Toward Credible IT Testing and Certification

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Outline

- Need for software certification
- Measurement in physical science and information technology
- Laboratory accreditation and certification processes
- Current trends and implications

Software is Rarely Certified

- One of the stronger software warranties:

THIS SOFTWARE IS NOT DESIGNED, MANUFACTURED OR INTENDED FOR USE OR RESALE FOR ON-LINE CONTROL EQUIPMENT IN HAZARDOUS ENVIRONMENTS REQUIRING FAIL-SAFE PERFORMANCE, SUCH AS IN THE OPERATION OF NUCLEAR FACILITIES, AIR TRAFFIC CONTROL, AIRCRAFT NAVIGATION OR AIRCRAFT COMMUNICATION SYSTEMS, LIFE SUPPORT MACHINES, OR WEAPONS SYSTEMS, IN WHICH FAILURE OF THE SOFTWARE COULD LEAD DIRECTLY TO DEATH, PERSONAL INJURY, OR SEVERE PHYSICAL OR ENVIRONMENT DAMAGE.

Examples

- U.S.S. Yorktown dead in the water because Windows NT failed to detect divide by zero error
- $500 Million Ariane 5 rocket explodes because guidance software failed to detect invalid parameter setting

Measurement in Physical Science

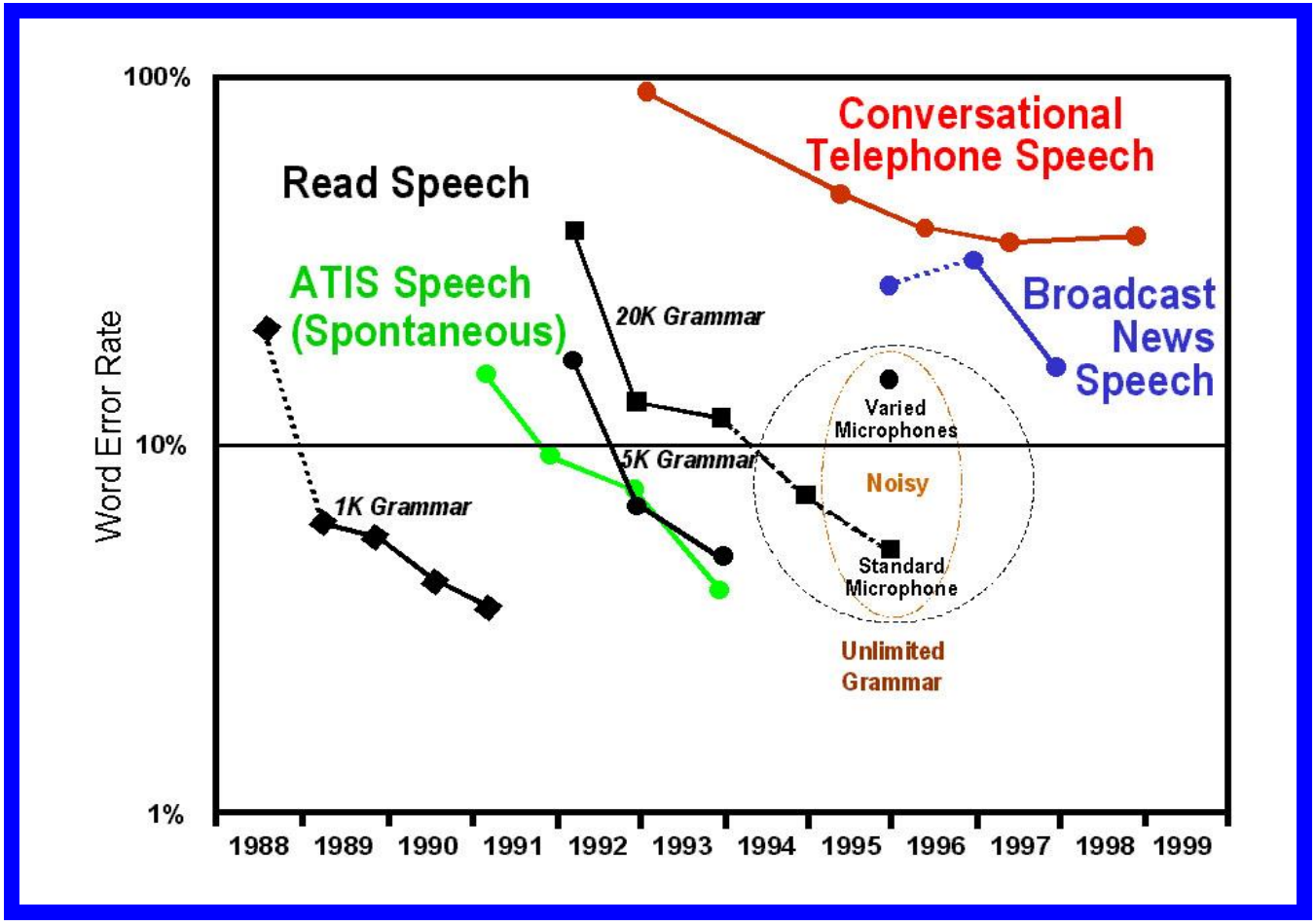
- Measurement requires:
- Traceability to a *reference* - e.g., platinum-iridium meter bar (in years past)
- Measurement *method* -
- *Statement of uncertainty* - e.g., using statistical variances

Measurement in Information Technology

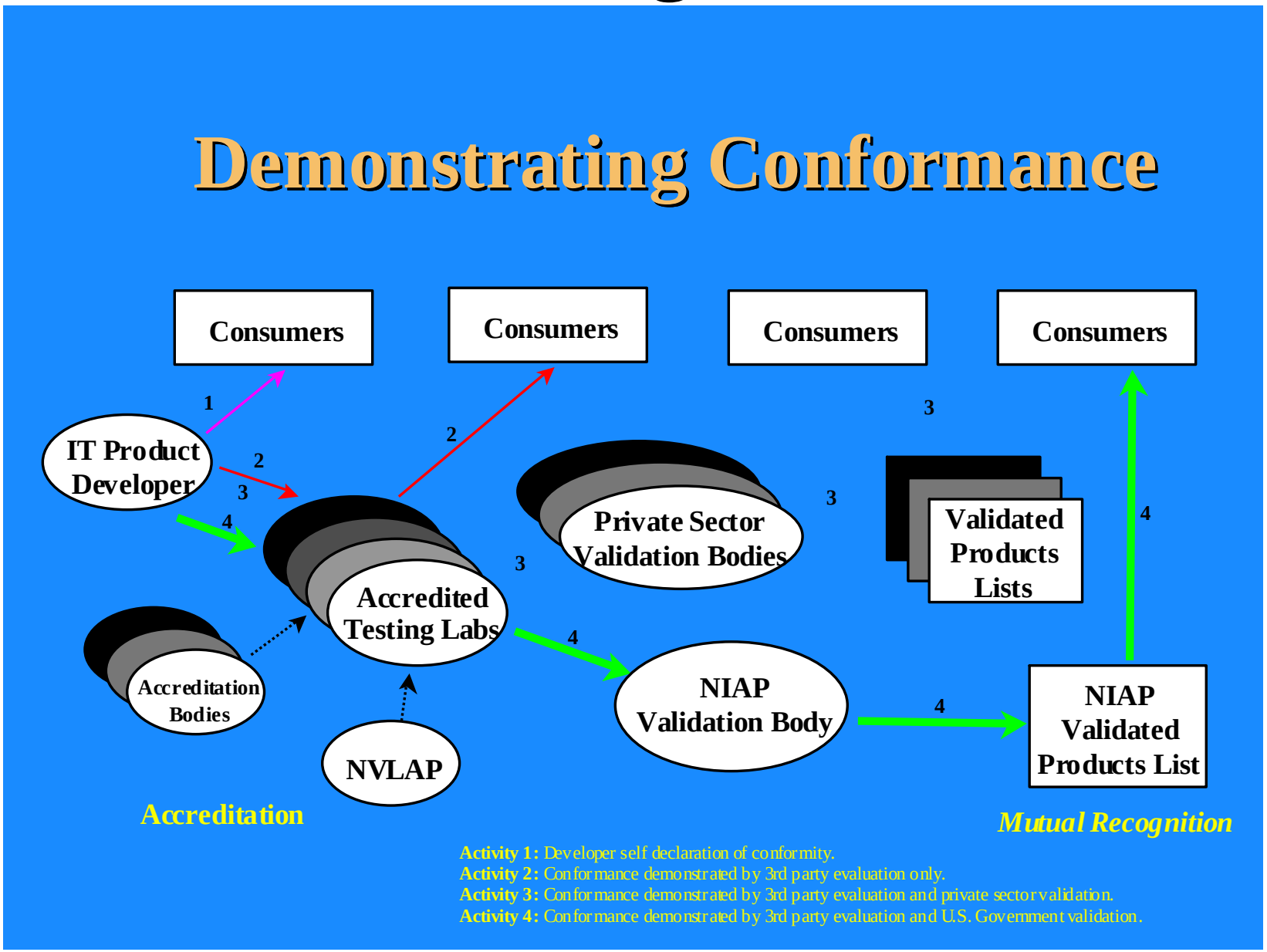
-- Examples --

- Traceability to a *reference* - e.g., IEEE standard for POSIX kernel, P1003.1
- Measurement *method* - standard test suite
- *Statement of uncertainty* - specific configuration and platform tested

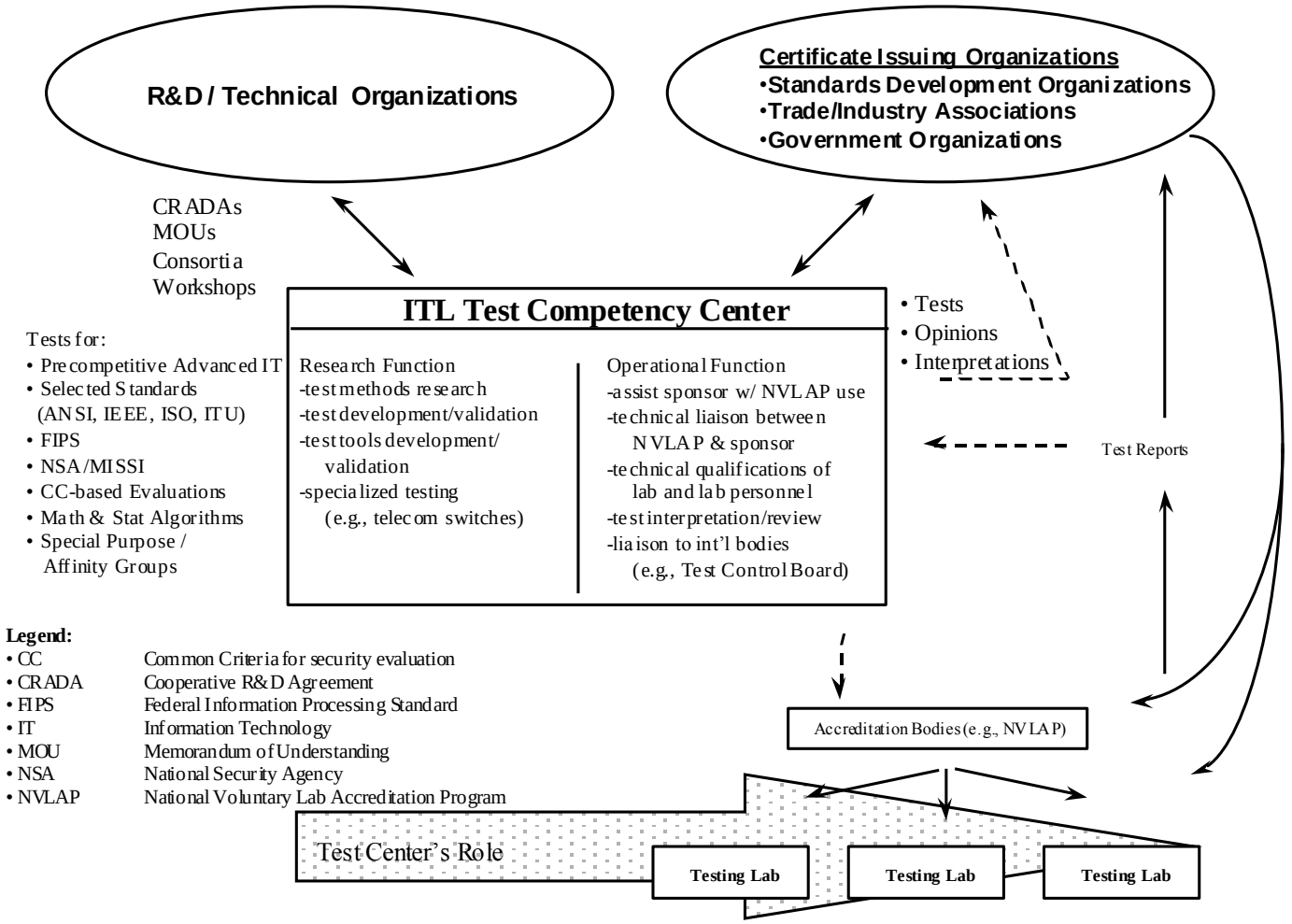
Reference Data Example - Speech Database



NIAP Testing Process



NIST ITL Test Competency Centers



NIST ITL Test Information

Conformance Tests and Reference Data	
Fortran78	http://www.itl.nist.gov/div897/ctg/fortran_form.htm
Cobol85	http://www.itl.nist.gov/div897/ctg/cobol_form.htm
CGM	http://www.itl.nist.gov/div897/ctg/cgm_form.htm http://www.itl.nist.gov/div897/ctg/graphics/cgmv3hd.htm
PHIGS	http://www.itl.nist.gov/div897/ctg/phigs_form.htm
RDA	http://www.itl.nist.gov/div897/ctg/rda_form.htm
JAVA Conformity Assessment and Diagnostics	http://www.nist.gov/java_ca.htm
VRML Conformance Tests and Viper Reference Parser	http://www.nist.gov/vrml.html
SQL	http://www.itl.nist.gov/div897/ctg/sql_form.htm
POSIX	http://www.itl.nist.gov/div897/ctg/posix_form.htm
Role Based Access Control (RBAC)	http://hissa.ncsl.nist.gov/rbac/
NIST Integrated Services Protocol Instrument (RSVP/RTP Testing)	http://www.antd.nist.gov/itg/ispi/
Cryptographic Modules and Algorithms: Specifications, Tests, and Validated Implementations	http://csrc.nist.gov/cryptval
Usability Tests	
Web Metrics	http://zing.ncsl.nist.gov/~webmet/

NIST ITL Test Information

Performance Tests and Reference Data	
ext Retrieval Test Collections	http://www.nist.gov/itl/div894/894.02/products.html
REC Test Collections on CD-ROM	http://trec.nist.gov/data/docs_eng.html
peech Processing Evaluations and Benchmark Tests	http://www.nist.gov/speech/online.htm
enchmark Tests	http://www.nist.gov/speech/test.htm
ptical Character Recognition (OCR)	http://www.nist.gov/itl/div894/894.03/ocr/ocr.html
CR Test Material on CD-ROM	http://www.nist.gov/itl/div894/894.03/databases/defs/vip_dbases.html#ocrlist
ingerprint Classification / Matching	http://www.nist.gov/itl/div894/894.03/fing/fing.html
ingerprint Test Data on CD-ROM	http://www.nist.gov/itl/div894/894.03/databases/defs/vip_dbases.html#finglist
ace Recognition	http://www.nist.gov/itl/div894/894.03/face/face.html
lugshot/Face Test Data on CD-ROM	http://www.nist.gov/itl/div894/894.03/databases/defs/vip_dbases.html#facelist
ciMark: a benchmark for numeric-intensive pplications in Java	http://math.nist.gov/scimark/
ools: S-Check	http://cmr.ncsl.nist.gov/scheck/scheck.html
ools: MultiKron Series of Instrumentation Boards nd Toolkits	http://cmr.ncsl.nist.gov/multikron

Laboratory Accreditation

Goal: Promote development of competitive market to:

- Increase availability of testing services
  - through third-party laboratories
  - market for testing encourages development of software testing industry
- Reduce cost
  - by increasing supply of testing services

National Voluntary Laboratory Accreditation Program

- Accredits **third-party testing services**, public and private labs
- Works with other national metrology institutes to establish criteria for **mutual recognition of test results**
- Accreditation in: instrument calibration, **computers and electronics**, dosimetry, environmental standards, fasteners and metals, product testing

National Voluntary Laboratory Accreditation Program

- Accredits third-party testing services, public and private labs
- NVLAP Computer/Electronics Group
  - Cryptographic Modules Testing
  - FCC Test Methods
  - GOSIP
  - MIL-STD-462 Test Methods
  - POSIX

NVLAP Computer/Electronics Group

- Cryptographic Modules - hardware and software
- FCC Test Methods
- GOSIP - OSI communications
- MIL-STD-462 Test Methods - electromagnetic emanations (TEMPEST)
- POSIX - IEEE operating system standard

Conformance Testing

- Reference: specification or standard
  - normally no access to source code
- Measurement method: test cases + test configuration + platform
- Uncertainty statement: accounts for limitation to tested platform, options, and test suite

Trends

- More standard component-based software
  - integrating components without source code
- Increased concern about liability
  - Y2K is just the beginning
- Increased demand for testing
  - need for consensus on prudent testing practices
  - need for precise definition of standards

Implications of Trends

- More standard component-based software
  - means usually no access to source code
- Increased concern about liability
  - means stronger assurance needed
- Increased demand for testing
  - means more efficient test methods needed

Bottom Line Implications

- Needs for rigorous assurance of standardized software
  - precise specifications of components
  - specification-based testing using
    - formal specifications
    - realistic fault models
    - statistical methods