Architecture for SoS
Evaluation of NextGen

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T&E of Systems-of-Systems

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Topics

• NAS/NextGen Challenges
• Need for SoS Evaluation Tools & Underlying Principles
• Important Characteristics of SoSAP
• Initial Lessons Learned
• Next Steps
OUR MAIN COMPUTER IS DOWN! THANK GOODNESS FOR THE BACKUP SYSTEM.
HAS IT COME ONLINE YET?

YEAH, BUT I DON’T THINK YOU’RE GOING TO LIKE IT-

Y’ALL BE CAREFUL UP THERE, Y’HERE!
Problem: No Existing NAS-Wide SoS Evaluation Capability

Where We’ve Been

Where We’re Going

NextGen represents a fundamental paradigm shift from:

stove-piped, analog, point to point systems to ... an integrated, digital, net-centric architecture
Need: Framework for SoS Assessment

- Open => Non-Proprietary system
- Low Cost => Leverage existing FAA/DoD investments
- Scalable => Model the entire NAS with varying levels of fidelity
- Flexible => Ability to immerse real systems, new concepts, and new procedures into the environment
Solution Concept

The Actors and Objects in the NAS are the touch points on the systems. (System of Systems)

**IF**

We model those actors and objects based on today's NAS behavior and we can create a baseline model of the NAS…

**THEN**

We can alter those behaviors based on new concepts, ideas, systems, etc., resulting in new emergent behavior of the System of Systems.

This new behavior might be measured by fuel savings, on-time percentage, capacity, etc., and could be used in the verification and validation (V&V) process.
Solution Overview
Model Decision-Making of Each Agent

• Use a combination of business rules and predictive analytics.

• Encode regulation, policy, know-how, and analytical insight into a knowledge base for each agent

• Each instantiation of an agent could have a different levels of knowledge
Solution Architecture

Federal Aviation Administration System-of-Systems Assessment Platform (SoSAP) January 26, 2012

GIS Server
Web Server
Analysis DB
Data Analysis Logger
Web Socket
GIS Server

External Systems

Constructive Simulation (Aircraft)

Policies, Procedures, Know-How

Inbound simulation (aircraft data)

Outbound Simulation Content

CPU Intensive Calculations

GPU Server
A priori DB

Agents ATC/Pilot/CmdCtr

Framework Tools

Ex. Control
Data Acq.
Rules Acq.
Flight Plans Editor
ATC Guidance Matrices
Initial Lessons Learned

• Agent technology is the best suited solution for scalability and configurability.

• Knowledge acquisition is complex. No one set of rules for a particular ATC function is the same across locations and domains.

• Data Acquisition and synchronization is complex and vast.

• Open real-time M&S systems, handling a full complement of ATC and airplane functions covering gate to gate operation across the NAS, do not exist.
Next Steps

• Continue integration with some systems within FAA

• Enhance IA capabilities/fidelity

• Work with academia for knowledge capture from ATC professionals for IA enhancement – document

• Work with academia in area of anomaly detection for future application to SoSAP experiment analysis

• Continue working on solutions for data acquisition and use

• Refine architecture

• Enhance current visualization tools and integrate with others

• Conduct demonstration of refined prototype architecture and use to solidify detailed architecture requirements identification
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