Challenges in IT Standards Development

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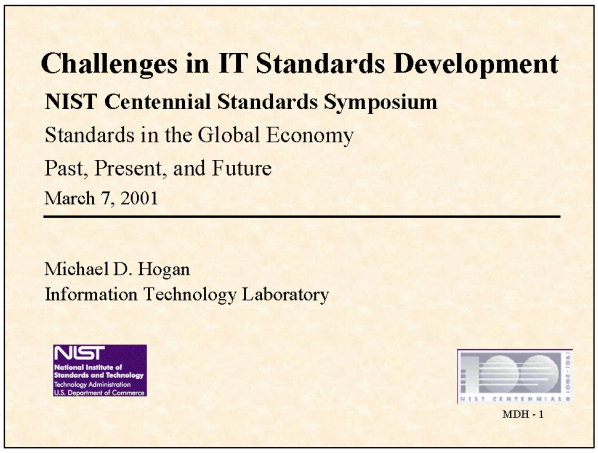
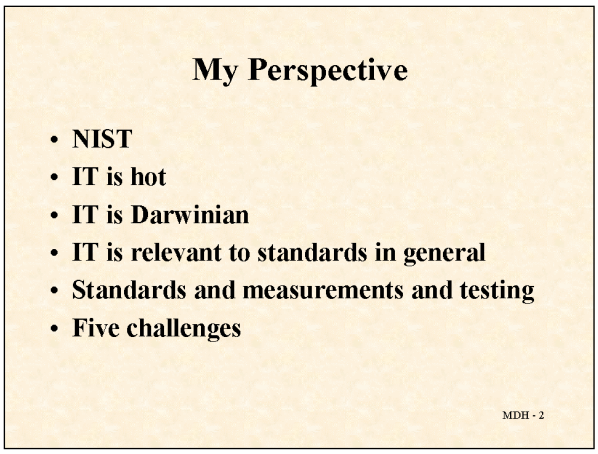


SLIDE 1

I am very happy to be here this morning and have the opportunity to talk about challenges in IT standards development. The NIST Centennial is certainly an appropriate time and venue to reflect upon IT standards, past, present, and future.

In just the last 10 years, IT has transformed the way people work, learn, and communicate with each other. While information technology promises to continue to improve our lives, the full potential benefits of IT will not be realized without a solid foundation of standards, measurements, and testing. This is a business necessity for both the United States and the world.

Slide 2 will give you a bit of a perspective, because I want you to know how emotionally involved we are at NIST with this subject.



SLIDE 2

My perspective starts with NIST. NIST has been involved with building and using computers for over 50 years, and with developing computer standards for more than 30 years. I myself have been working at NIST for over 25 years, and some of my colleagues have worked at NIST for over 30 years, and some for even over 50 years. For many of us working at NIST, it is the best job that we ever had, and for some of us it is the only job. As rewarding as the work has been, the people that I have worked with from government, industry, and academia have been the greatest rewards for me.

While my remarks are about technical and management challenges, and not about people, one former colleague is germane to this discussion, Jim Burrows. From 1979 to 1995, Jim served at NIST as Director of the Institute for Computer Sciences and Technology, which later became the Computer Systems Laboratory. This was a great time to be involved in the IT standards business at NIST. Jim was not only in the right place at the right time, but he was the right person. He was highly respected inside and outside of NIST.

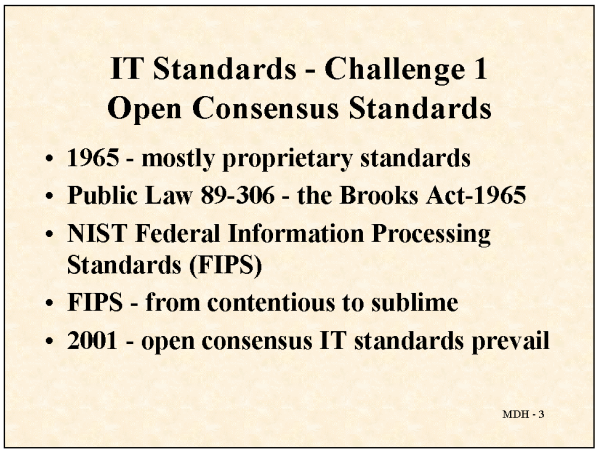
And now I would like to share a few words on my views of IT. IT is hot, and like many other things discussed today, IT is Darwinian, both for vendors and users. But I think it is truly Darwinian in a different way. It is about survival of the fittest, and unfortunately the rules for fittest keep changing over the years. The improvements in price performance for IT are unmatched by other industrial sectors. Information appliances and services are increasingly ubiquitous, and they are the great enablers of the productivity gains in other sectors of the economy.

To put IT innovation in perspective for you, let me compare the automobile industry to the IT industry. If the automobile industry was like the IT industry over the last 30 years:

1. Today your automobile would cost mere pennies to own and operate.
2. Today your automobile would travel at hundreds or thousands of kilometers per hour on high-speed networks, even at rush hour.
3. Once a year, today's automobile would blow up, killing everyone inside.

While my remarks are IT centric, I believe that they apply to standards in general. And, you cannot meaningfully talk about IT standards without also discussing IT measurements and testing.

I will discuss five challenges from past, to present, to future, and to some extent all interrelated.



SLIDE 3

Challenge One. Open Consensus Standards.

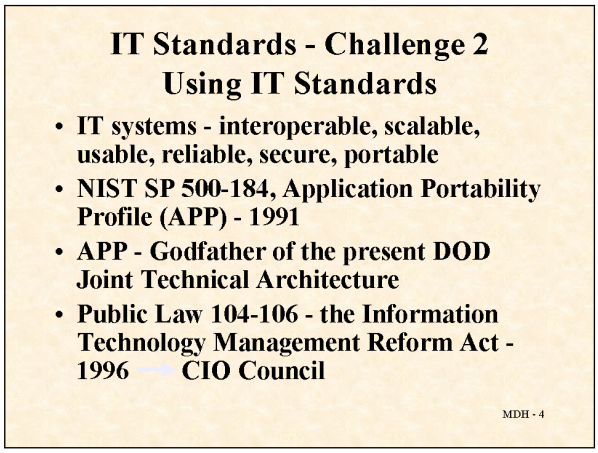
In the United States in 1965, the computer industry was based mostly on proprietary standards. So was what we now call POTS, the plain old telephone service. It was a very different world in 1965 from today, with no Internet and no World Wide Web.

The Brooks Act of 1965 was the Federal Government's response to avoid being locked in to buying proprietary, and expensive, computers. Under the Brooks Act, NIST was tasked with promulgating for Federal Government use, mandatory Federal Information Processing Standards, or FIPS, which were to be based upon open consensus standards. For over 25 years the, FIPS program was often quite adversarial, pitting some IT vendors against IT users. It was an exciting era. NIST was making history with its FIPS program. When Jim Burrows arrived in 1979, he found us very arrogant in our thinking; that such a small group at NIST could change the IT world. Ironically, being arrogant, we thought that Jim was just praising us.

Overall, the FIPS program has gone from contentious to sublime. I will review a few FIPS to show what has happened over the years:

1. FIPS 1 was approved in 1968. It was for ASCII. There was opposition from vendors. They saw compliance costs and no additional profit. They were right.
2. FIPS 21, was approved in 1972. It was for COBOL. There was opposition from vendors. They saw compliance costs and no additional profit. They were right.
3. Vendors' ire at NIST probably peaked with FIPS 60 in 1979. It was for the I/O Channel Interface. Now some vendors saw their entire business models for profitability threatened. Indeed, four computer vendors sued the U.S. Government to stop the implementation of FIPS-60. They lost. And they were right. It did threaten their profitability and their existence.
4. By 1987, we were starting to put out a different category of standards, like FIPS-127, Database Language SQL. Here the vendors were writing the standards along with the users, and the vendors had hopes, dreams, and aspirations of profiting from these open system standards. There had begun to be a sea-change somewhere along the line, between open systems as a threat to business models, to open systems as an inevitable cost of doing business in the changing world of IT.
5. Now in 2001, we have proposed a FIPS for the Advanced Encryption Standard (AES), and that has been greeted with enthusiasm from all corners, both users and vendors.

In 2001, open consensus IT standards prevail. But the need for more FIPS has largely gone. FIPS made history and became history.



SLIDE 4

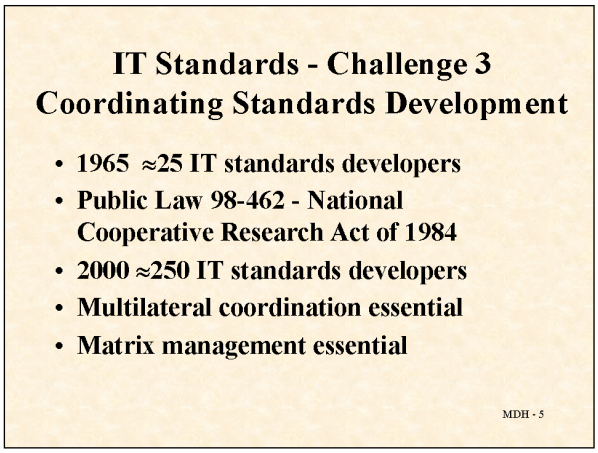
Challenge Two. Using IT Standards.

About 1990, Jim Burrows challenged his division chiefs to assist Federal Agencies in using open standards for their acquisitions, their near-term acquisitions. IT users were seeking to procure IT systems that were interoperable, scalable, usable, reliable, secure, and

portable. (They still are!) And they were beginning to see a bewildering array of IT standards from which to choose. This task was not nearly as much fun as developing FIPS. There was, and is, a thin line between deploying leading-edge technology and deploying bleeding-edge technology.

NIST did develop recommendations on specifications and standards to use in defining an Open Systems Environment (OSE). Our first publication in this series was NIST Special Publication 500-184, Application Portability Profile, in 1991. This series of publications were the godfather of the present DoD Joint Technical Architecture.

In 1996, the Information Technology Management Reform Act took NIST off the hook. It led to the Federal government forming a Chief Information Officer (CIO) council, and appointing Chief Information Officers throughout the agencies, with the task of wrestling with standards based deployment of IT systems.

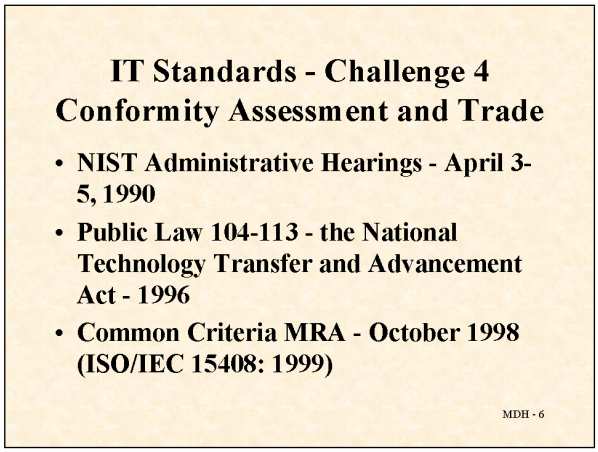


SLIDE 5

Challenge Three. Coordinating Standards Development.

In 1965, there were about 25 standards developers worldwide, wrestling with what we now call IT standards. In 1984, a law was passed that dramatically changed things for IT standards development in ways not foreseen. The National Cooperative Research Act was intended to promote research and development, and to amend the anti-trust, patent, and copyright laws in this country. This law, and its subsequent amendments, permitted IT vendors and others to form consortia that could jointly develop IT standards and specifications.

Now there are about 250 IT standards developers worldwide, about 10 times as many as in 1965. The 250 IT standards developers worldwide are not likely to go away anytime soon. Even if they did, the thousands of interdependent standards activities that they have underway would remain. Trying to make sense and use of these IT standards is increasingly difficult and increasingly necessary. Consequently, multilateral coordination among IT standards developers is now essential. Matrix management across IT standards developers is also now essential.



SLIDE 6

Challenge Four. Conformity Assessment and Trade.

NIST's role in national and international harmonization of conformity assessment has increased significantly over the last few years. By 1990, NIST had in place a growing number of testing activities in support of its FIPS program. So those of us involved in IT standards at NIST were very interested in the NIST administrative hearings held in April of 1990.

These hearings were intended to cover U.S. standards and conformity assessment practices that effect the acceptance of U.S. products in foreign markets. The hearings became a referendum on the state of the present U.S. standards system. It was overwhelmingly affirmed that the U.S. standards system was just fine. However, the furor over standards left little time to focus on conformity assessment and trade. But I believe that it cast the dye that this was now a top-down business issue for U.S. industry.

In 1996 the National Technology Transfer and Advancement Act tasked NIST with, among other things, developing a national infrastructure for laboratory accreditation. The recent MOU between NIST and the National Cooperation for Laboratory Accreditation (NACLA) is a real milestone in the development of a national system for laboratory accreditation.

Meanwhile, in the IT arena, NIST and NSA championed the Common Criteria MRA of 1998. This has started an international harmonization process in support of conformity assessment for ISO/IEC

15408:1999, Common Criteria for Information Technology Security Evaluation. The NIST National Voluntary Laboratory Accreditation Program has now accredited six laboratories for Common Criteria testing, and the results of this testing program are now accepted by government agencies in 14 countries.

I have saved my best for last.

IT Standards - Challenge 5
Software

- **Software is an intellectual creation**
- **"Nation needs software that is far more usable, reliable, and powerful than what is being produced today" (PITAC 1999)**
- **"measurement is one of the biggest obstacles now facing the software industry" (Capers Jones, Sci. Am., 1998)**
- **Sound software standards depend upon sound measurement standards**

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SLIDE 7

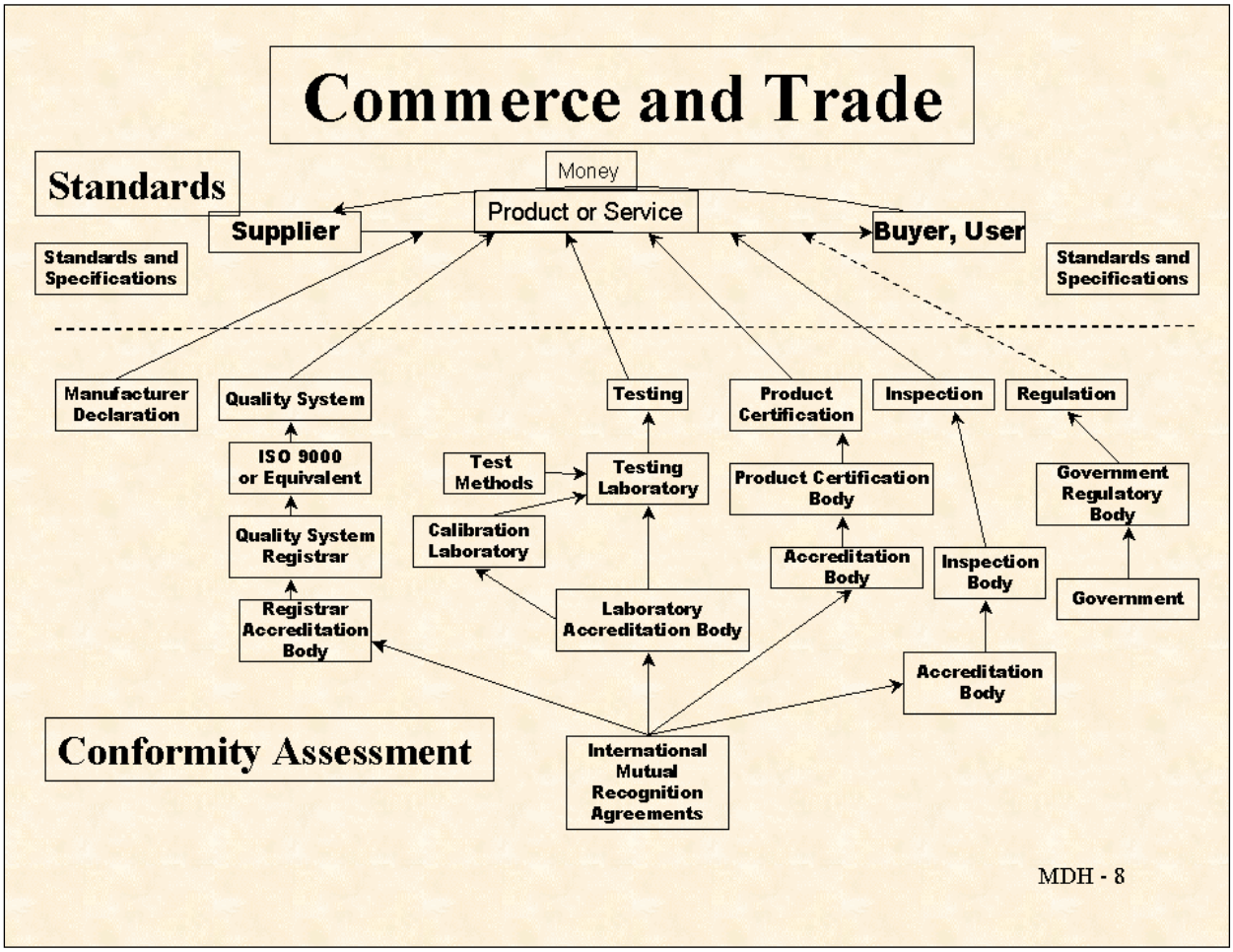
Challenge Five. Software.

Software is an intellectual creation that is independent of the medium on which it is recorded. Software is easy to manufacture. In other words, it is just a replication of a digital file. Software is difficult to develop.

In 1999, the President's IT Advisory Committee's (PITAC) Report, Investing in Our Future, listed software as its first concern for research, "the nation needs software that is far more usable, reliable, and powerful than what is being produced today."

In a seminal article on software metrics by Capers Jones, *Sizing Up Software,* Scientific American, 1998, the case was made that "measurement is one of the biggest obstacles now facing the software industry."

Sound software and software standards depend upon sound measurement standards. The physical metrology principles of unit, scale, and uncertainty presently have no counterpart in software metrics. The lack of software metrics affects virtually everyone because software is now used by almost everyone.



SLIDE 8

While software testing as a profession has certainly progressed over the last decade, the software testing researcher has been unable to fulfill the present needs of the software testing practitioner. In 1999, NIST initiated a study on the economic impacts of an inadequate infrastructure for software testing. The scope of this study was expanded in 2000, and the final report should be available sometime in 2001. Identifying economic impacts should help to identify, quantify, and focus research priorities for software testing.

Functional Model.

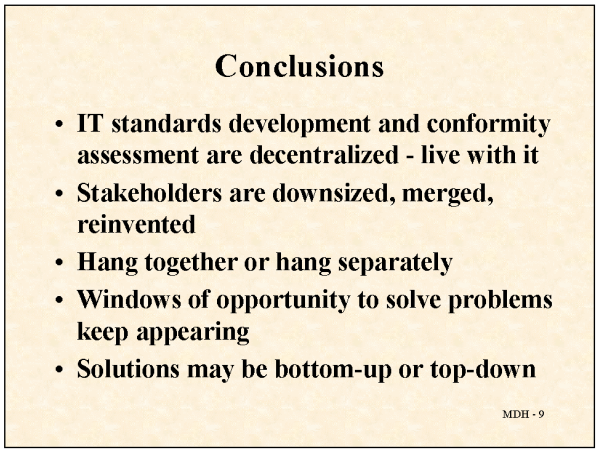
Don't try to take notes. This is not on the quiz.

All of the issues that I have discussed relate to the following functional model. Jeffrey Horlick, my colleague at NIST, has created this functional model of standards, conformity assessment, and testing. I have inserted it (here) as Slide 8 just to slam home my conclusions, which are mercifully brief.

Conclusions.

IT standards development and conformity assessment are decentralized. Live with it. Stakeholders have been downsized, merged, and reinvented, often more than once. There are scarce resources among stakeholders to cope with the ongoing torrent of IT standards, measurement, and testing activities. You can try for a competitive advantage by working alone. But often it is in your best interests to hang together or you will all hang separately. Don't lament what might have been. Windows of opportunity to solve problems keep appearing. Recognize and react. Solutions may be bottom-up or top-down.

Thank you.



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