



First SDP Workshop

- **Goals**
 - Bring together leading-edge researchers and practitioners
 - Encourage brainstorming and out-of-box thinking
 - Inform the research agenda
 - Raise the visibility of SDP
 - Involve Federal agencies and research community
- **Participants from**
 - 14 universities and non-profits
 - 8 commercial enterprises
 - 11 Government agencies

Panel Organization



- **Future of Software and Software Research**

Software's rapid penetration throughout the economy challenges fundamentals underlying software research and how research is conducted.

- **New Software Development Paradigms**

Software is increasingly the universal integrator for large-scale and possibly network-centric distributed “systems of systems.” Paradigms are needed for systems that are very complex and larger than previously built systems.

- **Software for the Real World**

There are vast numbers of embedded systems with behavior constrained by the physical world. We need principled methods for composition and integration of such constraints with conventional functional requirements and components.

- **Software for Network-Centric Distributed Systems**

Challenges include latency hiding, partial failure, causal ordering, dynamic service partitioning, and distributed deadlock avoidance. Techniques for end-to-end quality of service frameworks, multi-level distributed resource management, and adaptive and reflexive middleware are also needed.



Expanding Challenges for Software Design

- From Unattended to Human-Centric
- From Legacy to Net-Centric
- From Desktop to Embedded and Mobile-Global
- From Stand-Alone to Complex Systems of Systems
- Long-Lived and Pervasive
- Multi-Intent and Multi-Faceted
- Accidental complexity:
Incompatible models, languages, platforms, methods,
standards

Expanding Challenges for Software Productivity



- Larger and more diverse systems
- Pervasive demand
- Increased criticality
- Global teams and interoperability
- Workforce



Barriers and Challenges

- Intellectual control over
unbounded complexity
- Systems are
distributed
heterogeneous
hybrid
untrusted



Representative Goal Space

- Formal, repeatable *Software Engineering* discipline
- Software that provides consistent experience
- Software that self configures and self repairs
- Systems of large numbers of low-cost, redundant throwaways
- Load-adaptive behavior
- New types of systems and system support



Sample Solution Space Needs

- Trade-offs among managed properties
- Move away from one-size-fits-all
- Multi-level middleware:
 - Quality of Service (QoS) at all levels
- Support for multiple points of view
- Redefine the “what” of programming
and the “who” of programmer
- New ways to conceptualize and realize systems

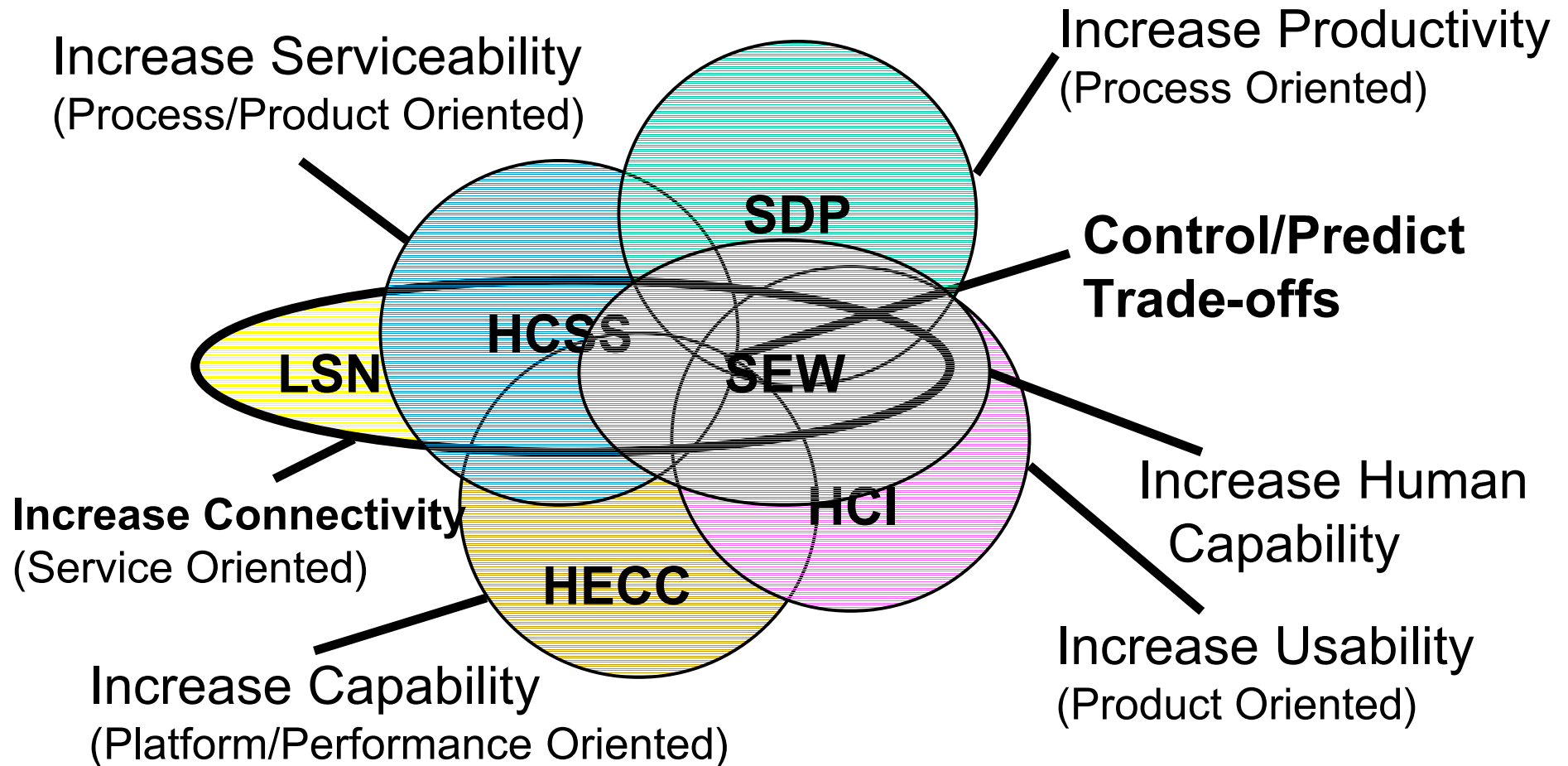
Sample Solution Space Needs



- **New high-productivity construction paradigms — examples:**
 - Aspect oriented
 - Intentional approaches
 - Compositional methods
 - Multi-view abstractions and environments
 - Rich modalities for capturing programmer intentions
 - Change the meaning of “program” and “programmer”
- **New workforce solutions**
 - Education and training
 - Empowering end users: Domain Specific Languages (DSLs)
 - Open software development



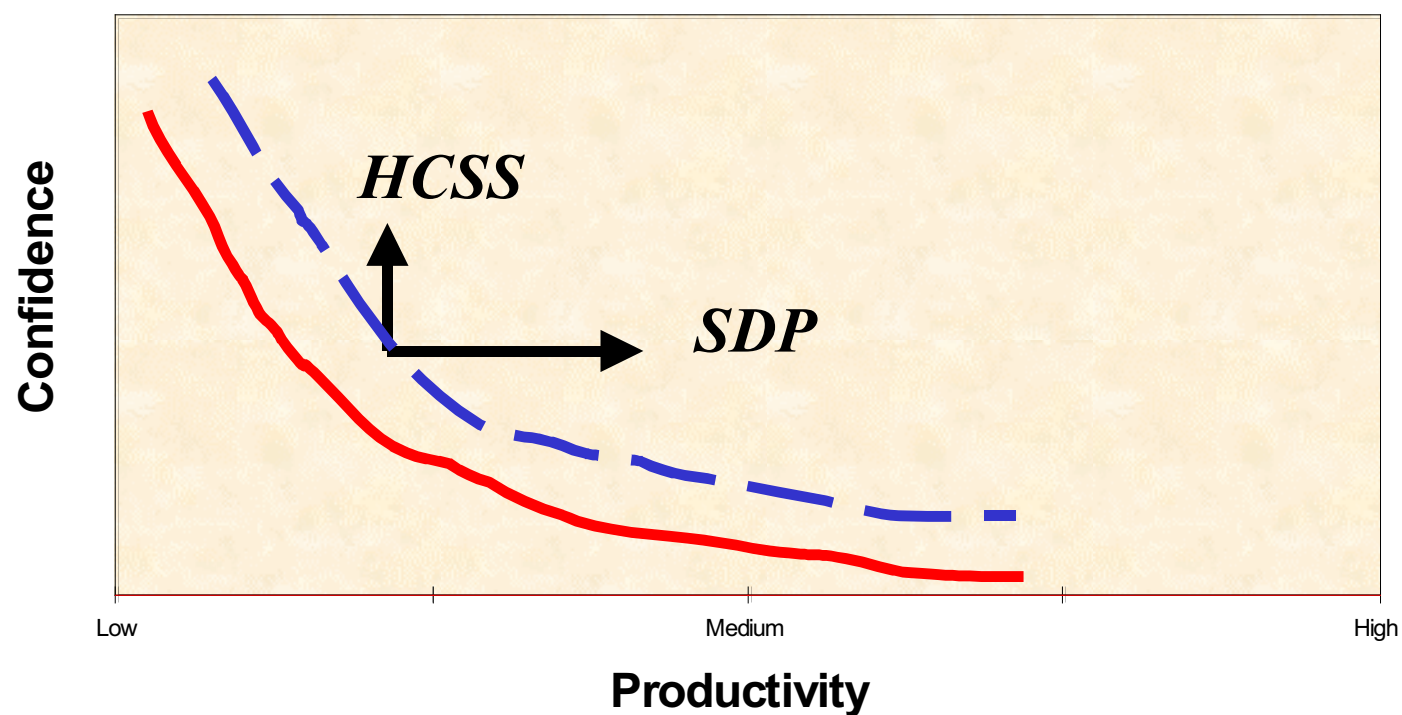
Related PCAs





More Productive or More Confident?

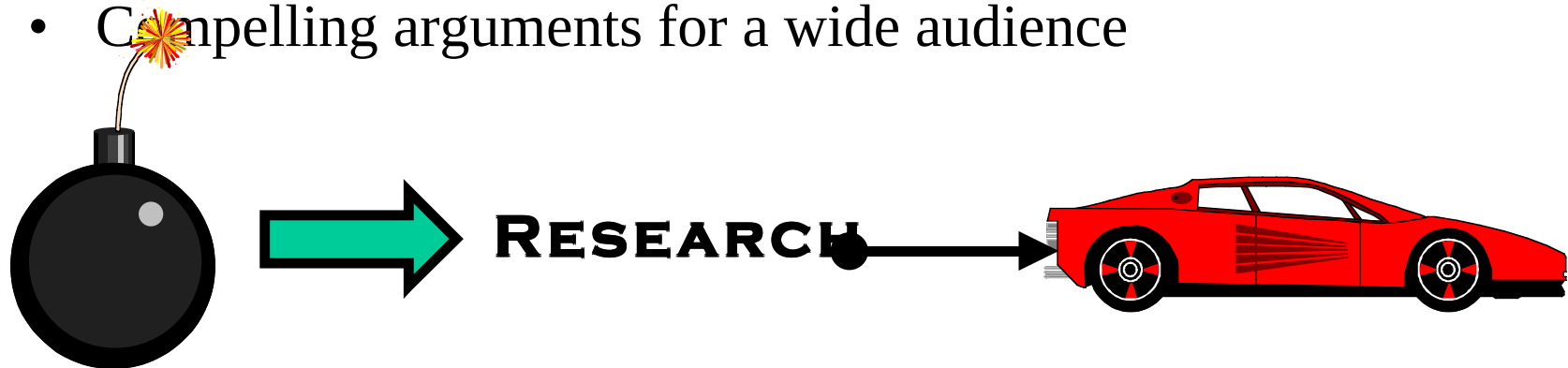
Effects of High Confidence (HCSS) and SDP Research



What Results We Need



- Input to a Research Agenda to increase software productivity
 - **Assess critical levels of research available in the community**
 - **Formulate next best investments toward goals**
 - **Produce SDP Research Needs document**
- Long-range Goals and Roadmaps
- Reasons for the government to invest in software research
- Research areas for the government to spend on
-  Compelling arguments for a wide audience





Metaphors

- | | |
|--|-------------|
| • Software Ecology: | EcoSoft |
| • Software Husbandry: | SoftHerding |
| • Software as a Global Infrastructure: | SoftSource |
| • Software as Ubiquitous Utility: | UUSoft |
| • Software as a Movable Resource: | SoftOre |
| • Software as a Commodity: | SoftGoods |
| • Software as an Engineered Artifact: | Dream |



End

Backup information: SDP Workshop Participants



Panel 1: Future of Software and Software Research

Bill Mark (lead)

SRI International

Barry Boehm

USC

Doris Carver

Louisiana State University

Bonnie John

Carnegie Mellon University

Benjamin Pierce

University of Pennsylvania

Shankar Sastry

University of California, Berkeley

Kevin Sullivan

University of Virginia

Panel 2: New Software Development Paradigms

Charles Simonyi (lead)

Microsoft

Grady Booch

Rational Software

Ralph Johnson

University of Illinois

Gregor Kiczales

University of British Columbia

John Vlissides

IBM T.J. Watson Research

SDP Workshop Participants



Panel 3: Software for the Real World

Don Winter (lead)

Martin Feather

Gabor Karsai

Patrick Lardieri

Edward Lee

Cleve Moler

Boeing Phantom Works

NASA/Jet Propulsion Laboratory

Vanderbilt University/ISIS

Lockheed Martin Advanced Technology

UC Berkeley

MathWorks, Inc.

Panel 4: Software for Network-Centric Distributed Systems

Rick Schantz (lead)

Ian Foster

Doug Lea

Adam Porter

Jim Waldo

BBN Technologies

Argonne National Laboratory

State University of New York at Oswego

University of Maryland

Sun Microsystems, Inc.

Federal government participants:

DARPA DOE EPA FAA NASA NCO NIST NSF ODUSD(S&T) ONR OSTP