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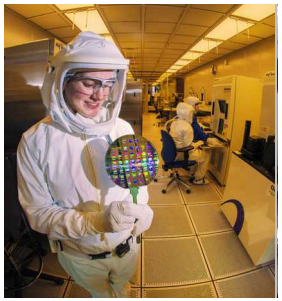
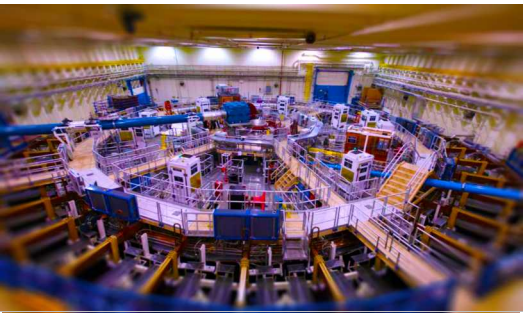




Sandia National Laboratories

Exceptional service in the national interest

Chief Technology Officer Update

Presentation to Sandia Emeritus

March 15, 2016

Rob Leland

Vice President, Science & Technology

Chief Technology Officer

U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Sandia Science & Technology Park (SS&TP)

Sandia National Laboratories

- Master-planned technology community
- Affiliated with Sandia
- Provides ease of access, close proximity to Labs
- Internationally recognized

Public-private partnership

Sandia National Laboratories

ORIGINAL PARTNERS

- Created vision
- Provides executive-level champion
- Provides executive director and program staff
- Manages day-to-day activities, including marketing

Sandia National Laboratories

SANDIA SCIENCE & TECHNOLOGY PARK DEVELOPMENT CORPORATION

- Nonprofit entity that oversees the Park
- Helped shape vision
- Provides Chairman of the Board
- Manages grants and infrastructure

City of Albuquerque Tricentennial 1706–2006 New Mexico

- Shared vision
- Funds infrastructure

Park MOU Signatories

LAND OWNERS

APS

UDC Union Development Corporation

New Mexico State Land Office

- Sell and lease land
- May build and own buildings

OTHER KEY PARTNERS

Provided planning funds

Provide telecommunications infrastructure

Provide infrastructure

PNM

Provide economic impact analyses

Provide leadership and support

SS&TP metrics and economic impact

Sandia National Laboratories

METRICS	
Number of Companies	40
Number of Employees	2304
Number of Buildings	25
Acreage Developed (out of 340)	125
Funds In to Sandia from Park Companies since 1998	$17.7 million
Contracts from Sandia Procurement to Park Companies since 1998	$408 million
Contracts between Park Companies since 1998	$10.4 million
Public and Private Investment in the Park since 1998	
Public	$89.0 million
Private	$279.3 million
Total	$368.3 million
ECONOMIC IMPACT	
Cumulative Impact on Taxable Personal Consumption (Goods and Services)	$2.2 billion
Cumulative Increase in Wage and Salary Disbursements Attributable to Park Activities	$3.7 billion
Average Salary for Each Full-Time Job in the Park	$83,300
Average Salary for Each Full-Time Job in Albuquerque	$41,900

Next phase for Sandia Science & Technology Park

Center for Collaboration & Commercialization (C3)

Sandia National Laboratories

Vision: "Sandia's Innovation Ecosystem" – A place located in SS&TP that would bring Sandia and its partners together to stimulate open collaboration and the commercialization of our technologies

Strategy: Increase Sandia's collaboration and commercialization activities

Strategic Objectives:

- Create an inspiring and energizing place that would serve as a "public face" for Sandia, provide access to Sandia, and build linkages with the external community
- Provide programs and services to maximize interaction with our broad array of partners – industrial/private sector, academic, and government – and facilitate successful technology commercialization

Proposed C3 facility

50,000 square feet
(20,000 square feet for Sandia)

Goal: LEED Gold Certified

CENTER for COLLABORATION and COMMERCIALIZATION

Sandia National Laboratories

Place (proposed)

- 50,000-square-foot facility, located in the Sandia Science & Technology Park
- **Private sector's role**
  - Build a private sector building on private sector land
  - Partner offices
  - Incubator and co-working space
  - 400+ person conference room and small conference rooms
  - Café/Catering kitchen
  - Social spaces
- **Sandia's role**
  - Sandia would lease 20,000 square feet
  - Sandia offices
  - Sandia conference room
  - Sandia technology showroom

Programs/Services

- Entrepreneur exploration
- Technology showcase
- Interactive IP library
- Technology maturation
- Small business assistance
- Investor access
- Scientific and technical consulting
- Retiree mentors

Leadership actions

- **October 2014:** Sandia hosts news conference to announce C3
- **January 2015:** Rob Leland agrees to serve as Executive Level Champion for Sandia
- **January 2015:** General Klotz cites C3 in discussion with Kirtland Partnership Committee
- **March 2015:** U.S. Senator Martin Heinrich introduces Microlab Technology Commercialization Act
  - Accelerate technology transfer by establishing off-campus microlabs to serve as "front doors" to national laboratories
  - Incorporated into the National Defense Authorization Act

- **April 2015:** General Klotz cites C3 in testimony before U.S. Senate Committee on Armed Services Subcommittee on Strategic Forces
- **July 2015:** Labs Director Jill Hruby agrees to support and move forward with C3
- **September 2015:** Sandia Field Office manager Jeff Harrell briefed

Entrepreneur Exploration Program

- Invigorate – Inspire - Increase
  - Invigorate entrepreneurial culture
  - Inspire entrepreneurs
  - Increase number of entrepreneurs
- Entrepreneur database (525+ Sandians)
- Events (400+ Sandia participants)
  - Entrepreneur Office Hours
  - Entrepreneur Roundtables
  - Entrepreneur Workshops
  - National Speakers Series (coming soon)

Sandia's commitment

- Lease space in C3, a multi-tenant facility to be built by the private sector on private sector land (less than half the space in the proposed building)
- Provide programs and services in C3, such as licensing support, small business assistance, entrepreneurial training, technology maturation, and year-round showcase
- Align with city of Albuquerque and University of New Mexico efforts

Innovation Corridor

Innovate ABQ
- To be developed
- +/- 7 acres
- Innovation, Office, Residential
- Live, work, play concept
- Leveraging physical proximity to UNM and Downtown

C3
- To be developed
- 50,000 sf building
- Public face of Sandia, easy access to Sandia
- Leveraging physical proximity to Sandia

ABQid/Verge Building

Air Force Research Laboratory

BioScience Center

FatPipe

Sandia Science & Technology Park

Technology Ventures Corporation

WESST

The National Strategic Computing Initiative

Office of Science and Technology Policy

Rob Leland

May, 2014

Strategic dimensions

SCIENTIFIC DISCOVERY

- HPC accelerates scientific discovery
- Traditional simulation
  - Applicable in nearly every domain
  - A "third branch" on par w/ theory & experiment
- Big Data Analytics
  - Recent success
    - Human genome
    - Higgs particle
  - A "fourth paradigm"
- *A transformative enabler*

NATIONAL SECURITY

- Leadership in HPC has been critical since the 1940's
- Then
  - Design of H-bomb
  - SIGINT
  - ballistics tables
- Now
  - Safety/security of NW
  - SIGINT
  - military HW design
  - Counterterrorism, etc.
- *A decisive strategic advantage*

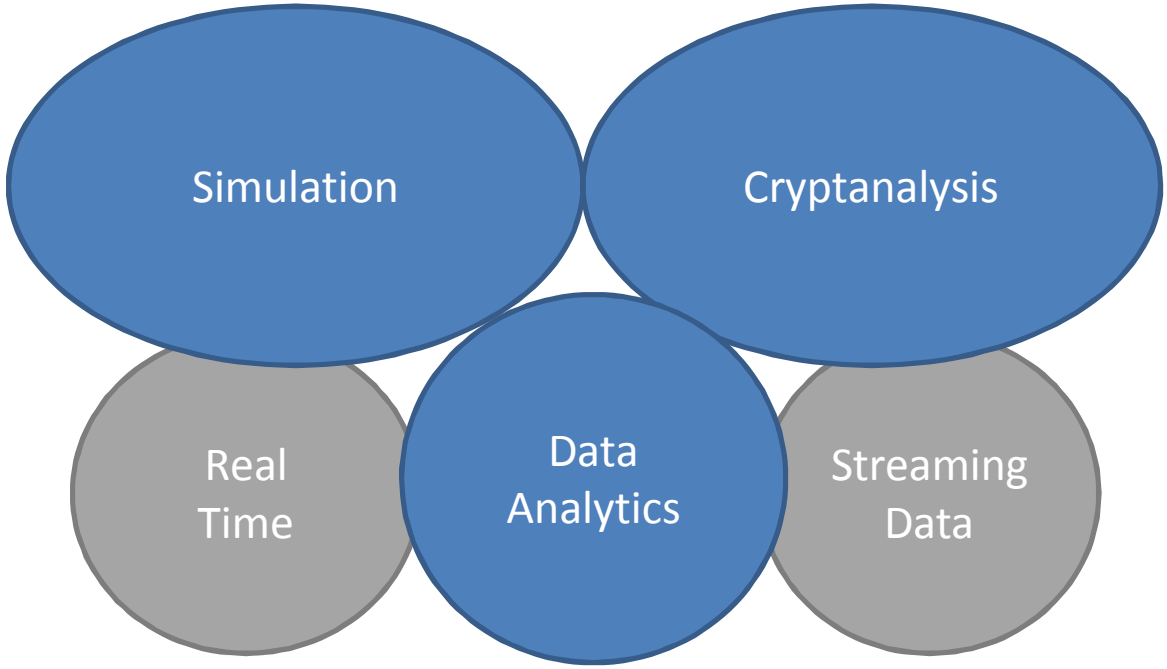
ECONOMIC COMPETITIVENESS

- Many economic benefits of leadership in HPC
- Traditional simulation
  - Energy production
    - Oil & Gas
    - Renewables
  - Virtual engineering
    - Automotive
    - Aerospace
    - Consumer, etc.
- Big Data Analytics
  - Health care
  - Retail
  - Manufacturing
- *A key competitive advantage*

Major strategic trends affecting HPC

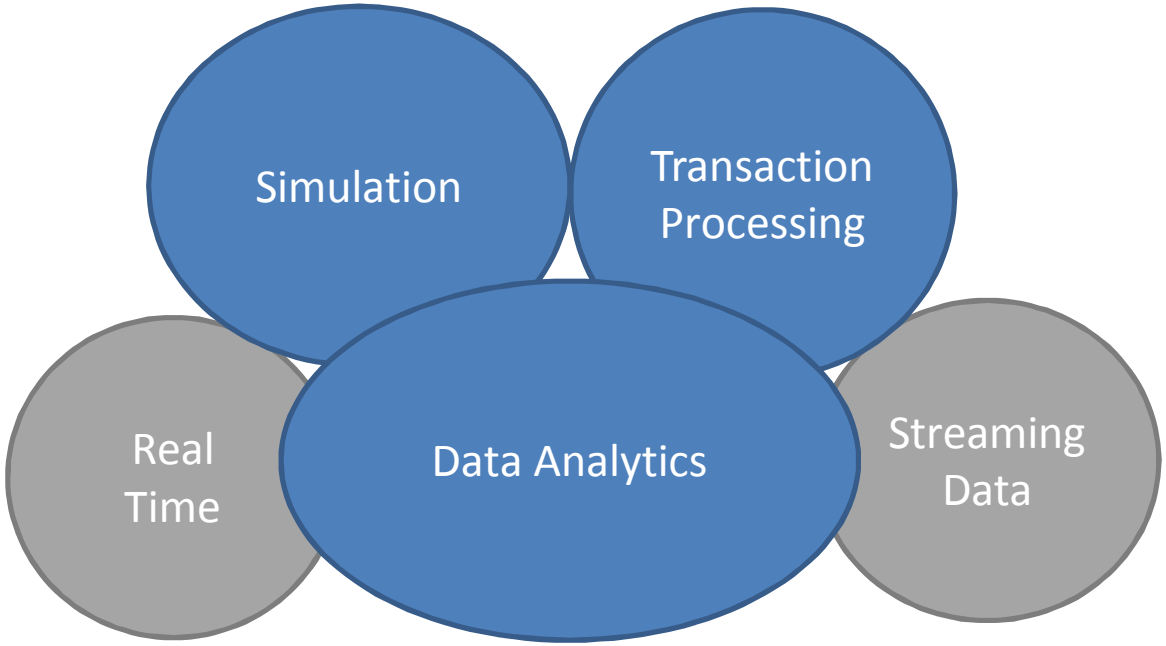
- **Increasing foreign investment in HPC**
  - U.S. previously dominated, with investment on par with rest of world combined
  - Went through an inflection point about 5 years ago
- **Departure from Moore's Law**
  - Lithographic scaling of semiconductors is approaching physical limits
  - No clear successor to standard CMOS technology
- **Rise of Big Data**
  - Traditional HPC hardware and software poorly suited to Big Data problems
  - Emerging problem spaces require improved memory & data mobility
- **Movement off-shore of much of microelectronics industry**
  - US control of the HPC ecosystem at risk
  - Supply chain risks increased
- **End of Massively Parallel Processing (MPP) era of stability**
  - Provided a stable target for software which was largely preserved between generations
  - Entering a period of architectural exploration with less software stability

Key HPC capabilities for federal agency missions



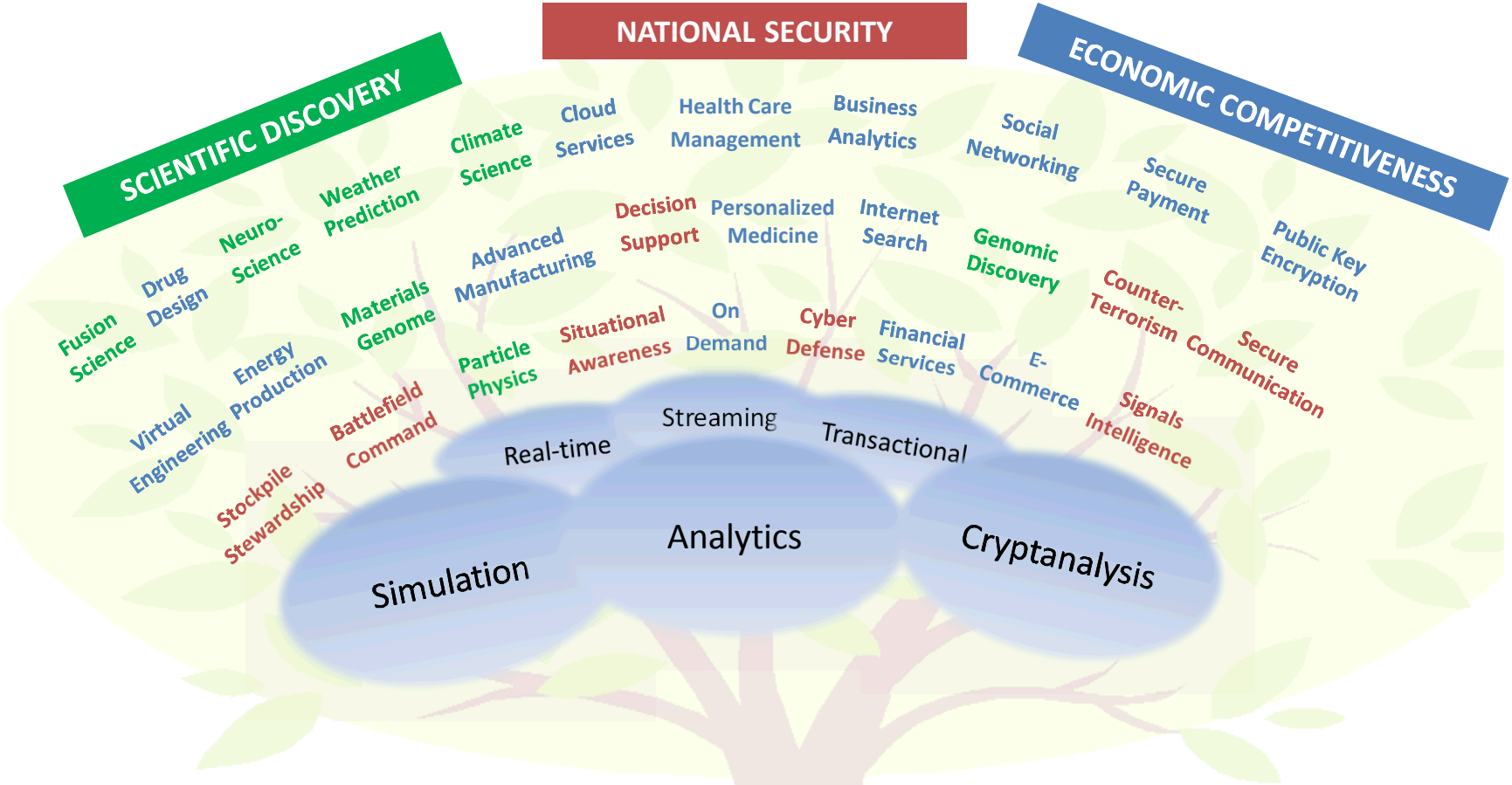
- **Simulation:** Large-scale, high fidelity simulation of partial differential equations for multi-physics models
- **Cryptanalysis:** Conversion of encrypted data to plaintext
- **Data analytics** on massive data stores
- **Streaming:** Real time analysis of high-speed streaming data
- **Real time:** decision support for deployed systems

Key HPC capabilities for private sector



- **Data analytics** on massive data stores
- **Simulation:** Large-scale, high fidelity simulation of partial differential equations for multi-physics models
- **Transaction Processing:** information exchange and processing
- **Streaming:** Real time analysis of high-speed streaming data
- **Real time:** decision support for deployed systems

NSCI ecosystem



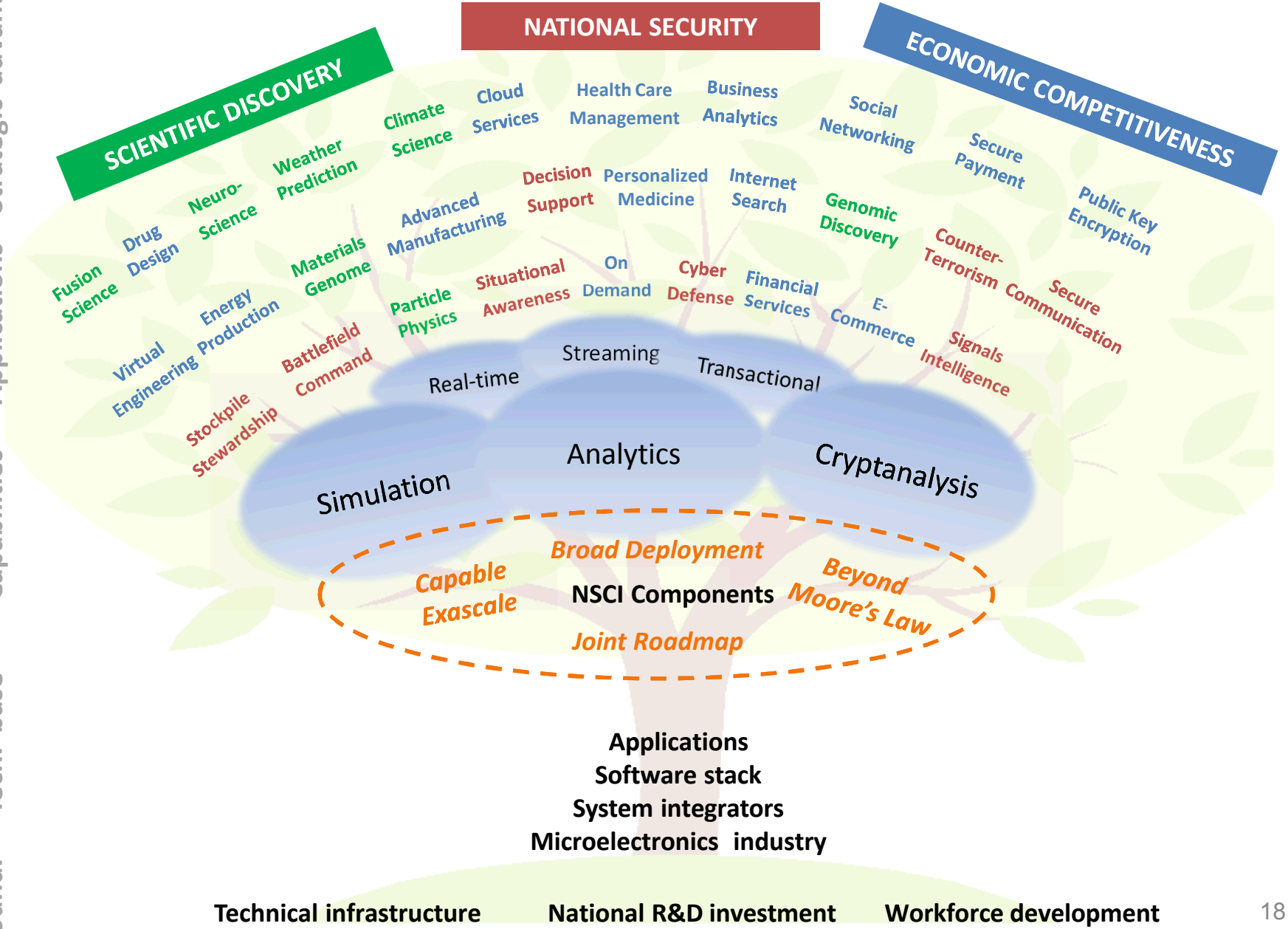
Computational & data sciences
Uncertainty quantification
Verification & validation
Domain specific codes

Applications
Software stack
System integrators
Microelectronics industry

Algorithms & tools
Computing & math. sciences
System software

Technical infrastructure **National R&D investment** **Workforce development**

NSCI vision


NATIONAL SECURITY
SCIENTIFIC DISCOVERY
ECONOMIC COMPETITIVENESS
Climate Science
Cloud Services
Health Care Management
Business Analytics
Social Networking
Secure Payment
Public Key Encryption
Weather Prediction
Neuro-Science
Drug Design
Fusion Science
Advanced Manufacturing
Materials Genome
Energy Production
Virtual Engineering
Decision Support
Personalized Medicine
Internet Search
Genomic Discovery
Counter-Terrorism
Secure Communication
Signals Intelligence
E-Commerce
Financial Services
Cyber Defense
On Demand
Situational Awareness
Particle Physics
Battlefield Command
Stockpile Stewardship
Real-time
Streaming
Transactional
Simulation
Analytics
Cryptanalysis
Broad Deployment
Capable Exascale
NSCI Components
Beyond Moore's Law
Joint Roadmap
Applications
Software stack
System integrators
Microelectronics industry
Technical infrastructure
National R&D investment
Workforce development
Found.
Tech. base
Capabilities
Applications
Strategic advantage

Strategic objectives

- **Deliver, within a decade, a "capable" exascale computing system that integrates hardware and software capability to deliver approximately 100X the performance of current 10PF systems across a range of applications reflecting government mission needs for simulation.**
- **Create, over the next five years, substantially increased synergy between the technology base used for simulation and that used for analytic computing.**
- **Deliver, within a decade, advanced HPC technology to meet national security computing needs in data analytics and cryptanalysis.**
- **Establish, over the next 15 years, a viable path forward for future HPC systems in the post Moore's Law era.**
- **Develop, on a continuing basis over the next 15 years, a system-level optimization of the national HPC ecosystem that addresses networking, workflow, and workforce development challenges.**
- **Develop, on a continuing basis over the next 15 years, a public-private partnership to assure that the benefits of these research and development advances can be applied in the US commercial sector.**


EXECUTIVE OFFICE OF THE PRESIDENT OF THE UNITED STATES
OFFICE OF SCIENCE AND TECHNOLOGY POLICY

Principles

- **The U.S. must be the first to create and deploy new HPC technology with substantial national security benefits.**
- **The U.S. must be the first to leverage this technology broadly for economic competitiveness and scientific discovery.**
- **The NSCI is a public-private partnership that relies on the respective strengths of government, industry and academia.**
- **A "whole-of-government" approach that draws upon the strengths of and seeks synergy between all federal departments and agencies with significant expertise in HPC is needed.**
- **A comprehensive technical approach that integrates theory and practice, software and hardware is needed.**

Intent

- **National**
  - "Whole of government" approach
  - Public/private partnership with industry and academia
- **Strategic**
  - Leverage beyond individual programs (a key "platform" technology)
  - Long time horizon (decade or more)
- **Computing**
  - HPC = most advanced, capable computing technology available in a given era
  - Multiple styles of computing and all necessary infrastructure
  - Scope includes everything necessary for a fully vertically integrated capability:
- **Initiative**
  - Above baseline effort
  - Link and lift efforts

Enhance US strategic advantage in HPC for security, competitiveness, and discovery