Fundamental Challenges for Systems Research

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Content

Charge and Problem
Characteristics of Future Systems
Abstract  Formulation of Challenges
Specific Technical Challenges
Connections to CISE Directorates and Programs
Charge and Problem

• Charge – Work with CNS/CSR to generate vision for future research in systems

• Systems – Abstract machines in which applications are built
  – Systems are applications in the resource management domain
  – Systems provide the “tools” for development of applications, networks, etc.

• Problem – Future research challenges for systems do not fit in systems “stovepipe.”
Characteristics of Future Systems

Distributed resources with distributed control
Heterogeneous multiple domain systems
  Computers – Humans - Mechanical
Time constrained
Intrinsic uncertainty of state
Self-managing and adaptive
Correct, reliable and robust
Cost Effective Implementations/Deployment
Abstract Formulation of Research Challenges

While (…..)

1. Specify State for Decisions
2. State <= Gather System State
3. Decision = Function(State)
4. New State = Transformation(State)

EndWhile
Technical Challenges

Collaborative/cooperative control spanning multiple semantic domains with dynamic structure and uncertainty in system state

“Algorithms” for state gathering, decision making and computation

Extending CCC to enable self-composition and self management. (adaptation and reconfiguration)

Design/development methodology enabling composition, verification/validation and adaptability

Methods and tools for correctness and robustness
Connections to CISE Directorates and Programs

CNS/CSR – PDOS, AES, EHS, SMA, CPS, CSI, VCM, DDDAS
CNS/NeTs - GENI
CCF - Algorithms
SoD – Design and development
IIS – Learning and reasoning
Cyber Trust – Security and correctness
Structure For Systems Research???

Common Problem Core

Languages, Compilers, Runtime Systems

Resource Management Domain

Integrated Control Applications

Abstraction and Modeling

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