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July 25, 1991

Dr. George K. C. Liu
Director, Science Division
Coordination Council for
North American Affairs
4201 Wisconsin Avenue, NW
Washington, DC 20016-2137

Dear Dr. Liu:

AIT is pleased to propose to CCNAA a Collaborative Research Arrangement in Telecommunications Sciences under the Guidelines for a Cooperative Program in the Physical Sciences between AIT and CCNAA.

I am enclosing two signed originals of the proposed arrangement for your comment and consideration. If acceptable to your side, please have both signed and return one to this office for our files.

Thank you for your continuing cooperation.

Sincerely,

(Signed)

Clarke N. Ellis
Deputy Managing Director

Enclosure: As stated.

July 18, 1991

APPENDIX NO. 2,
A COLLABORATIVE RESEARCH
ARRANGEMENT IN
TELECOMMUNICATIONS SCIENCES

UNDER THE GUIDELINES FOR A
COOPERATIVE PROGRAM IN THE
PHYSICAL SCIENCES BETWEEN THE
AMERICAN INSTITUTE IN TAIWAN
AND THE COORDINATION COUNCIL
FOR NORTH AMERICAN AFFAIRS

This Appendix No.2 is made by and between the Coordination Council for North American Affairs (hereinafter referred to as "CCNAA") and the American Institute in Taiwan (hereinafter referred to as "AIT") This Appendix is entered into pursuant to the Taiwan Relations Act (Public Law 96-8, April 10, 1979; 22 U.S.C. 3301. et seq.)

WHEREAS, CCNAA, on behalf of its designated representative, the Telecommunications Laboratories (TL) of the Directorate General of Tele communication, Ministry of Communications, is desirous of receiving the transfer of technology and the implementation of test systems and tools for Open Systems Interconnection (OS) protocols,

WHEREAS, AIT, on behalf of its designated representative the Computer Systems Laboratory (CSL) of the National Institute of Standards and Technology (NIST), is willing to provide these services,

NOW, therefore, its is agreed by and between CCNAA and AIT as follows:

This proposal identifies a framework where the Computer Systems Laboratory (CSL) of the National Institute of Standards and Technology (NIST) and the Telecommunications Laboratories (TL) of the Directorate General of Telecommunications, Ministry of Communications will collaborate. Both CSL and TL will participate in the accomplishment of specific tasks. The main results of this collaboration will be the transfer of technology to TL and the implementation of test systems and tools for OSI protocols. Working closely with CSL on its R & D program, TL will gain insight into current and future Open Systems Interconnection (OCI) test problems, and will have early access to CSL solutions. The means

by which this collaboration will be achieved include TL staff participation in the work of the Automated Protocol Methods Group. These activities will be sponsored by TL and CSL.

Section 1 describes the activities in which the Automated Protocol Methods group has been involved in the past ten years. Section 2 introduces the opportunities where TL and CSL can achieve substantial progress.

1. Background: the Automated Protocol Methods Group

The Automated Protocol Methods Group of the Computer Systems Laboratory has unique experience in the design of test systems for OSI protocols and tools for formal description techniques. Furthermore, the automated Protocol Methods group has been responsible for the establishment and implementation of the U.S. GOSIP Testing Policy.

1.1 Transport Class 4 Protocol Test System The Transport protocol (ISO 8073) provides transparent transfer of data between Session entities. It relieves Session entities from any concern with the detailed way in which reliable and cost -effective data transfer is performed. A test system for Transport Class 4 was developed at NIST in 1982 and constituted the first Transport tester ever built.

1.2 Connectionless Network Protocol Test System

The ISO Connectionless Network protocol (ISO 8473), or Internet protocol, is a protocol within the ISO Basic Reference Model of Open Systems Interconnection. When viewed as an end system it uses the service provided by the subnetwork dependent convergence function and augments this with routingand addressing functions, and segmentation and reassembly of Internet Protocol Data Units (IPDUs) to provide a network service to Transport entities and other network layer users. When viewed as an intermediate system (or gateway), it routes IPDUs received from one subnetwork to a destination system on the same, or another subnetwork.

The architecture for testing the Connectionless Network protocol was developed in 1985. This tester was the first impl-

ementation of sucl21 a test system for both end and intermediate systems.

1.3 Estelle Tools

Estelle is a form al description technique for communication protocols that has been standardized (ISO 9074) by the International Organization for Standardization (ISO). It describes protocols in terms of modules that are based on an extended state-transition model. Modules are arranged in a dynamic hierarchy and communicate by exchanging interactions at named interaction points. The Automated Protocol methods group has a long experience with Estelle. The group participated in the design of the ISO language and built several tools:

- The Estelle Prototype compiler Tool (1987): as the first compiler for Estelle, this tool translates Estelle into C and is supported by a runtime system written in C. This tool did not implement all the Estelle constructs.
- The Estelle Syntax-Directed Editor (Wizard, 1989): this tool is a syntax-directed editor that includes thorough checking of syntax and semantics, and that generates code for use with the Wise tool.
- The Estelle Simulation environment (Wise, 1989): This tool is a simulator and symbolic debugger for specifications written in Estelle that provides simulated multiple sites and processes and a window-based interface for control that requires a commercial smalltalk environment,
- The Portable Estelle Translator (PET, February 1991): this tool has been designed to provide support for a wide variety of tools for Estelle. The translator is built around an object-oriented model of Estelle, which allows the representation of Estelle specification as a collection of objects. The PET checks Estelle specification for syntax and semantics and generates a collection of Estelle objects . These objects can then be exploited by a variety of applications ranging from pretty printing to generation of d-

istributed code that implements the specification.

- The Distributed Implementation Generator (DINGO, February 1991): This tool generates C++ code for distributed prototype implementations of systems described in Estelle. The input of DINGO is in the form of objects generated by PET. DINGO generates code that implements all Estelle. This is the first complete and distributed Estelle implementation. The distribution of modules over operating system processes and over the sites of the target distributed system is controlled by the user. Elements of an X-Window interface may also be generated by DINGO, so that individual modules can be monitored by the user.

1.4 Abstract Syntax Notation One Tool

The Abstract Syntax Notation One (ASN.1) standard (ISO 8824 and 8825 defines a notation to be used in standards for protocols. ASN. 1 is used to describe the information content of user data parameters and application protocol control information that cross the application-presentation interface. The Automated Protocol Methods group developed the Free Value Tool for ASN. 1 in 1989. This tool is suitable for the study and evaluation of one or several ASN. 1 modules or for building a prototype encoder-decoder. The tool can not handle macros.

1.5 Research and Development in Conformance Testing

The Automated Protocol Methods group has been a pioneer in the conformance testing domain. This leading role has continued with R & D in conformance testing in the late 1980s. A new testing methodology, the NIST Test Entity Methodology, has been developed to tackle the upcoming problems in testing: multi-layer testing and multi-peer testing. This methodology is based on Estelle formal description of test compon ents which include reference implementation(s) of the protocol(s) being tested. This methodology was applied to two gateway test systems: the MHS/SMTP gateway test system (1987) and the FTAM/FTP gateway test system (1989). A new applicat-

ion, the IS-IS test system, is in progress and should be completed before the end of 1991.

1.6 The U.S. GOSIP Conformance Testing Program

The Automated Protocol Methods Group has been responsible for the complete set up and implementation of the U.S. GOSIP Testing Program. The first version is based on GOSIP Version 1 (FIPS 146) and consists of various initiatives. Abstract Test Suites for the relevant OSI protocols were reviewed, selected and registered. Testers were assessed and registered. A laboratory accreditation program was set up and resulted (as of February 1991) in the assessment and accreditation of 8 laboratories in the U.S. and abroad. The program is begin updated/upgraded to take into account new requirements in GOSIP Version 2 that will be mandated in August 1992.

2. Collaborative Opportunities

CSL and TL will collaborate over a period which may extend to five years. This five year target corresponds to the introduction of GOSIP Version 3. The activities where CSL and TL will cooperate encompass different subjects with different time periods. The sections below describe briefly what can be the focus.

2.1 Short Term Technology Transfer

In the short term (i.e., one year window), CSL will transfer to TL its current OSI technology expertise. The topics to be considered were presented in Section 1, and include:

- All the Estelle tools and their understanding: CSL staff will teach TL staff the Estelle language and how the CSL Estelle tools can and should be used.
- The ASN. 1 Free Value Tool and its understanding: the CSL staff will teach TL staff the expertise in ASN.1 and how the CSL ASN.1 Free Value tool can be used.
- The NIST Test Entity Methodology: this methodology is based on the use of formal description techniques in conformance testing. TL staff will get a thorough understanding and expertise on the concepts of conformance testing and

the specifics of the NIST Test Entity Methodology.

- The OSI protocols: CSL will transfer its expertise of OSI to TL staff. This transfer will be achieved via tire use of OSL product implementations (such as the FTAM/FTP tool, ISODE), and other protocols on which CSL is working (in p-articular the Transaction Processing protocol). CSL will provide the necessary support to facilitate this transfer (i.e., consultation as needed and/or requested).

  The software tools for Estelle and ASN,1 will be provided to TL. The FTAM/ FTP, and MHS/SMTP gateway testers will be given to TL. When the IS-IS test tool is completed, it wi-ll be provided to TL.

2.2 Taiwan OSI Testing Program Set Up

The Automated Protocol Methods group has been responsible f-or the set up and implementation of the U.S. GOSIP Testing Program. Indeed, the group possesses a large expertise in c-onformance testing and its requirements. The group will pro-vide consultation with TL concerning the establishment of a Conformance Testing Program in Taiwan. Support extending fr-om the teaching of the basic ISO conformance testing concep-ts to the review of the Taiwan Conformance Testing Program will be provided. In addition, consultation will be provided to TL concerning the set up of a conformance testing labora-tory. CSL will support TL in reaching a mutual-recognition agreement between AIT and CCNAA on OSI Conformance Testing. This aspect of NIST-TL cooperation will last over a period of five years, in order to achieve a complete set up and mu-tual-recognition agreement when the U.S. GOSIP Version 3 Co-nformance Testing Program is in place.

2.3 Moving Into the Future

Two topics seem appropriate to consolidate CSL and TL coope-ration: development of new testing tools and development of new tools for formal description techniques. As the work pr-ogresses, new topics could be added.

2,3.1 Develop New Test Systems

CSL and TL staff will work together to build new testing tools for new protocols. The specific protocols are negotiable, but two candidates appear to be good targets: the Network Management and Transaction Processing protocols. As of today there are no testing tools for these protocols on the market. TL will gain the expertise in the design and development of test tools and will hold a leading position in conformance testing. As these protocols and their testing are complex, a target window of two years per tool should be allowed.

2.3.2 Develop New Tools for Formal Description Techniques

This aspect of CSL-TL collaboration is dependent upon funding from TL additional to that specified in this Appendix. Conformance testing and the development of new testing tools are the primary concerns of this proposal. Nevertheless, the new PET-DINGO tool for Estelle offers an interesting potential for collaboration. PET-DINGO is remarkable in various aspects. First, this is the only tool available in the world that implements the complete Estelle language. Second, the way the tool has been designed allows incremental additions to its capabilities. New target languages can be considered. Graphical interfaces can be added. Amerging between ASN.1 and Estelle could be achieved. Depending on TL commitment and funding, one or more of these additions could be considered.

2.4 TL Resource Requirements

This initial proposal assumes that two persons from TL work at NIST, and that TL supports CSL staff. The level of funding has been evaluated at US$200,000 for the first year. This funding will increase depending on TL decisions new commitments. Initially, a portion of TL's funding will be allocated to cover partially the salary for two NIST staff members. The remaining will cover the salary of two TL persons working at NIST.

For: Coordination Council for North American Affairs

Name: (Signed)

Title: Deputy Representative

Date: Oct. 4,1991

For: American Institute in Taiwan

Name: (Signed)

Title: Deputy Managing Director

Date: July 25,1991