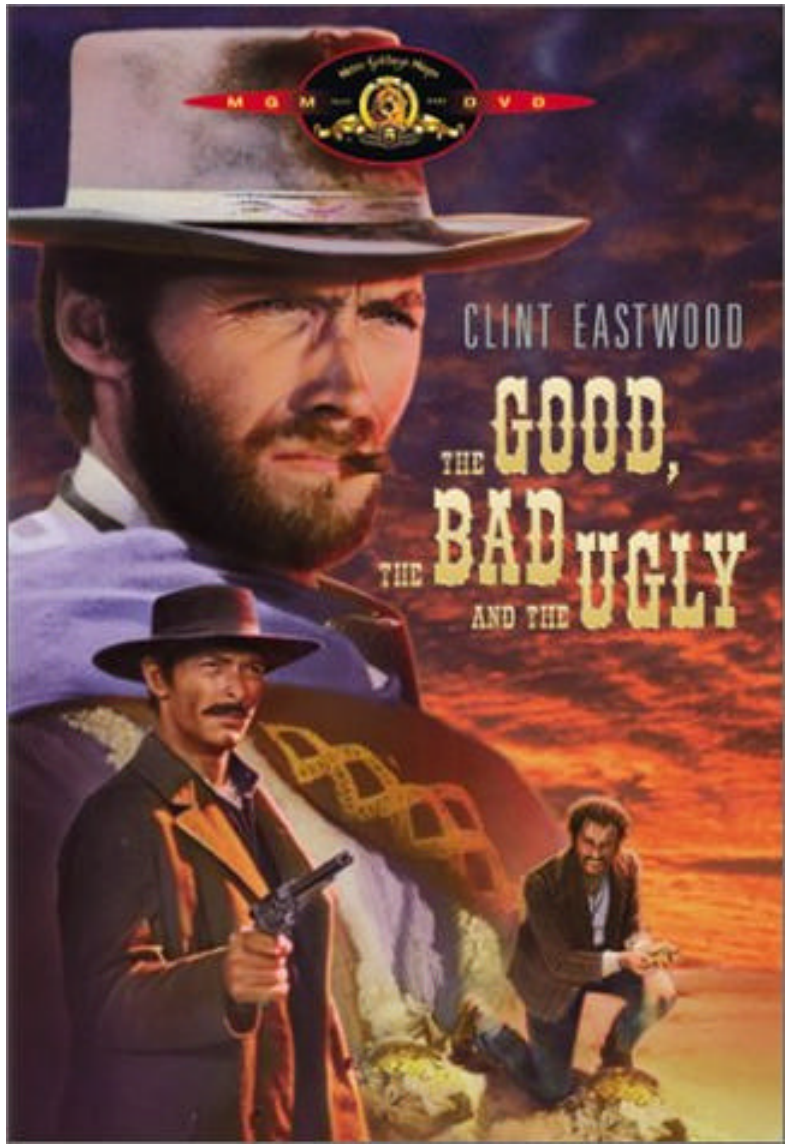
NORTHROP GRUMMAN



The Good, The Bad, and The Ugly of Interoperability Metrics

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Mission Systems

DEFINITIONS

- **Interoperability usually defined at the 30,000ft level**
  - ✓ ***…the ability of systems…to provide data…and services to … other systems…to enable them to operate effectively together***
  - ✓ ***The ability of two systems to exchange information and to mutually use that information***
- **Interoperability is not an "absolute"**
  - ✓ ***The degree of interoperability should be defined when referring to specific cases***
  - ✓ ***The probability of successful interoperation of subscribers in a network under specified conditions for a given mission time***

What do these mean at ground level?

CONTEXT

INTEROPERABILITY METRICS:

- **Quantify "suitability" for inclusion in GIG/NCES/JC2**
  - ✓ ***GIG/NCES/JC2 Implementation details remain fluid***
  - ✓ ***Legacy/heritage/deployed systems retain important role***
- **Encompass diverse requirements**
  - ✓ ***Interoperability, functionality, security, usability, …***
  - ✓ ***Technical, Operational, System requirements***
- **Define a calculus for an Interoperability Quotient (IQ)**

THE GOOD

INTEROPERABILITY METRICS:

- **Embolden acquisition commands to make technical decisions**
  - ✓ ***Mitigates push-back from "emotional" stake-holders***
- **Quantify a program's degree of interoperability**
  - ✓ ***Provides repeatable & defendable discriminators***
- **Focus design/development on interoperability**
  - ✓ ***Not a bolt-on-later capability***
- **Force disciplined engineering for life-cycle support**
  - ✓ ***Development, integration, deployment, support***

THE BAD

INTEROPERABILITY METRICS:

- **Limit flexibility**
  - ✓ ***Legacy/deployed systems impose constraints***
- **Limit innovation**
  - ✓ ***"Better" may be less important than "consistent" or "common" or "integrated" or "sustainable" or …***
- **Slow technology insertion**
  - ✓ ***Impedance mismatch between new and old technology must be addressed***

THE UGLY

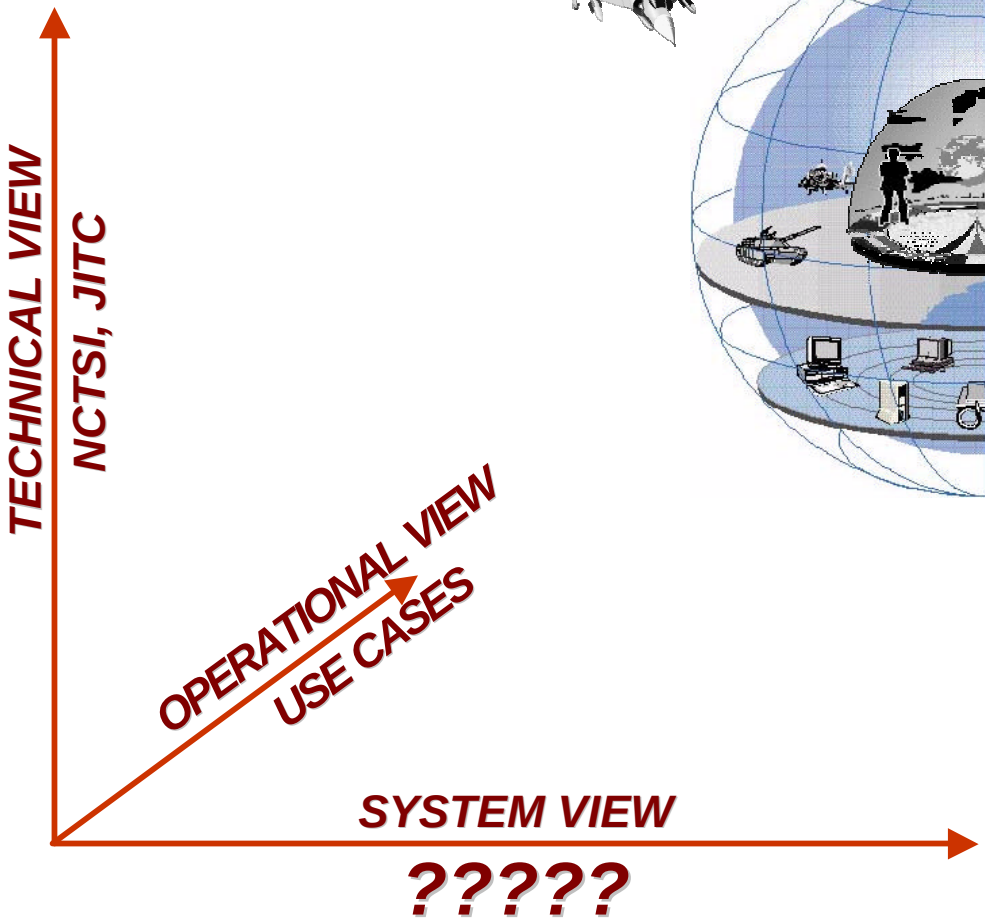
INTEROPERABILITY:

- **Defies actionable definition**
  - ✓ ***Does it apply to applications or interfaces?***
  - ✓ ***How far into an application does interoperability apply?***
- **Leads to significant software complexity**
  - ✓ ***Backward compatibility is mandated***
- **Facilitates propagation of viruses**
  - ✓ ***Boundary-less global network is prime breeding ground for destructive effect of network-borne viruses***

- **Combination of complexity and boundary-less environment may lead to a "Perfect Storm"**
  - ✓ ***Seemingly unrelated events cascade into a sequence of unexpected actions that are perfect – in the worse sense – leading to meltdown***

….. so what's my approach to addressing the broad range of interoperability issues?

Design IQ to combine Technical, Operational, and System Views



Challenge

Interoperability tests for the System View

- **Taxonomy**
  - ✓ ***External Interfaces***
  - ✓ ***Internal Context***

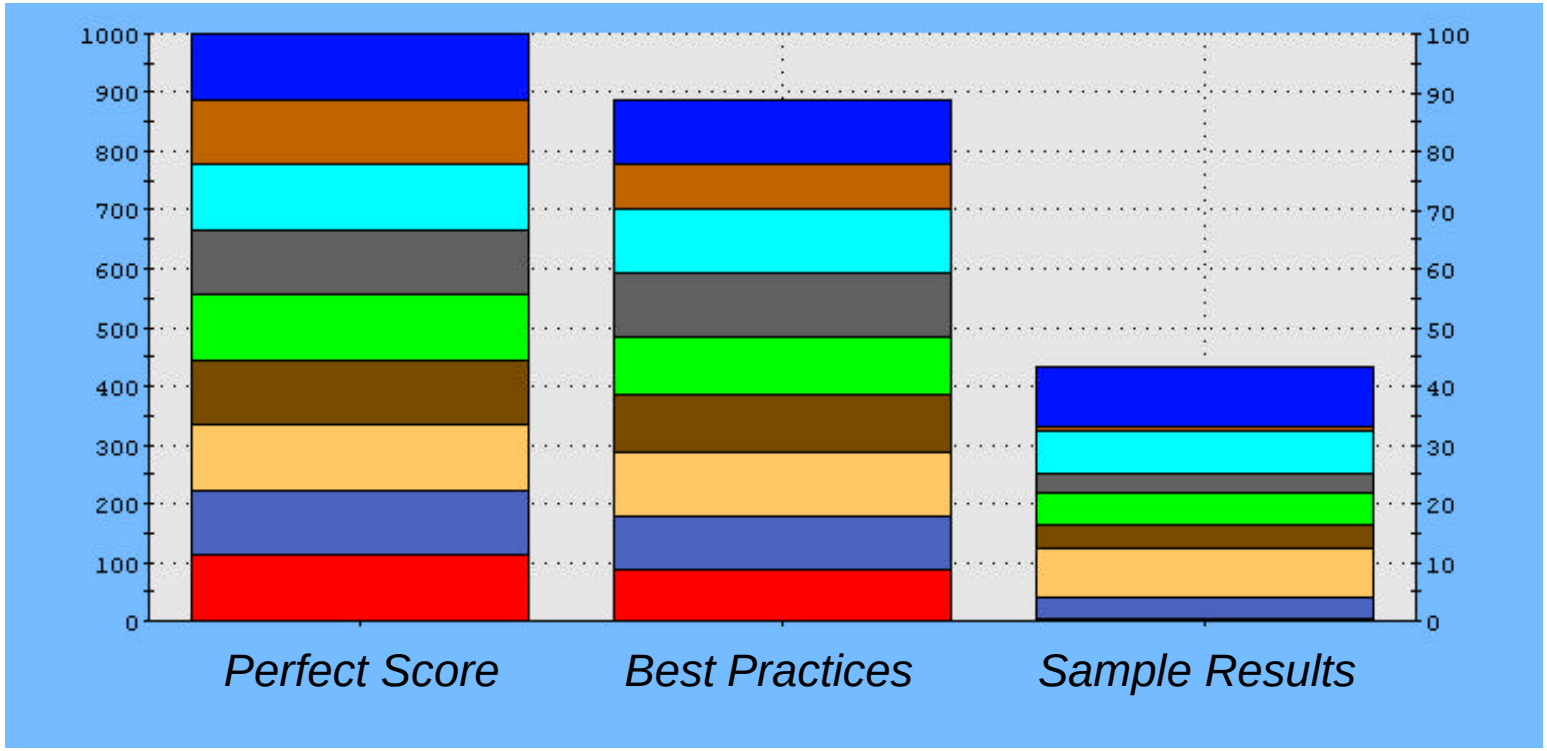
"System View" IQ – 10 External Interface Tests

1. ***Interface security – inbound*** **(validation, access control)**
2. ***Interface security – outbound*** **(digital signature, encryption options)**
3. ***Data integrity –low level*** **(syntactic & semantic validation)**
4. ***Data integrity – high level*** **(semantic cast/loss, precision cast/loss)**
5. ***Interface flexibility*** **(data formats, transport protocols)**
6. ***Interface bandwidth*** **(manage/control bandwidth use)**
7. ***Interface registration & version control*** **(register information on interface, provide version control)**
8. ***Interface management*** **(flow control, health status, error conditions)**
9. ***Interface performance*** **(support operational data rates, support multiple connections, degrade gracefully under load)**
10. ***Interface documentation*** **(clear & complete documentation)**

"System View" IQ – 10 Internal Context Tests

1. ***Security*** **(access control tied to user profile)**
2. ***Data processing integrity*** **(compliant business logic)**
3. ***Data presentation*** **(dynamic updates, customizable, UI compliant)**
4. ***User help, prompts, process controls*** **(on-line context-sensitive help, user prompts & error/status alerts, activity status, training scenarios)**
5. ***Web enabled*** **(browser, web services, PDA access)**
6. ***Sysadmin*** **(logging, monitoring, trouble-shooting tools)**
7. ***Collaboration*** **(support for collab sharing/viewing/annotation)**
8. ***Upgrade & version control*** **(upgrade without loss of data, compatibility between versions on LAN/WAN)**
9. ***Reliability/Robustness*** **(self-protecting from data loss/contamination, survivable from catastrophic failure, resilient to network failure)**
10. ***Special processing/performance*** **(MLS, RT, smart "down-sampling")**

Sample IQ Assessment



Any Questions?

Interoperability and the Quantum Effect

- **Quantum Physics**
  - ✓ ***Act of observing affects what is being observed***
  - ✓ ***Act of observing sometimes creates what is being observed***
- **Quantum Computing (new definition)**
  - ✓ ***Act of test & evaluation affects the occurrence of problems***
  - ✓ ***Act of test & evaluation creates the occurrence of problems***
- **Conclusion**
  - ✓ ***Computing Systems work properly until being observed (e.g., tested or used)***
  - ✓ ***Reduction of observations effectively and efficiently reduces problems and saves money (by eliminating T&E labs)***