ORAL TESTIMONY OF
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HEARING ON
APPLICATIONS FOR INFORMATION TECHNOLOGY
RESEARCH AND DEVELOPMENT

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Thank you Chairman Bucshon, Ranking Member Lipinski, and the other members of the Subcommittee for the opportunity to speak with you today.

My name is Ed Lazowska. I'm a long-time faculty member in computer science at the University of Washington. I've been a member or chair of many Federal IT advisory committees – most recently, Co-Chair of the President's Council of Advisors on Science and Technology's Working Group for the 2010 review of the NITRD program.

What that review found is that the research ecosystem supported by NITRD has been *the primary factor* in the U.S. becoming the world leader in information technology. And if we are to remain competitive in an increasingly competitive world, there is no sector more important in which to retain leadership than information technology.

I'd like to focus on that today – on the *unique* and *essential* role that the relatively modest Federal investment in research plays in America's leadership.

The National Research Council has, over the years, produced a series of diagrams that attempt to illustrate the nature and productivity of America's IT R&D ecosystem. The most recent version is on the screen.

This diagram is a timeline running from bottom to top, tracking the growth of eight major sectors of the IT industry, which are labeled near the top – "broadband and mobile," "microprocessors," "personal computing," and so on. There are three lines for each sector:

- The red line indicates when research was performed in universities (largely supported by the Federal government).

- The blue line in the middle shows when industry R&D organizations were working in that space (largely with private sector funding).

- The dotted black line shows when the first product was introduced.
  - Where that dotted line turns solid green indicates when it became a billion-dollar market sector.
  - Where the green line thickens, that sector has reached $10 billion.

- The small diagonal arrows indicate flows of *specific key people and ideas* between academia and industry, and between the sectors.

- Above the lines are some of the multi-billion-dollar companies that resulted.

The diagram shows many key aspects of this incredibly productive IT R&D ecosystem:

1. Research often takes a long time before it pays off. In a number of cases illustrated, critical research took place 15 years before the introduction of the first product.

2. Research often pays off in unanticipated ways – we can't predict what the biggest impact will be.

3. Advances in one sector enable advances in other sectors.

4. The research ecosystem is fueled by the flow of people and ideas back and forth between academia and industry.

5. *Every one* of these multi-billion-dollar IT industry sectors has a clear relationship to Federal research investment. *Federal investment doesn't supplant private sector investment – it complements it.*

Here's why. The vast majority of industry R&D is *development* – the engineering of the next release of the product. This is entirely appropriate. Developing products is hard. And research often takes many years to pay off.

Even at Microsoft and IBM – which invest *far* more than any other IT companies in research that looks out more than one or two product cycles – this investment constitutes only about 5% of total R&D. *At the vast majority of IT companies, it's 0%.*

Here's a great example of this R&D ecosystem at work: Apple's iPad. It's amazing – a device that perhaps only Apple could have designed. But *every* distinctive aspect of this device – the multi-touch user interface, the sensors, the processor – has its origins in Federally sponsored research.

So IT R&D leads to exciting companies and exciting products and services. But it does far more.

Advances in IT drive the economy, in two ways.

- *Directly*, in the growth of the IT sector itself. *Just the eight biggest U.S. IT companies* today account for *nearly $700 billion in annual revenue*.

- And *indirectly*, in the productivity gains that all other sectors achieve from the application of IT. Advances in IT empower U.S. businesses, augment their competencies, and enable them to compete in a global economy.

Looking to the future, dramatic advances in IT – advances that will require fundamental research – are essential not only to our prosperity, but also to meeting all of our national and global challenges – challenges such as:

- improving health care
- enabling advanced manufacturing
- increasing national and homeland security
- revolutionizing transportation
- achieving personalized education and life-long learning
- putting the "smarts" in the smart grid, and
- driving advances in all fields of discovery.

In my written testimony, I've detailed some specific research areas that are particularly key to national priorities and national competitiveness.

Given IT's broad influence, it shouldn't be surprising that demand for IT workers is strong:

- The latest monthly hiring figures bear this out. A total of 157,000 new jobs were added to the economy in January. More than 22,000 of these were in IT.

- Bureau of Labor Statistics projections indicate that during this decade, more than 60 percent of *all new jobs* in *all fields of science and engineering* will be for computing specialists.

It's important to note that research at universities produces not only ideas, but also people – the number one vehicle for technology transfer.

To summarize:

- Computing research – networking and information technology R&D – changes our world, drives our prosperity, enables advances in all other fields, and is essential to meeting our national and global challenges.

- The Federal government has played an essential role in fostering these advances through the NITRD program. The payoff has been an explosion of new technologies that have touched nearly every aspect of our lives, and the creation of new industries and millions of new jobs

- The future is bright. There is tremendous opportunity for – and tremendous need for – further breakthroughs.

- There also is tremendous need for well-educated graduates.

- The Federal government's role in fostering these advances – in supporting fundamental research in computing – is essential. *Federal investment doesn't supplant private sector investment – it complements it.*

Thank you again for the opportunity to testify today.