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???