
Telecommunications and Information Technology Planning

The telecommunications and information technology planning function represents the highest-level system or network perspective of the Institute. This work can be characterized generally as planning and analyzing existing, new, and proposed telecommunications and information technology systems, especially networks, for the purpose of improving efficiency and enhancing the technical performance and reliability of those systems. In many cases, ITS performs this work for both wireline and wireless applications. This portion of the ITS technical program encompasses work that is frequently referred to in industry as “systems engineering.”

All phases of strategic and tactical planning are conducted under this work area; problem solving and actual implementation engineering also are done. ITS engineers identify or derive users' functional

requirements and translate them into technical specifications. Telecommunication system designs, network services, and access technologies are analyzed, as well as information technologies (including Internet and Internet-related schemes). Associated issues, such as network management and control and network protection and privacy, also are addressed. Integration of individual services and technologies is a common task in many projects, along with the application of new and emerging technologies to existing applications.

Following is a summary of significant activities that occurred in the area of telecommunications and information technology planning during FY 2005. By far, telecommunications interoperability was the largest program area.

Areas of Emphasis

Interoperability Efforts for Justice/Public Safety/Homeland Security

The Institute conducts a broad-based technical program aimed at facilitating effective telecommunications interoperability and information-sharing among dissimilar wireless and information technology systems within the justice/public safety/homeland security community. ITS activities are sponsored by a number of Federal agencies and programs, and are planned and performed only after close coordination with local, State, tribal, and Federal practitioners. Technical thrusts within the program, which are described in separate sections on the following pages, include:

Engineering Support and Coordination

Information Technology Interoperability Standardization and Quality

Wireless Telecommunications Interoperability Standardization

Emergency Telecommunications Service (ETS)

The Institute develops and verifies ETS Recommendations for International Telecommunication Union - Telecommunication Sector (ITU-T) Study Group 9. A second project provides ETS expertise relating to ANSI-accredited Performance, Reliability, and Quality of Service Committee, PRQC (formerly T1A1). These projects are funded by the National Communications System (NCS).

Engineering Support and Coordination for Justice/Public Safety/Homeland Security

Outputs

- Interoperability and performance evaluations of Project 25 equipment.
- Automated suite of Project 25 Radio Performance Measurements.

ITS is conducting a technical program aimed at facilitating effective interoperability and information sharing among dissimilar wireless telecommunications and information systems within the justice/public safety/homeland security community. The primary focal points of the program are: (1) Standards support, (2) Test and Evaluation (T&E), (3) Research and Development (R&D) support, and (4) Technical Coordination among local, State, tribal, and Federal departments and programs associated with interoperability activities. All efforts described here are complementary to the ITS technical programs focused on wireless telecommunications interoperability standardization and information technology interoperability standardization. The ITS program is sponsored by a number of different Federal departments and programs that have a keen interest in public safety interoperability, including: National Institute of Standards and Technology (NIST) Office of Law Enforcement Standards (OLES), Department of Justice Office of Community Oriented Policing Services (COPS), Department of Homeland Security's (DHS) Public Safety Wireless Communications (SAFECOM) Program, and the Federal Partnership for Interoperability Communications (FPIC).

Standards Support

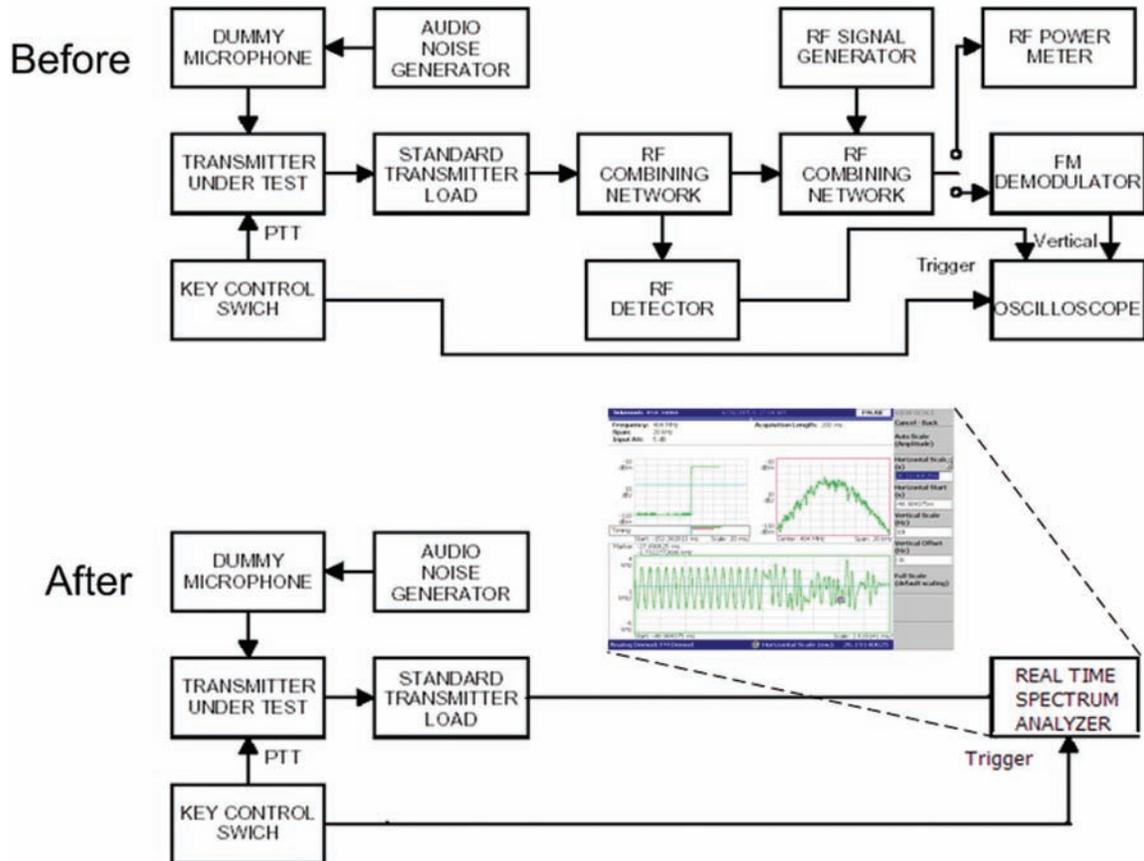
Through research conducted in its Interoperability Research Laboratory (IRL), ITS has made significant contributions to standards development organizations supporting justice, public safety, and homeland security goals. Following up on last year's performance and interoperability tests which demonstrated multiple failures among a considerable sample of Project 25 (P25) subscriber units, the Project 25 Steering Committee in April 2005 formally requested that NIST/OLES work in conjunction with ITS to establish a P25 Compliance Assessment Program. Accordingly, ITS engineers have taken a lead role in describing the framework and defining

the critical elements of such a program and are presently assisting the Steering Committee and appropriate Telecommunications Industry Association (TIA) TR-8 subcommittees in the establishment of the program and the development of the functional test procedures which underpin it. These test procedures include evaluations of performance, interoperability, and conformance for each system interface. This year ITS focused on evaluating and proofing the performance measurement procedures defined in TIA-102.CAAA and has recommended dozens of editorial comments and procedural enhancements for that document. For example, as shown in the figure, an instrument with multi-domain views can replace six separate test devices, greatly simplifying the test procedures. In addition, ITS engineers are actively involved in completing and publishing an interoperability test procedure for P25 trunked radio systems. In the coming year, work on encryption tests and common air interface conformance tests will commence.

In addition, ITS engineers made considerable progress toward developing and documenting a repeatable Delivered Audio Quality (DAQ) test measurement. An automated test routine was developed and the functionality of the program proven. Test subjects containing recently standardized enhanced vocoders are expected next year. The DAQ definition project will provide clear and concise instructions on how to perform objective audio quality measurements. The published results will be backed by a publicly available, exhaustive compendium of thousands of audio recordings of impaired RF channels which will enable third parties to investigate possible means of automating such measurements.

Test and Evaluation

The IRL has been equipped to support a broad variety of testing requirements, especially public safety applications. Demonstration type testing continued this year with greater attention being paid to the measurement methods and procedures for testing the electrical performance of P25 radios. ITS engineers reviewed the suite of tests identified in the TIA-102.CAAA test document and selected a number of viable procedures which would provide a useful characterization of the performance of various subscriber units. Ultimately 18 receiver and transmitter



Test procedure for P25 subscriber units. An instrument with multi-domain views can replace six separate test devices, greatly simplifying the test procedure.

test procedures were selected, mocked-up, and documented.

R&D Support

At the request of several Federal Departments and Programs, ITS worked alongside practitioners from the justice/public safety/homeland security community to technically evaluate grant proposals. By acting as the Government’s common “technical thread,” ITS engineers helped ensure that R&D proposals from industry and telecommunications integration proposals from local, State, and tribal government agencies were feasible and consistent with long-term interoperability strategies. Evaluations were conducted on behalf of SAFECOM’s Request for Information on Rapidly Deployable Interoperability Solutions, the COPS Program, and DHS’s Emergency Preparedness and Response Directorate.

On behalf of NIST/OLES, in support of the Project 25 Compliance Assessment Program, ITS engineers

have embarked on a program to develop and deploy an automated suite of performance measurements to test P25 subscriber units. The software suite which automates 18 typical receiver and transmitter measurements will be made available to manufacturers and third-party independent laboratories involved in the compliance assessment process.

Other Support

In addition to the established areas of activity mentioned above, ITS frequently responds to the immediate needs of its sponsors by performing a variety of other research and applied engineering activities. These activities may include strategic and tactical planning, system engineering, technical analysis, and economic benefit studies.

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Information Technology Interoperability Standardization and Quality for Justice/Public Safety/Homeland Security

Outputs

- XML Data Model and Data Dictionary.
- Audio quality testing.

ITS is conducting a technical program aimed at facilitating effective interoperability and information sharing among dissimilar information systems within the justice/public safety/homeland security community, and ensuring that there are standardized procedures to measure the quality of speech delivered through public safety's communications systems.

The primary focal points of the information technology (IT) interoperability portion of the program are: (1) the identification and delineation of applicable information sharing architectures, (2) coordination between major Federal players and local and state public safety practitioners to collegially develop a nationwide strategic plan for information sharing, and (3) the identification and/or development of standards that address the community's requirements

and are in conjunction with the strategic plan. All efforts are aimed at allowing local, State, and Federal agencies to exchange information, without requiring substantial changes to internal systems or procedures.

The focal point of the audio quality portion of the program is to provide a facility that can emulate, in a controlled laboratory environment, the field conditions experienced by public safety practitioners.

The ITS program is sponsored by a number of different Federal departments and programs that have a keen interest in public safety interoperability, including: National Institute of Standards and Technology (NIST) Office of Law Enforcement Standards (OLES), Department of Homeland Security's Public Safety Wireless Communications (SAFECOM) Program, Department of Homeland Security Chief Information Officer's Wireless Management Office (WMO), Department of Justice Office of Community Oriented Policing Service (COPS), National Institute of Justice (NIJ) CommTech Program (formerly AGILE Program), and NTIA.



A Method for Building Your Schemas

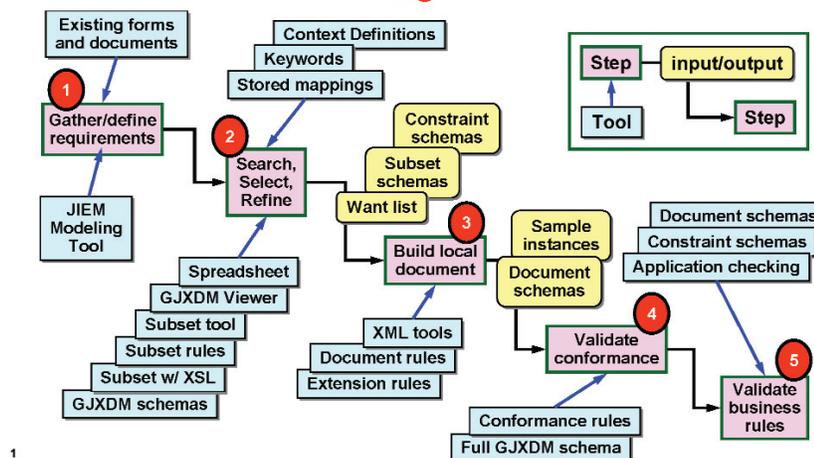


Figure 1. Structured process for GJXDM Exchange Document Development.

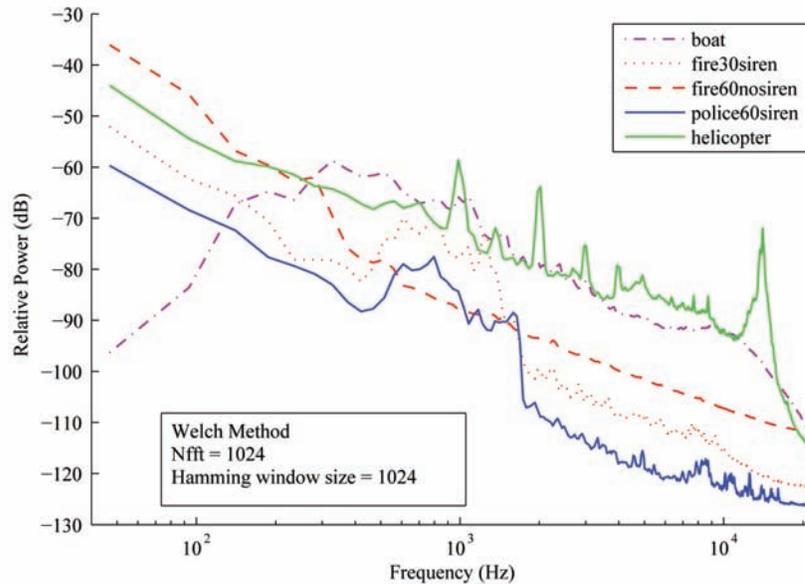


Figure 2. Noise spectra of public safety operating environments.

XML Data Model and Data Element Dictionary Development

In prior years, ITS played a significant role in providing technical assistance and coordination in the initial development of an Extensible Markup Language (XML) Data Element Dictionary that can provide common “words” for a common “language” to be used by the justice/public safety/homeland security community. The public release of the Global Justice XML Data Model (GJXDM), the data dictionary along with an associated data model, was in 2004.

While the release of the GJXDM was a significant step forward in achieving information sharing interoperability among members of the justice and public safety community, it is a very complex model. Thus, FY 2005 efforts primarily focused on training and education related to the data model. This includes guidance for structured development of documents to be exchanged, and messages to be passed, shown in Figure 1 on the previous page. Users and developers use the “words” of the Data Dictionary to build documents that represent a particular information exchange. The current released version of the GJXDM is available to the public at <http://it.ojp.gov/gjxdm/>.

The next phase of development for the XML data model was identified in 2005: the National Information Exchange Model (NIEM). The NIEM uses the foundation of the GJXDM to extend the

architecture of the data model to the broader context of Justice and Homeland Security. The first public version of the NIEM is expected in 2006.

Audio Quality Testing for Public Safety

There are several reasons for developing high-quality acoustic coupling capabilities to provide speech stimulus to public safety communications devices. One is that the electrical interfaces are non-standard and highly specific to each manufacturer and/or device model. Another is that acoustic coupling provides a means to perform calibrated laboratory emulation of the acoustic environment experienced in the field.

One of the most severe challenges that public safety practitioners face is the extreme nature of the environment in which they must operate. Of particular impact to speech quality is the variety and volume of noise environments. Public safety equipment operates at high noise levels with disparate noise spectra even before the inclusion of application specific features such as sirens (see Figure 2 above). These make for very challenging communication scenarios.

The first subjective test to evaluate public safety practitioner opinion of quality in the presence of real public safety background noise was conducted in 2005. The test was specifically requested by the Project 25 Steering Committee for the purpose of evaluating enhancements in vocoder technology since the initial adoption of a Project 25 standard vocoder in 1998. The test results showed that there had been significant improvements in quality that would not impact interoperability, and based on that information, the Project 25 Steering Committee immediately moved to adopt the newer, higher-quality, version of the vocoder.

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Wireless Telecommunications Interoperability Standardization for Justice/Public Safety/Homeland Security

Outputs

- Wireless telecommunications Statement of Requirements (SOR) for Public Safety.
- Functional and performance specifications for Project 25/TIA digital radio & system standards.
- Standardized measurement methods for testing Project 25 radios and systems.

Too often, public safety practitioners' communications systems do not meet their needs for *operability* (security, service area, performance, and survivability for intra-agency communications) and *interoperability* (inter-discipline and inter-jurisdiction communications where and when communications are needed). The public safety community recognizes that five steps are needed to specify and implement wireless systems: (1) define *user requirements* for communications and information exchange, (2) specify the *architecture framework* to support the communications, (3) develop *standards* for the systems, (4) conduct *technology performance tests* to evaluate proposed solutions for the standards, and (5) conduct *vendor products functional tests* to validate that tested equipment supports the standards prior to implementation. ITS is the common technical thread through all these steps and it conducting a technical program aimed at facilitating effective interoperability and information sharing among dissimilar wireless telecommunications systems in the justice/public safety/homeland security community.

The ITS program is sponsored by several Federal departments and programs with a keen interest in public safety interoperability, including: National Institute of Standards and Technology (NIST) Office of Law Enforcement Standards (OLEs), Department of Justice Office of Community Oriented Policing Services (COPS), Department of Homeland Security's Public Safety Wireless Communications (SAFECOM) Program, Federal Partnership for Interoperable Communications (FPIC), and the Department of Homeland Security Chief Information Officer's Wireless Management Office (WMO).

Wireless Telecommunications Statement of Requirements (SOR)

Public safety communications are often too critical and unique to rely on traditional solutions. To have a vision of their communications and information sharing needs, the public safety practitioners have defined their functional and operational tasks while relating their communications needs now and into the future. ITS has helped document that vision in *Statement of Requirements for Public Safety Wireless Communications and Interoperability – Version 1.0*, at http://www.safecomprogram.gov/SAFECOM/library/technology/1200_statementof.htm. This SOR is focused on the functional needs of public safety first responders — Emergency Medical Services (EMS) personnel, fire fighters, and law enforcement officers — to communicate and share information as authorized when it is needed, where it is needed, and in a mode or form that allows the practitioners to use it effectively. The communications mode may be voice, data, image, video, or multimedia that includes multiple forms of information. To keep the emphasis on functional requirements, the SOR avoids specifying either technologies or business models (i.e., whether requirements should be addressed through owned products and systems, or via commercial services). With aid of ITS, the practitioners will soon have available Versions 1.1 and 2.0 that will provide more detail on technical parameters and values derived from subjective practitioner tests designed to evaluate quality and performance requirements of the communication systems and services.

Wireless Communications and Information Exchange Architecture Framework

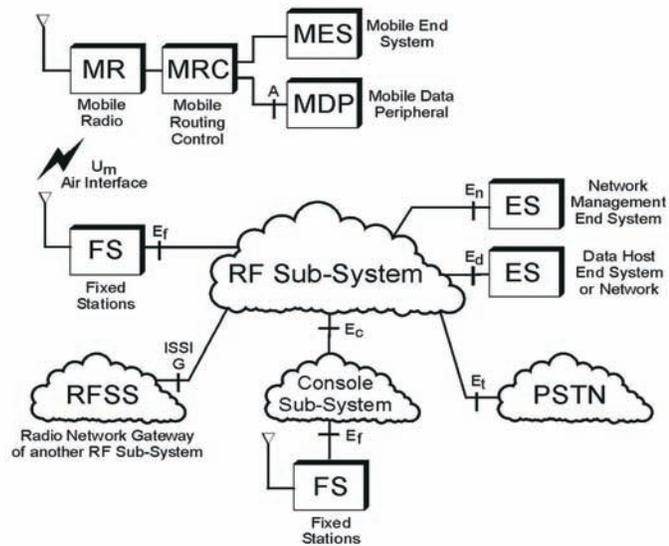
Through its sponsors, ITS is supporting the development of an architecture framework for wireless communications and information exchange interoperability. Working with SAFECOM and others, ITS is expediting the overall Federal effort by taking advantage of background engineering work already conducted. For example, ITS has investigated frameworks for high-level enterprise architectures, and is also reviewing and analyzing the wireless integration activities being performed, and contemplated, to characterize common architectural elements that

have been successfully applied in the field. Governance and other non-technical issues have also been researched. Once the architecture framework (system of systems) document matures, it will be reviewed and approved by practitioners as was the SOR. The framework will then guide the development of standards that support it.

Project 25/TIA TR-8 and Project MESA

Standards development activities for the public safety community’s new generation digital land mobile radio systems are being performed under a joint effort of public safety users and equipment manufacturers. The users are represented by local, state, and Federal government organizations, and manufacturers are represented by industry members of the Telecommunications Industry Association (TIA). This standards development process is known as Project 25 (P25). P25 members establish user requirements and draft specifications based on the users’ perspective, and TIA (and its TR-8 Committee) uses processes accredited by the American National Standards Institute to develop formal, nationally recognized standards that can be used to design and manufacture equipment and evaluate its performance and interoperability. ITS represents users on technical contributions and issues and provides guidance when technical decisions are to be made. ITS holds leadership positions within P25 Working Groups: Vice Chair of the ISSI Task Group and Vice Chair of the Project 25 Systems Architecture Working Group (PSAWG); and Chairman of the BroadBand Task Group (BBTG). In addition, an ITS engineer represents Federal users on the Project 25 Steering Committee.

With Congress providing grants to state and local governments for telecom equipment and the funding for Federal public safety communications systems, Congressional bills have defined the importance of having P25 standards in place. As a result, the P25 Steering Committee and technical committees have set aggressive timeframes for completion of the documents that make up the standards associated with each P25 interface. The interfaces defined with the highest priority for completion (shown in the figure) are the Inter-RF SubSystem Interface (G, ISSI), the Fixed Station SubSystem Interface (E_f , FSSI), and the Console SubSystem Interface (E_c , CSSI).



P25 system interfaces.

Standards for these interfaces will be in place in late 2006, and will be sufficient for manufacturers to begin building, testing, and delivering products. Commercially available equipment is expected to be available 12-18 months after the standards are approved. ITS continues to be active and instrumental in helping to accelerate the technical completion of these critical interfaces.

ITS continues to develop procedures to test the performance and interoperability of P25 radio systems. In FY 2006, the Conformance Test Procedure documents will be put into the P25 process for review and consensus acceptance.

For Project MESA, a joint effort of the European Telecommunications Standards Institute (ETSI) and TIA, efforts have concentrated on defining the public safety requirements for broadband mobile applications worldwide. ITS has provided user operational requirements that represent the views of U.S. public safety users. An ITS engineer is Chair of the Technical Specification Group — Systems.

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Emergency Telecommunications Service (ETS)

Outputs

- Technical contributions to ATIS Technical Committee PRQC.
- Technical contributions to ITU-T Study Group 9.

In the aftermath of the 2001 terrorist attacks, the Federal Government has become very interested in priority treatment for emergency communications. While the Government Emergency Telecommunications Service (GETS) has served emergency workers well for many years, it is limited to the Public Switched Telephone Network (PSTN) and to the United States. ETS is envisioned as a GETS-like service that will be available internationally and encompass virtually all wireless and wireline communications networks. The types of traffic to be carried include voice, video, database access, text messaging, e-mail, FTP, and web-based services.

The ETS effort at ITS encompasses two projects: Packet-Switched Networks, and Network Survivability and Restoral. For both of these projects, laboratory studies, security analyses, and standards development are used to support Critical Infrastructure Protection (CIP) initiatives. These two projects are funded by the National Communications System (NCS). This work supports NCS in its mission to protect the national security telecommunications infrastructure, and to ensure the responsiveness and availability of essential telecommunications during a crisis.

In the first project, Packet-Switched Networks, ITS develops and verifies ETS Recommendations for International Telecommunication Union's Telecommunication Standardization Sector (ITU-T) Study Group (SG) 9. The major goal of this project is to ensure that future ETS mechanisms and the current GETS service will interoperate over broadband cable television networks in the delivery of voice and multimedia communications.

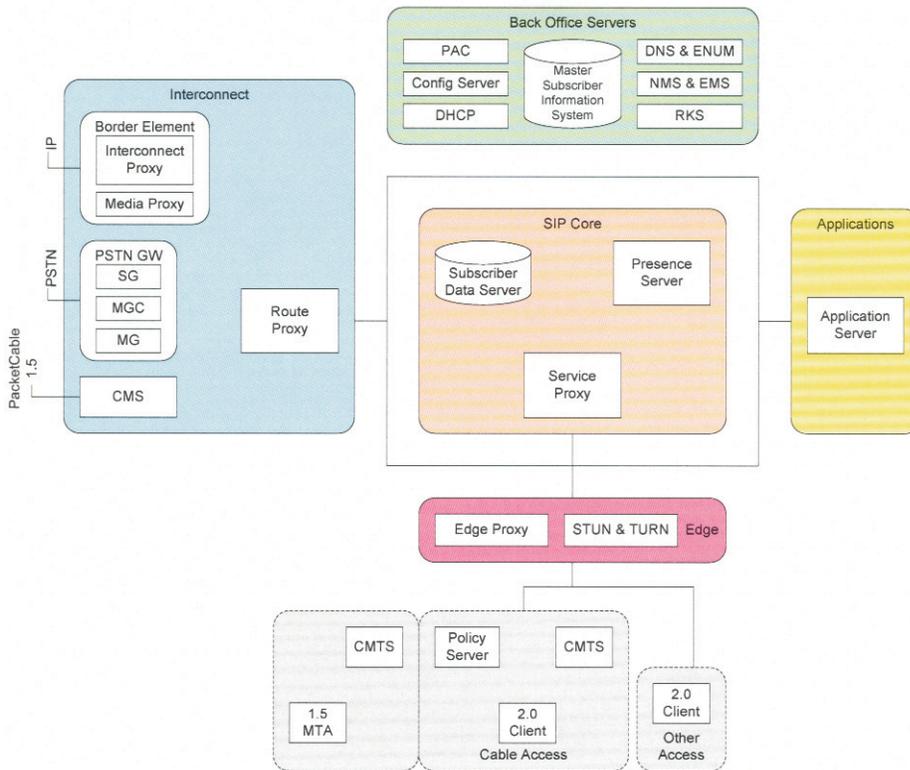


Figure 1. IPCom 2 reference architecture.

The second project, Network Survivability and Restoral, provides ETS expertise relating to priority support and network security for the American National Standards Institute (ANSI)-accredited Performance, Reliability, and Quality of Service Committee, PRQC. Within this project, an ITS engineer served as a co-editor of several ANSI and Alliance for Telecommunications Industry Solutions (ATIS) Standards and Technical Reports. These Standards and Technical Reports provide guidelines, specifications, and requirements for aspects of

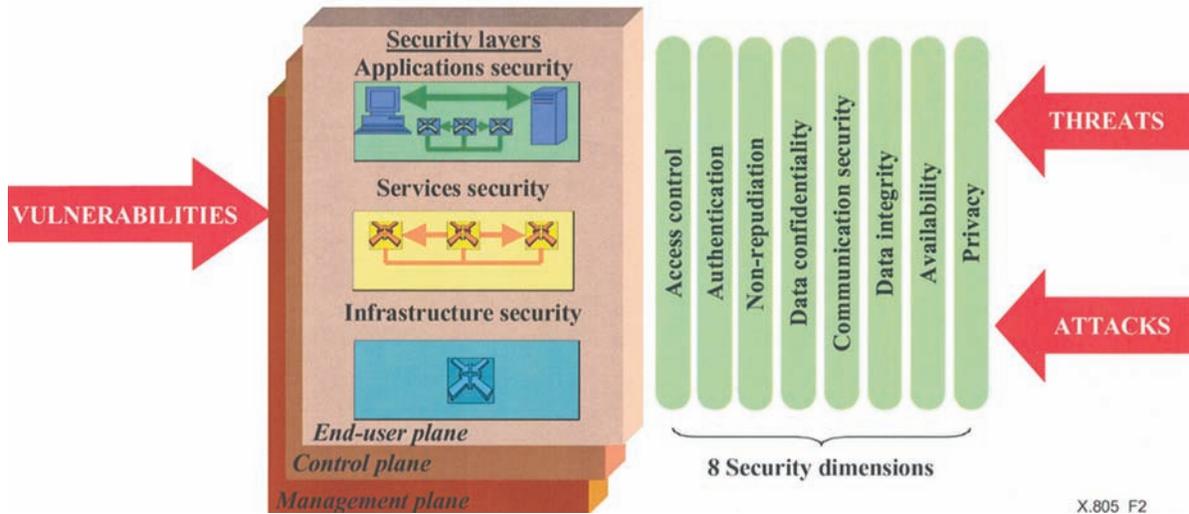


Figure 2. Security planes reflect the different types of network activities.

ETS communications. An ITS Engineer serves as the Chair of PRQC's Security Task Force where he leads security standardization for the Network User Plane.

The standardization work in ITU-T SG 9 is focused on the IPCablecom family of Recommendations. These Recommendations define the protocols and signaling to be used on broadband cable television networks to support telephony, multimedia, and Internet access. The IPCablecom Recommendations have been standardized in ITU-T SG 9, and equipment implementing them is currently in production worldwide. One of the goals of this project is to identify where additions or changes might be needed to support the ETS. This effort also involves work with the Internet Engineering Task Force (IETF), since many of the underlying protocols used in IPCablecom (as well as some of the ETS mechanisms) are under development in the IETF. An ITS engineer served as the Editor and principal author of ITU-T Recommendation J.260 — "Requirements for preferential telecommunications over IPCablecom networks" in SG 9. This Recommendation was approved in January of 2005. An ITS engineer also serves as the Editor of Draft new ITU-T Recommendation J.PREF — "Specifications for preferential telecommunications over IPCablecom networks" in SG 9. This Recommendation will provide specifications to satisfy the requirements set forth in J.260.

Another important study underway at ITS is a series of tests of GETS over IPCablecom networks. The evolution of GETS from a PSTN-only service to one that will interoperate over the wireless, IPCablecom, and Next Generation networks (NGN) is an NCS goal. Another goal of the ETS effort is determining the security needs of ETS in IPCablecom networks.

Figure 1 is a diagram of the IPCablecom2 Architecture. IPCablecom 2 will be the next generation of IPCablecom and we expect to include support for ETS in the first version of IPCablecom2. Figure 2 shows the X.805 diagram with different Security planes reflecting the different types of network activities. Joint effort with the other ATIS groups doing security work will allow us to better define and coordinate this important network security work.

In FY 2006, ITS will continue to address work on the development and standardization of ETS in ATIS PRQC, the IETF, and ITU-T SG 9. The projects will address technologies in the NGN and interactions with the IPCablecom networks. This work on ETS must of necessity be conducted with the help of representatives from network providers and cable television equipment manufacturers, as well as NCS. The work in FY 2006 will focus on priority and security in the NGN ETS as well as GETS compatibility in the IPCablecom networks.

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