Measuring the United States Measurement System

Clare Allocca
Chief, United States Measurement System Office
National Institute of Standards and Technology

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Introduction

- NIST Introduction
- United States Measurement System (USMS) background
  - What is the USMS?
  - 2007 Assessment Results
  - Permanent Office / 2008+ Activities
- Measurement Needs (MN) and Assessment
- Measurement Knowledge Hub
- What next?

NIST Today: Mission

- To promote U.S. innovation and industrial competitiveness by advancing

- measurement science,
- standards, and
- technology
-

in ways that enhance economic security and improve our quality of life

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NIST provides the “innovation infrastructure”

The equivalent of research “roads and bridges” the industrial and scientific communities need to develop and commercialize new technologies

- Groundbreaking research tools that foster new fields — quantum information, nanotechnology, bioscience
- Evaluated data for technology development
- Better measurement methods to ensure quality
- Performance measures for accurate technology comparisons
- Standards to assure fairness in trade

NIST has… … two main campuses

Gaithersburg, MD

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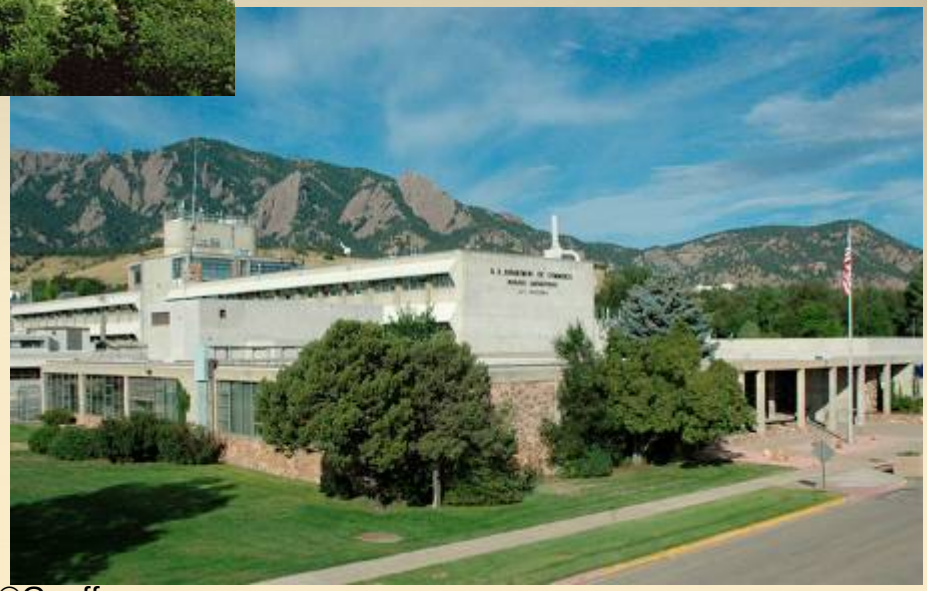
Boulder, CO



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NIST has… ...four joint institutes

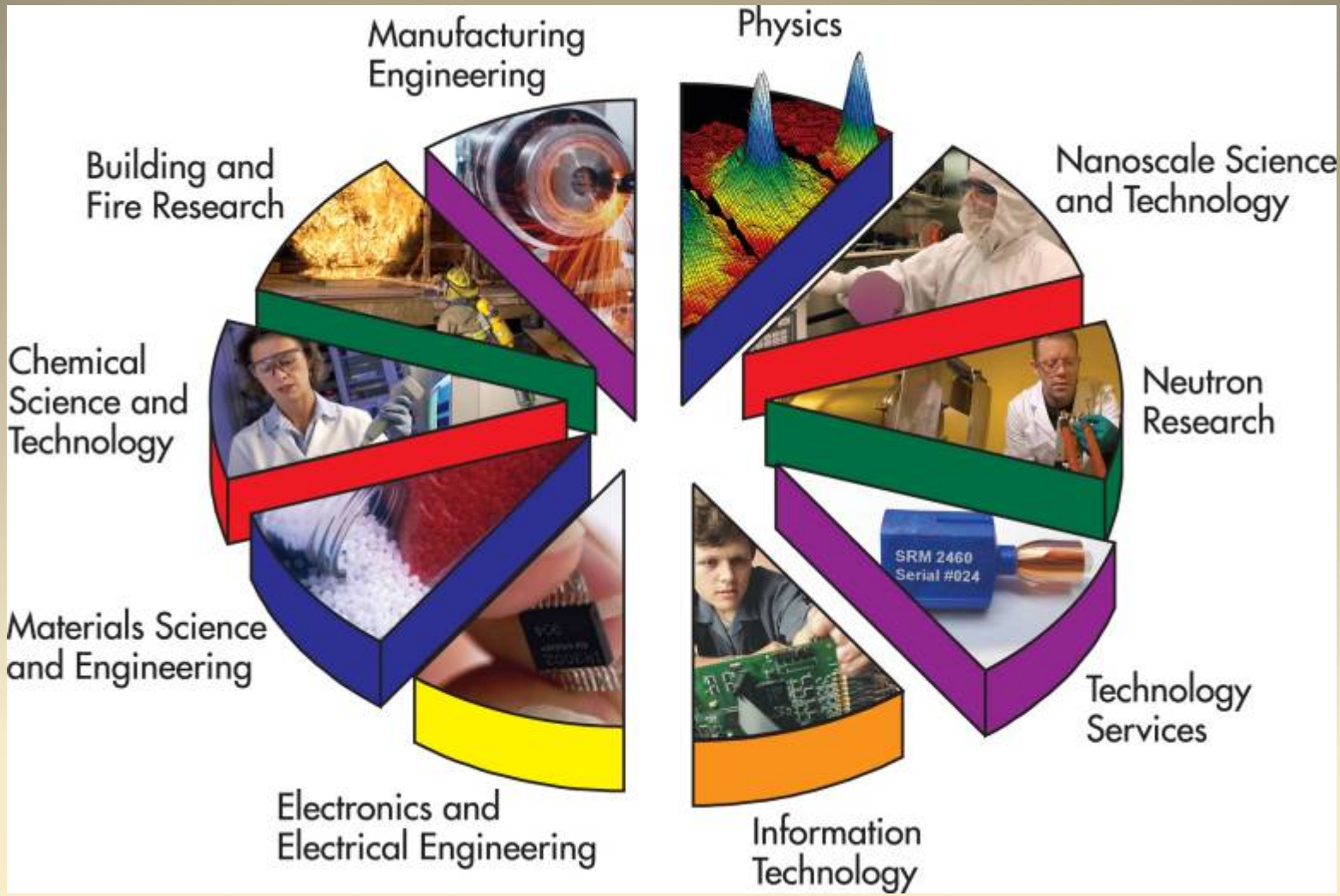
JILA
NIST + University of Colorado

Center for Advanced Research
in Biotechnology
NIST + University of Maryland

Joint Quantum Institute
NIST + University of Maryland + NSA

Hollings Marine Laboratory
NIST + NOAA + South Carolina
+ College of Charleston
+ Medical University of South Carolina

The NIST Laboratories



NIST Extramural Programs

Hollings Manufacturing Extension Partnership

•Nationwide network of resources helping smaller manufacturers compete globally

Baldrige National Quality Program

•Promoting and recognizing performance excellence via information and Presidential awards in manufacturing, service, small business, education, health care, and the nonprofit sector

Technology Innovation Program

•Supports development of cutting edge technologies by the private sector and universities to address critical national needs

Courtesy Stoner Inc.

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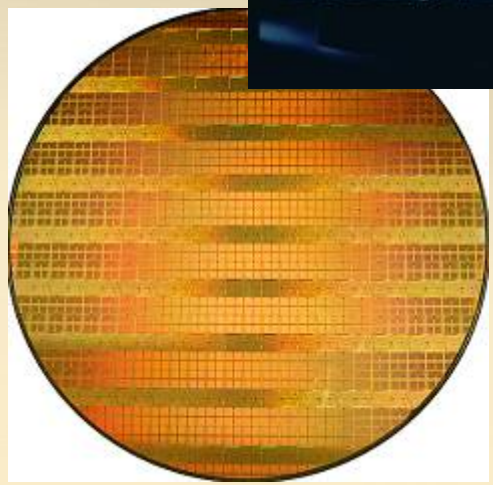

Courtesy intel Inc.

NIST has… … unique facilities

Advanced Measurement Laboratory

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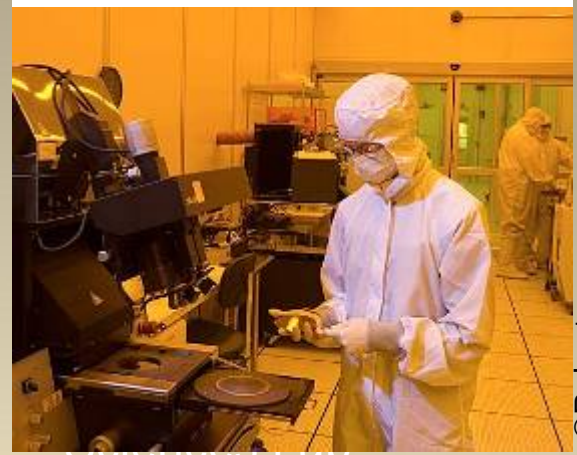
Center for Nanoscale Science & Technology



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NIST Center for Neutron Research

Advanced Chemical Sciences Laboratory

NIST Products and Services

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Measurement Research

- ~ 2,200 publications per year

Standard Reference Data

- ~ 100 different types
- ~ 6,000 units sold per year
- ~ 130 million data downloads per year

Standard Reference Materials

- ~ 1,300 products available
- ~ 33,000 units sold per year

Calibration Tests

- ~ 16,000 tests per year

Laboratory Accreditation

- ~800 accreditations of testing and calibrations laboratories per year

NIST Future: Overcoming Barriers to Innovation

- **USMS**: The set of measurement solution providers and users, and the relationships between them
- **USMS Program Mission**: To promote U.S. innovation and industrial competitiveness
  - By increasing the effectiveness and efficiency of the USMS in developing and deploying measurement solutions
    - By identifying and fostering efforts to address unmet measurement needs

To enhance economic security and improve the quality of life

Result: A roadmap to help NIST and other organizations plan research that accelerates innovation

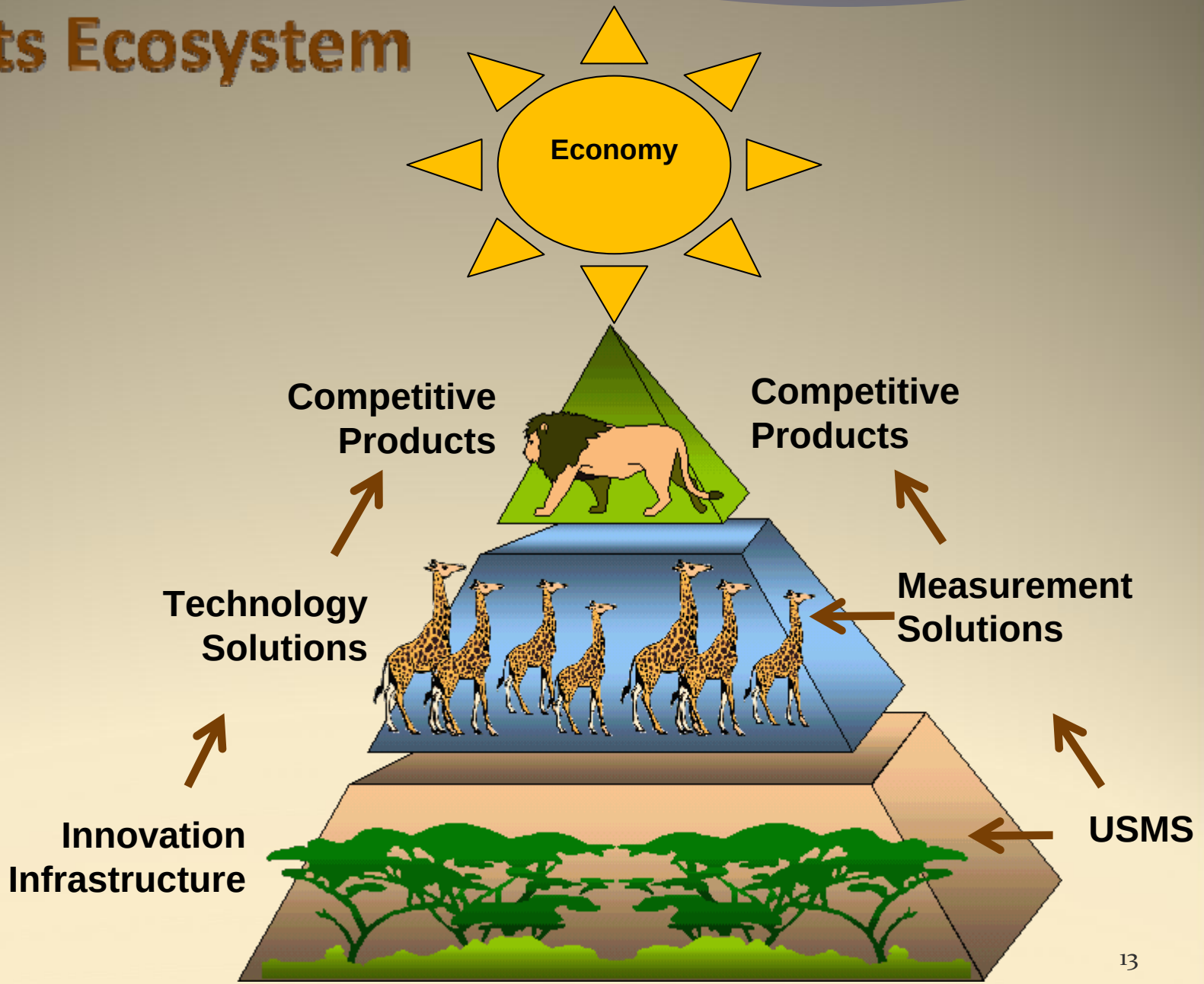
Documents 723 measurement barriers to innovation
Covers 11 industry sectors
Over 1000 contributors from industry, academia, and other government agencies

Measurement Needs Cross Sectors, Technologies

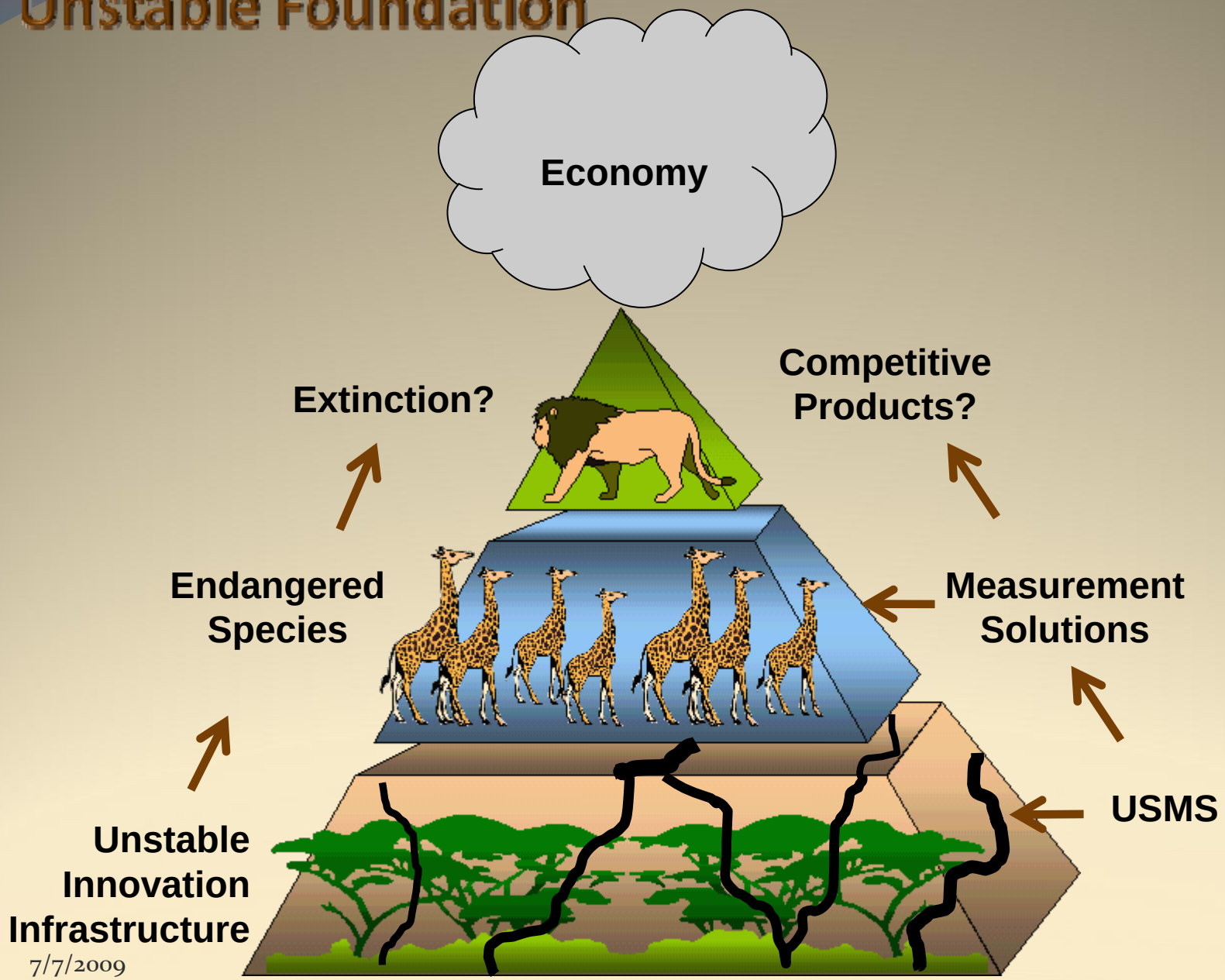
Needs Across 11 Sector/Technology Areas for…

- Increased Accuracy, Resolution
- Fundamentally New Measurement Methods
  - Some Existing Capabilities Pressed to Their Limits
  - Advances in Science & Technology, Changes in Society Require Novel Responses
- Affordable, Accurate Sensors for Real-Time Process Monitoring and Control
- Standards and Metrics for Evaluating System-Level Performance
- Practical, Cost-Effective Methods to

Business Case for USMS: US Innovation Products Ecosystem



The US Innovation Products Ecosystem with an Unstable Foundation



Why can't the USMS do what it has done in the past?

- What's Different?
  - Accelerated Product Development cycles
  - Increasingly Multi-disciplinary Technology Solutions
  - Increasingly Complex Measurement Solutions
- What can the USMS do?
  - Increase Effectiveness & Efficiency

Changing the Game by Innovating Innovation

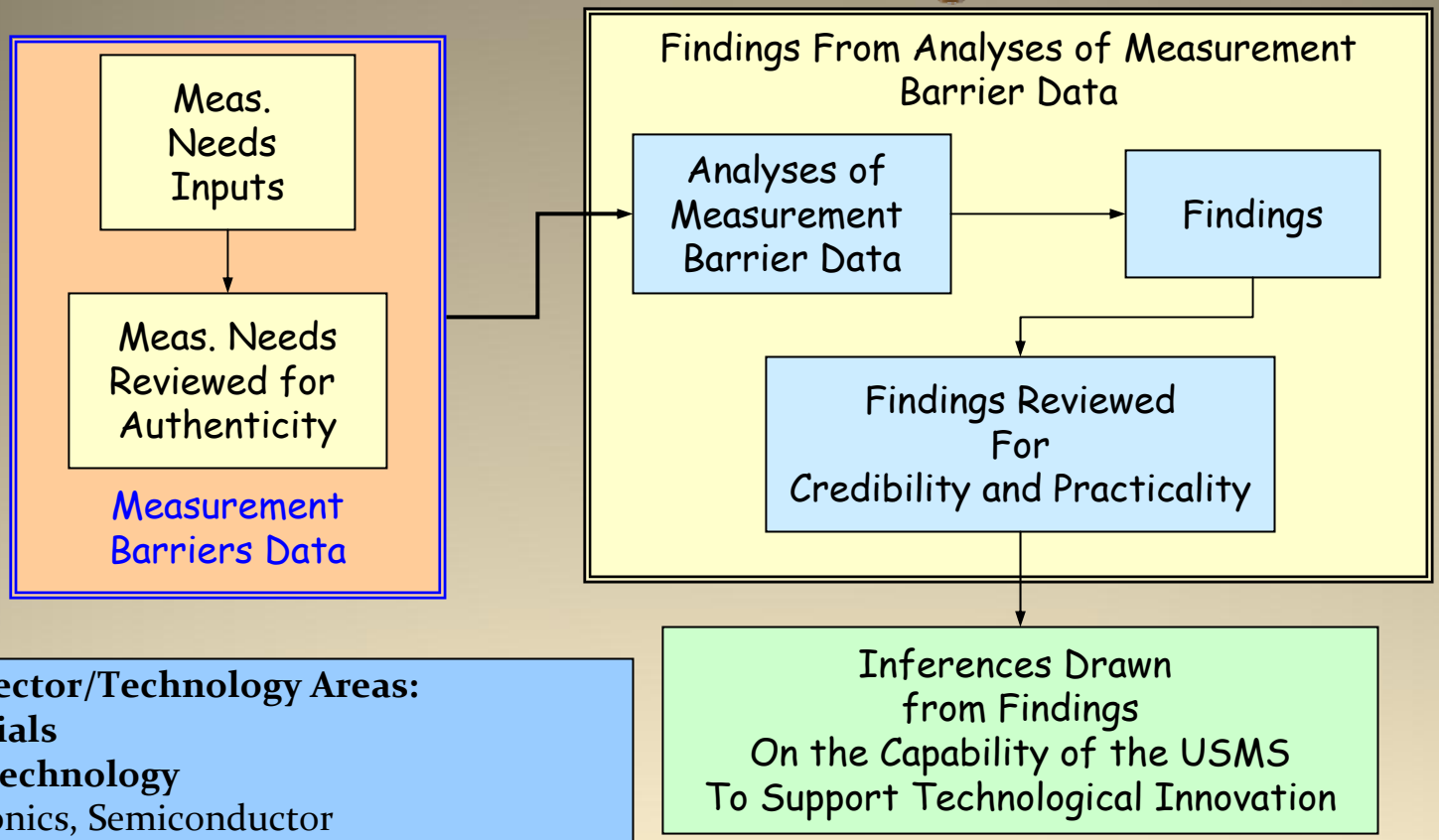
Establish Permanent USMS Program at NIST to Provide:

- **Access** to Measurement-related Information and Tools
  - Infrastructure for Continual Submission of Measurement Needs and Solutions
  - Awareness of Importance of USMS
- Enhanced Methodologies for Periodic **Assessment**s
  - Examination of USMS from Different Vantage Points
- **Action** to Stimulate Pursuit of Critical Unmet Measurement Needs
  - Platform to Maximize Efficiency and Effectiveness of USMS

Basis for Assessment: Authenticated Measurement Needs (MN)

- MN Template
  - Technological innovation at stake
  - Economic significance of the innovation
  - Technical barrier to the innovation
  - Stage of innovation at which technical barrier appears
  - Measurement-problem part of the technical barrier
  - Potential solutions to the measurement problem
  - Potential providers of these solutions
- Tags / Indicators
  - MN Characteristics that may be used to compare MNs
- Authentication
  - Evidence that MN represents a significant portion of Measurement Solution Users

Using Measurement Needs to Assess the State of the USMS: Measurement Barriers to Technological Innovation



Sector/Technology Areas:

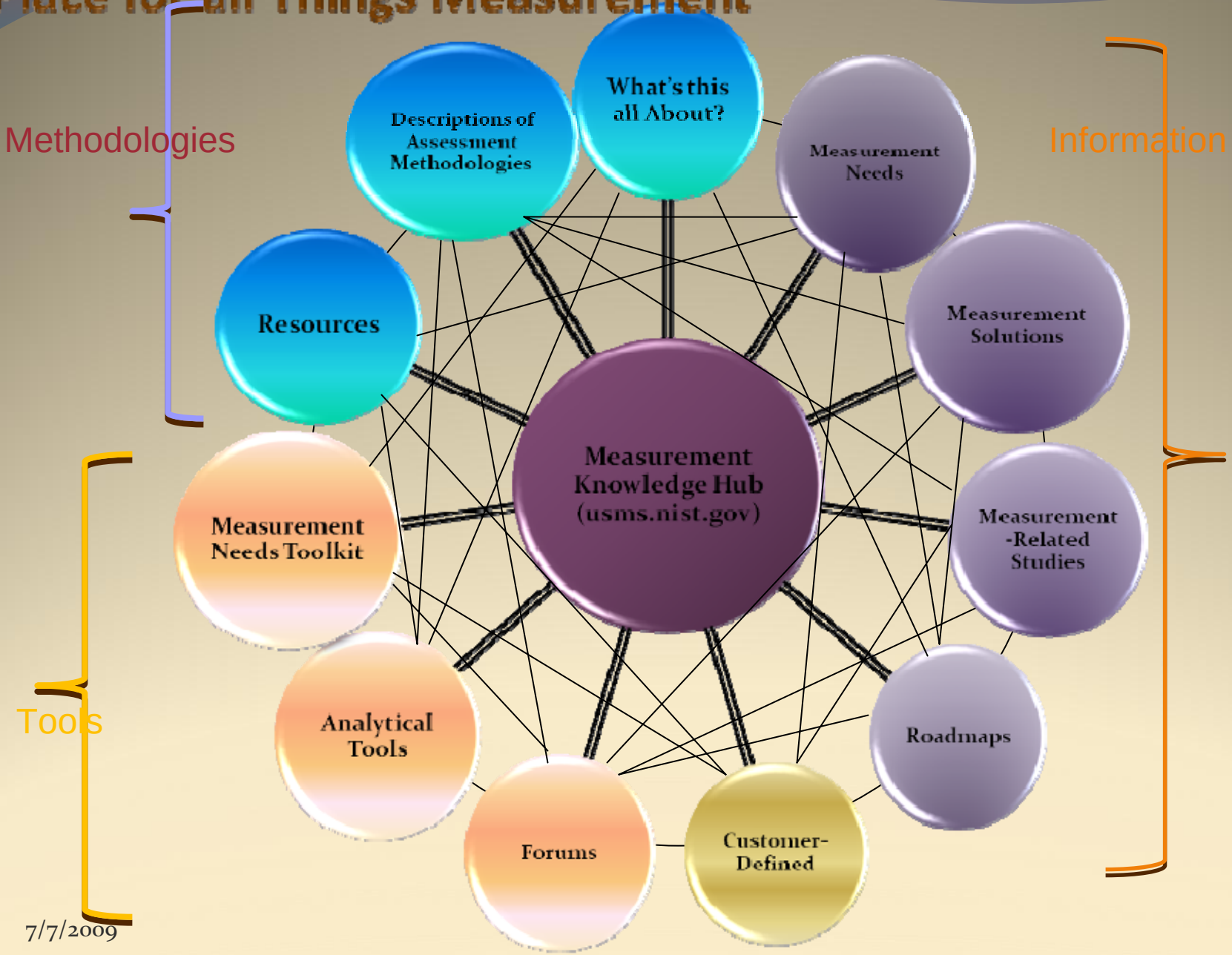
Materials
Nanotechnology
Electronics, Semiconductor
Electronics, Non-Semiconductor
Healthcare
Energy, Power and Environment
Manufacturing (Discrete), including Automotive
Building and Construction
Defense and Homeland Security
Chemicals and Continuous Manufacturing
IT Software

Over 700 measurement needs were identified in 11 sector/technology areas, with input from 322 individual measurement needs and 162 technology roadmaps

What's in all this for me?

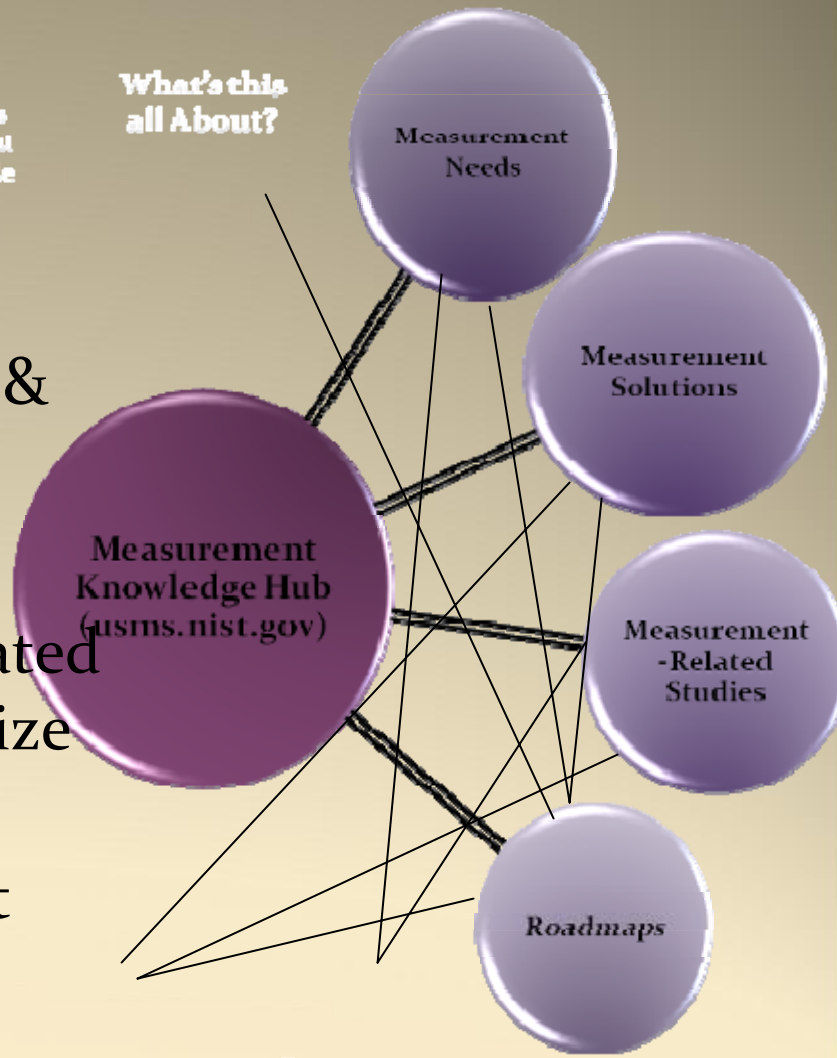
- Inform strategic decision making
- Understand customer needs
- Inform prioritization by customers
- Identify and authenticate existing measurement needs & solutions
- Identify opportunities
- Educate
- Communicate
- Accelerate development of measurement solutions

Measurement Knowledge Hub: A Web-based Meeting Place for all Things Measurement



Measurement Knowledge Hub: Information

- Information Resources for Measurement-Related Strategic Decisions, Education, Awareness & MN/MS Submission
  - News Blogs and/or Podcasts
  - Wikis to investigate unauthenticated measurement needs, or to prioritize measurement needs
  - Blogs to investigate measurement solutions



Information: Measurement Needs

- MN submission portal
- User accounts
- Guidance for MN template, tags, and authentication
- MN submission to NIST QA team
  - QA team to communicate directly with authors

Information: Measurement Solutions

- Resolved measurement needs
- Available USMS products, including SRMs, Standards, Measurement methods…
- USMS Solution Provider Research Areas
- Searchable
- Template under development

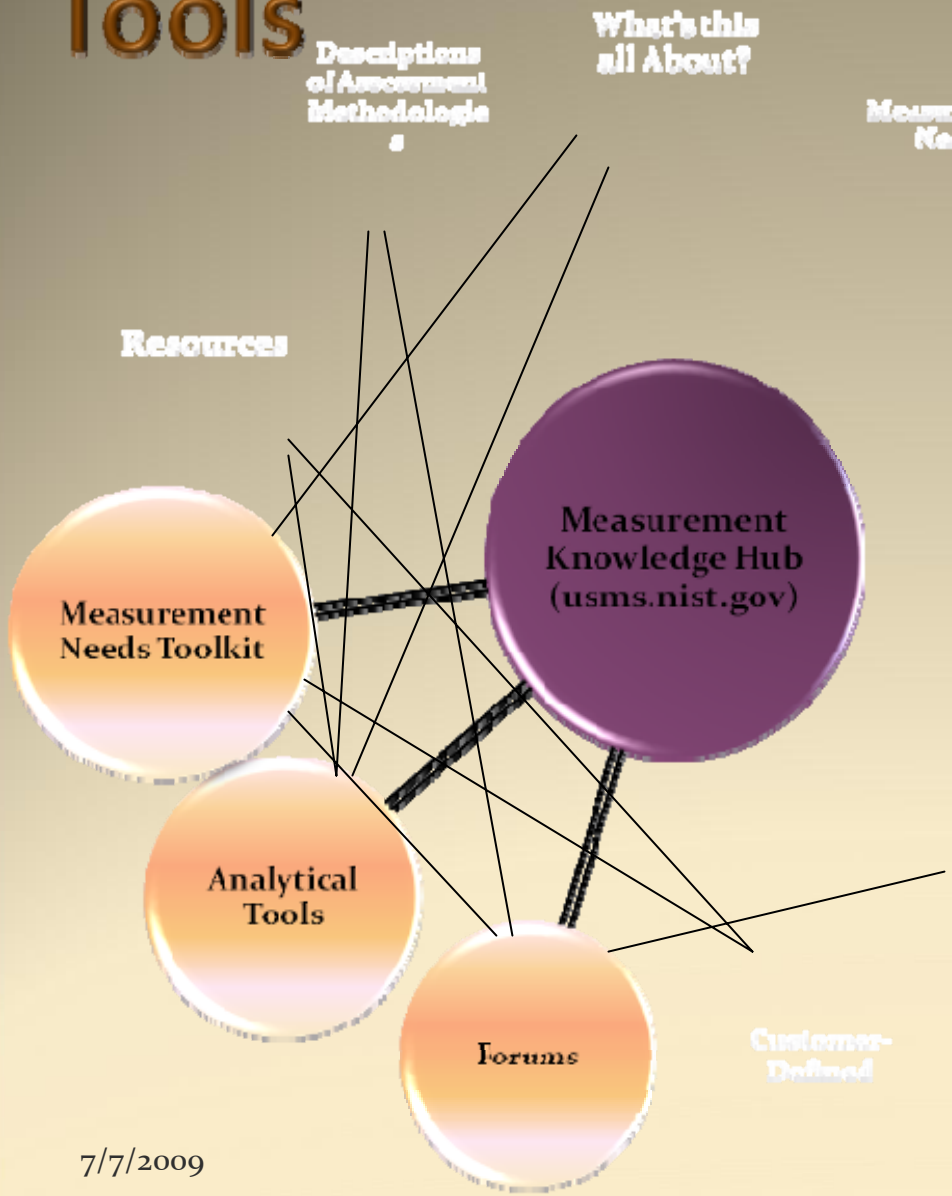
Information: Measurement-Related Studies

- USMS assessment reports / documents
- Other studies specific to measurement (NIST and non-NIST authors)

Information: Roadmaps

- Access to USMS-I roadmaps
- Roadmap database is currently being updated

Measurement Knowledge Hub: Tools



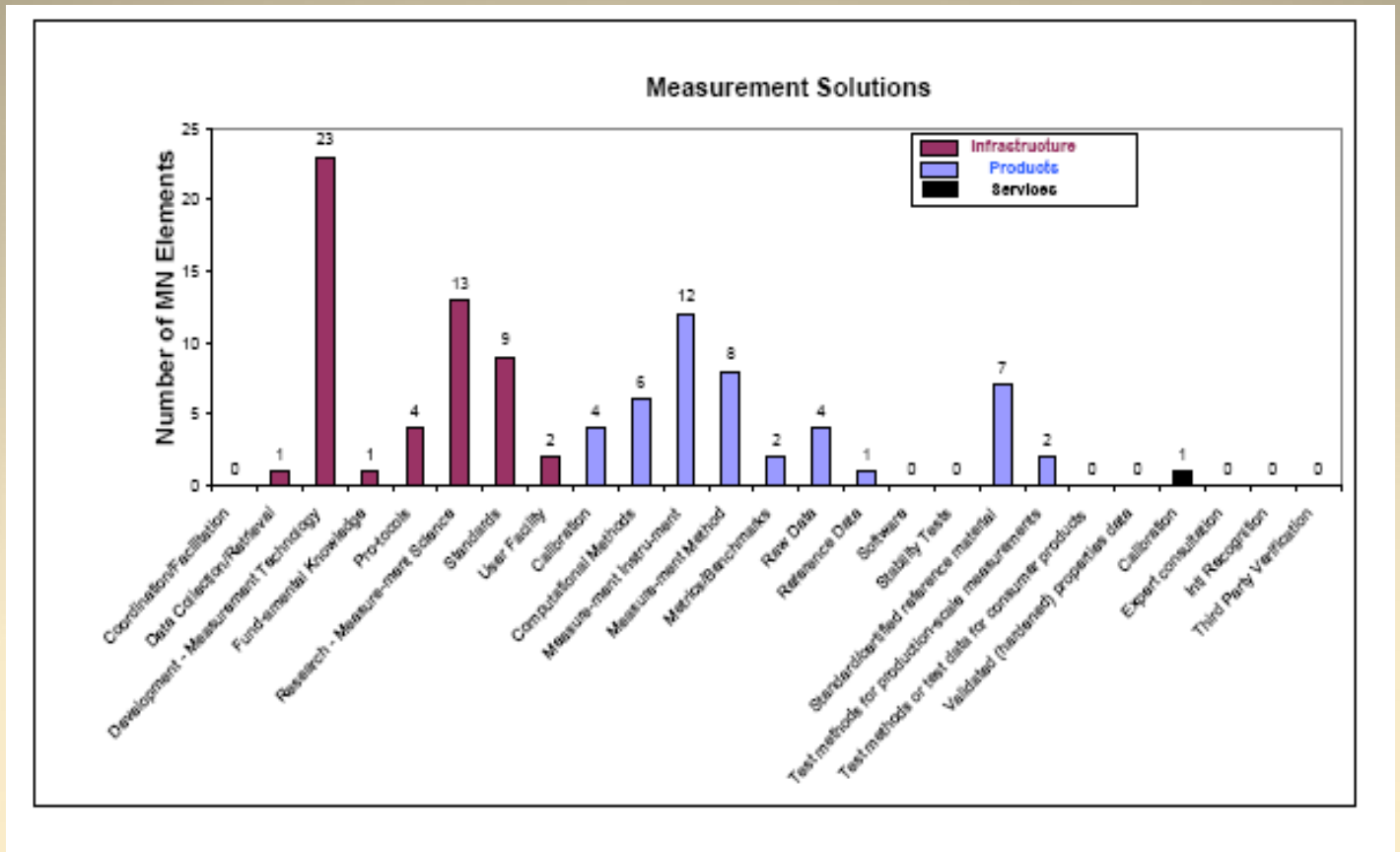
- Tools for analysis of information
  - Webinars , materials for the conduct of measurement needs workshops
  - Online query assistance
  - Blogs moderated by subject experts
  - Wikis for the development of measurement solutions databases

Tools: Measurement Needs Toolkit

- Explanation of USMS (Overview)
- Cues and Clues (characteristics of a good MN)
- Mechanisms for developing Measurement Needs
  - Individual consultations
  - Suggestions for conduct of MN Workshops
    - Pre-work (Who to invite and how)
    - Conduct
      - Potential agendas (1/2,1,1.5,2 days)
    - Post-work
      - How to use groups of MNs to inform strategic decision making & measurement solution development
  - Other mechanisms

Tools: Analytical Tools

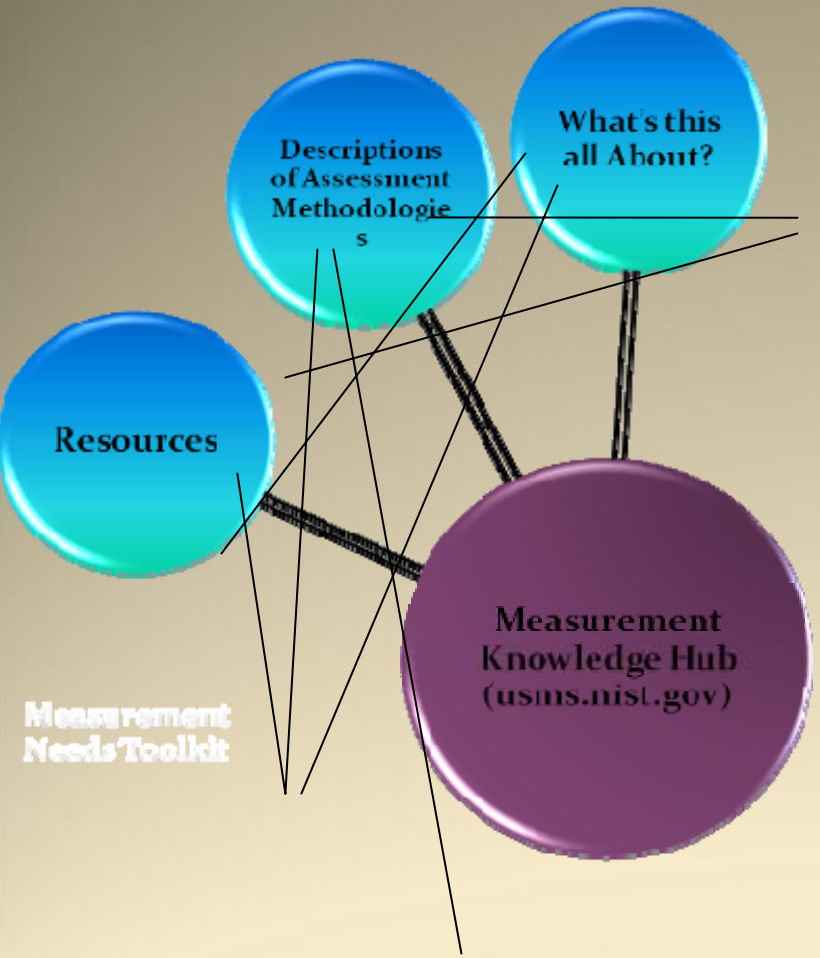
- Extension of statistical tools used during the USMS Phase I assessment



Tools: Forums

- Technology and/or market specific
- Wikis
- Blogs
- Webinars
- Other communications mechanisms as appropriate
- Links to conferences, workshops, and events

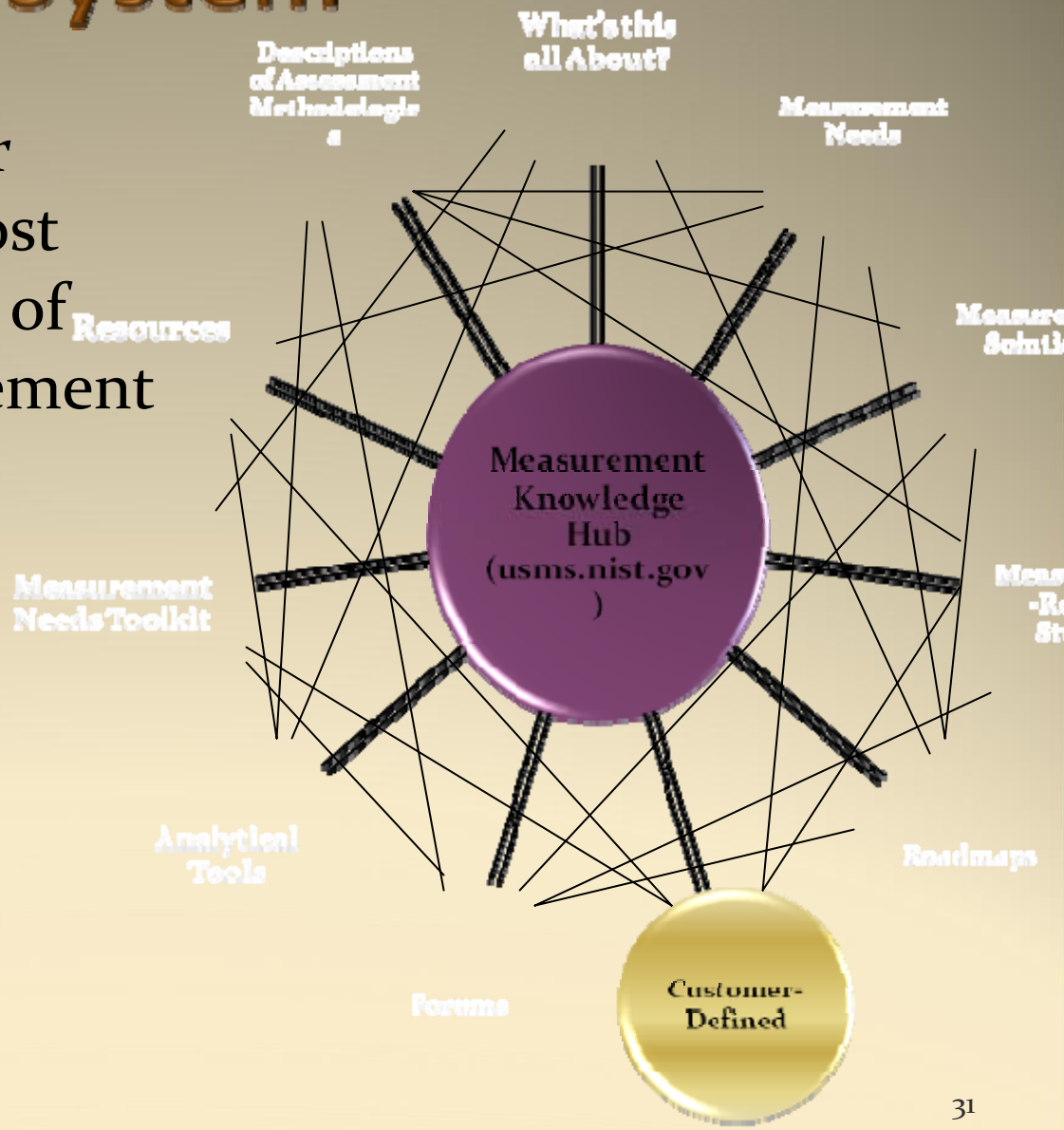
Measurement Knowledge Hub: Methodologies



- Resources for the understanding of approaches to analyses / assessments

Measurement Knowledge Hub: Living, Evolving System

- Customer / Stakeholder feedback will be the most important determinant of changes in the Measurement Knowledge Hub



The USMS: Looking Ahead

- Submit or solicit measurement needs (MNs)
- Conduct workshops to produce MNs
- Analyze MNs or groups of MNs
- Participate in USMS workshops / functions (detailed on http://usms.nist.gov)
- Work with other organizations to evaluate / prioritize MNs
- Participate in USMS working groups
- Use the Measurement Knowledge Hub

Assess the state of the measurement system in the context of the next generation of innovation

What's Next?

- Unveil Measurement Knowledge Hub
- Release Assessment Report #2
- Continue to pursue Resources for Unmet Critical Measurement Needs

The US Measurement System…

…transforming
Measurement Needs
Into
Measurement Solutions

For more information:
Website: http://usms.nist.gov
Contact: Clare Allocca, Chief, USMS Office,
Clare.allocca@nist.gov /301-975-4359

Breakout Sessions (and Beyond)

- Review current Measurement Needs
- Identify further Measurement Needs
- Prioritization of Measurement Needs
- Path to Measurement Solutions
- Definition of long-term Working Groups

While Listening to Presentations…

- What are the most critical Measurement Needs?
- Which critical Measurement Needs were not mentioned?
- How might we arrive at Measurement Solutions?
  - Approaches
  - Resources
  - Players