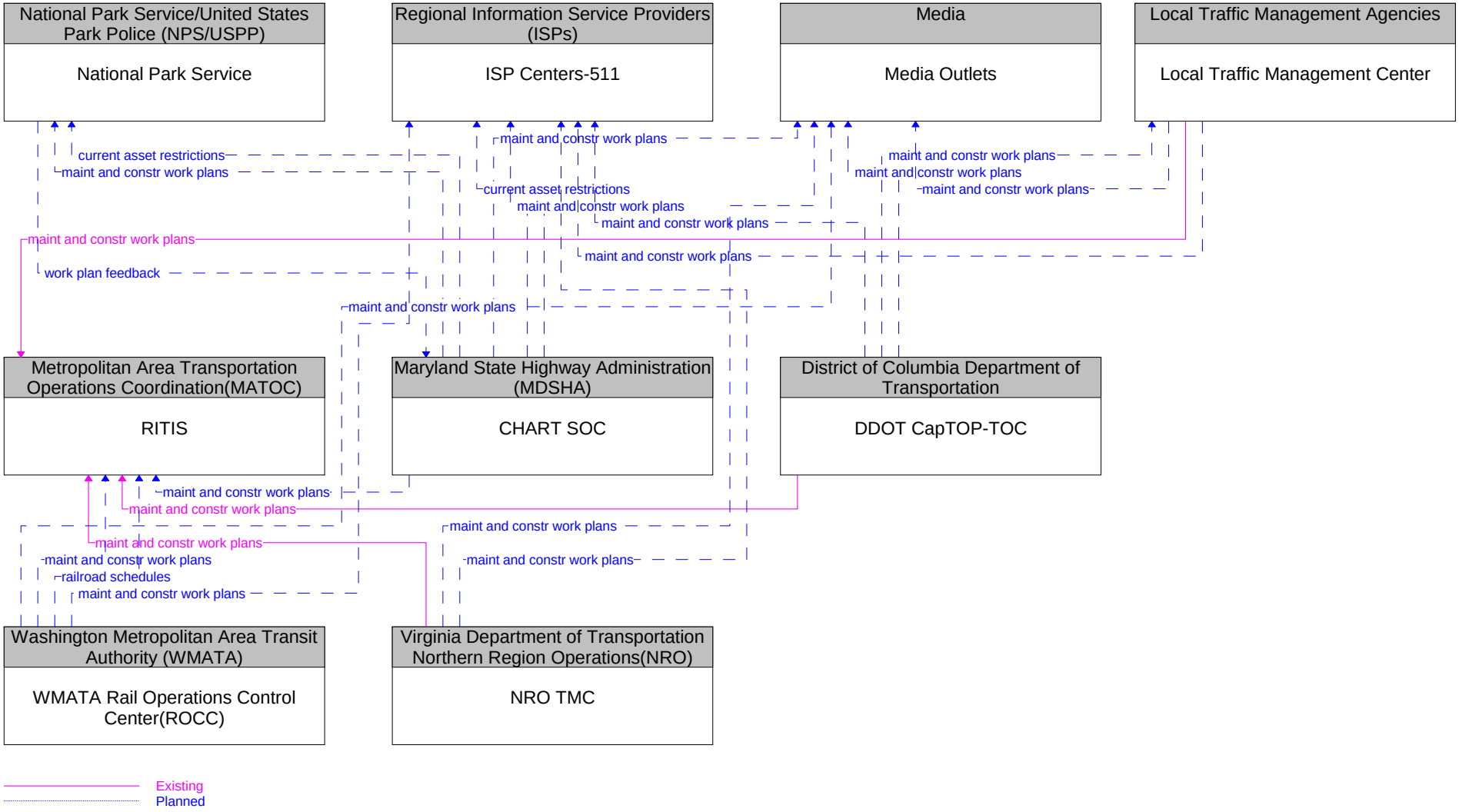

Figure 18

4. Overall Findings and Recommendations

To be written.