NORTHROP GRUMMAN

DEFINING THE FUTURE

Software Architecture Evaluation

Transforming a craft into a business process

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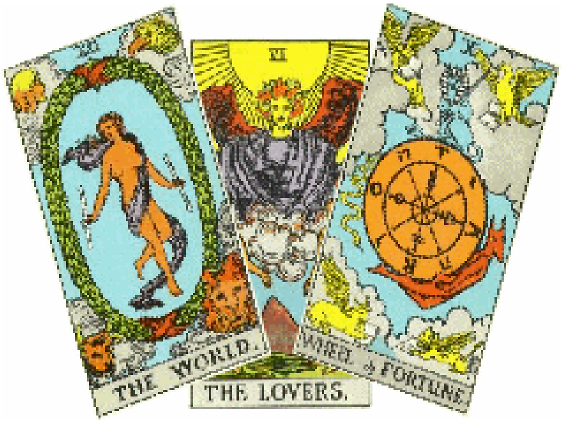
George Haley
Program Manager
Northrop Grumman Corporation

The Architecture Evaluation Toolkit



Why is evaluating architecture so hard?

- **Intangibility: Architecture is only a framework, so most standard TPMs don't apply directly, such as**
  - SLOC/code size
  - Processing resources
  - Memory resources
  - Storage resources
  - I/O resources
- **Evaluation criteria can be esoteric and obscure, lacking in good operational definitions**
- **Interrelationships among criteria are highly complex**
  - Non-trivial hierarchy
  - Conflicting criteria*
- **Certain criteria are difficult to apply & use for evaluation**

* Refer to B. Boehm/H. In presentation in GSAW 1998

Presentation overview

1. Identifying bottom-line architecture evaluation criteria
2. Defining the impact tree/matrix
3. Selecting architecture evaluation criteria
4. Evaluating architecture candidates

1. Identify bottom-line criteria

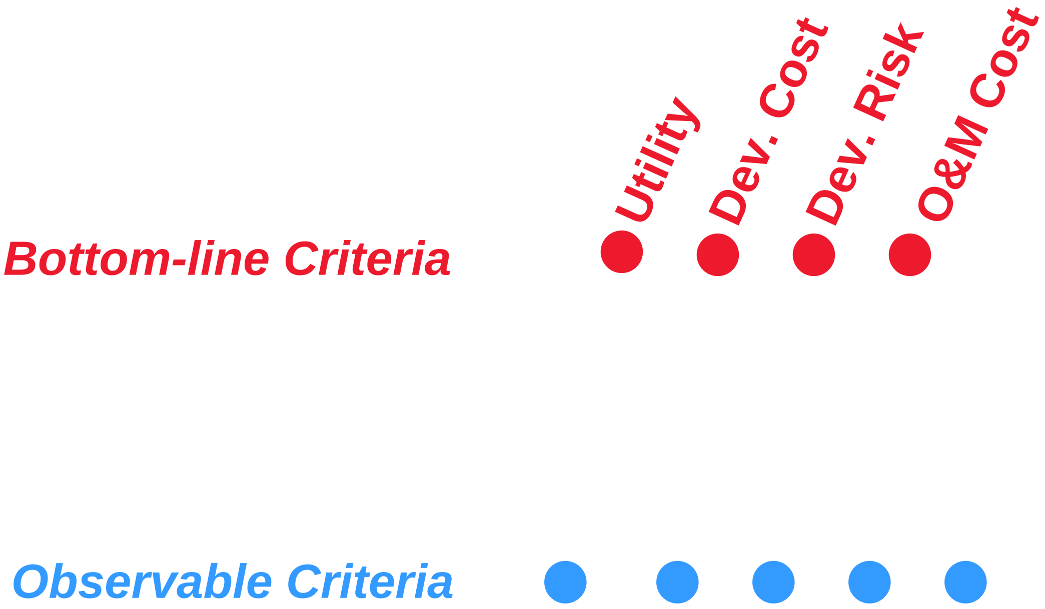
- **Focus is on stakeholder needs, not details**
- **Only five criteria really matter***
  - Utility (primary missions, new missions, product line)
  - Development Cost
  - Development Schedule
  - Development Risk
  - O&M Cost
- **Development Schedule is almost always directly correlated to Development Cost**

Detailed criteria must relate to these criteria

* given that requirements are met

2. Define Impact Matrix/Tree

- **Determine candidate observable criteria**



Bottom-line Criteria

Utility

Dev. Cost

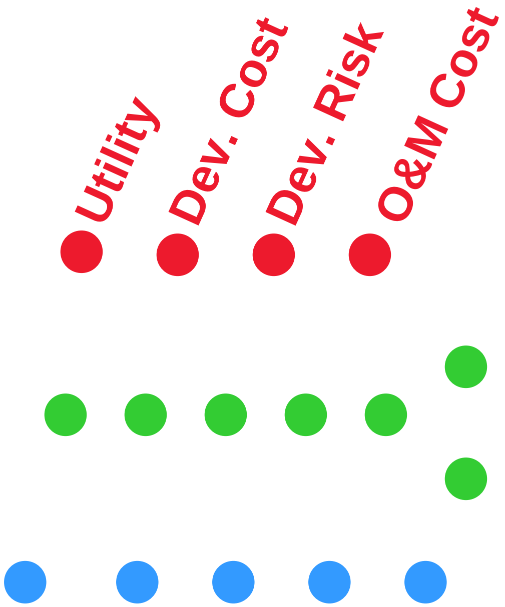
Dev. Risk

O&M Cost

Observable Criteria

2. Define Impact Matrix/Tree

- Determine candidate observable criteria
- Derive any candidate intermediate criteria needed to relate to bottom-line criteria



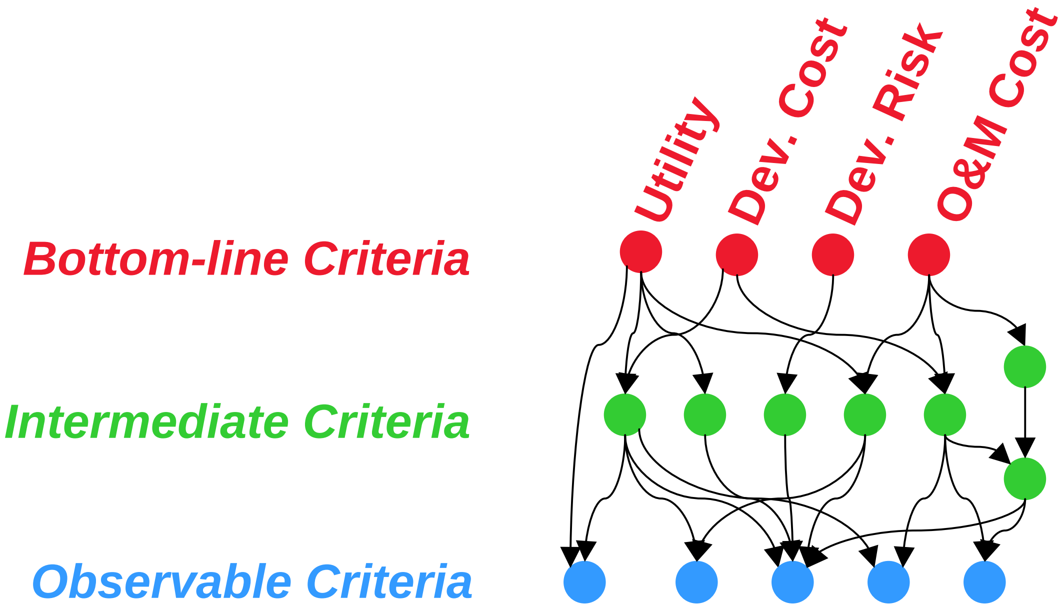
Bottom-line Criteria

Intermediate Criteria

Observable Criteria

2. Define Impact Matrix/Tree

- Determine candidate observable criteria
- Derive any candidate intermediate criteria needed to relate to bottom-line criteria
- Establish and (preferably) quantify relationships between criteria



2. Define Impact Matrix/Tree (cont.)

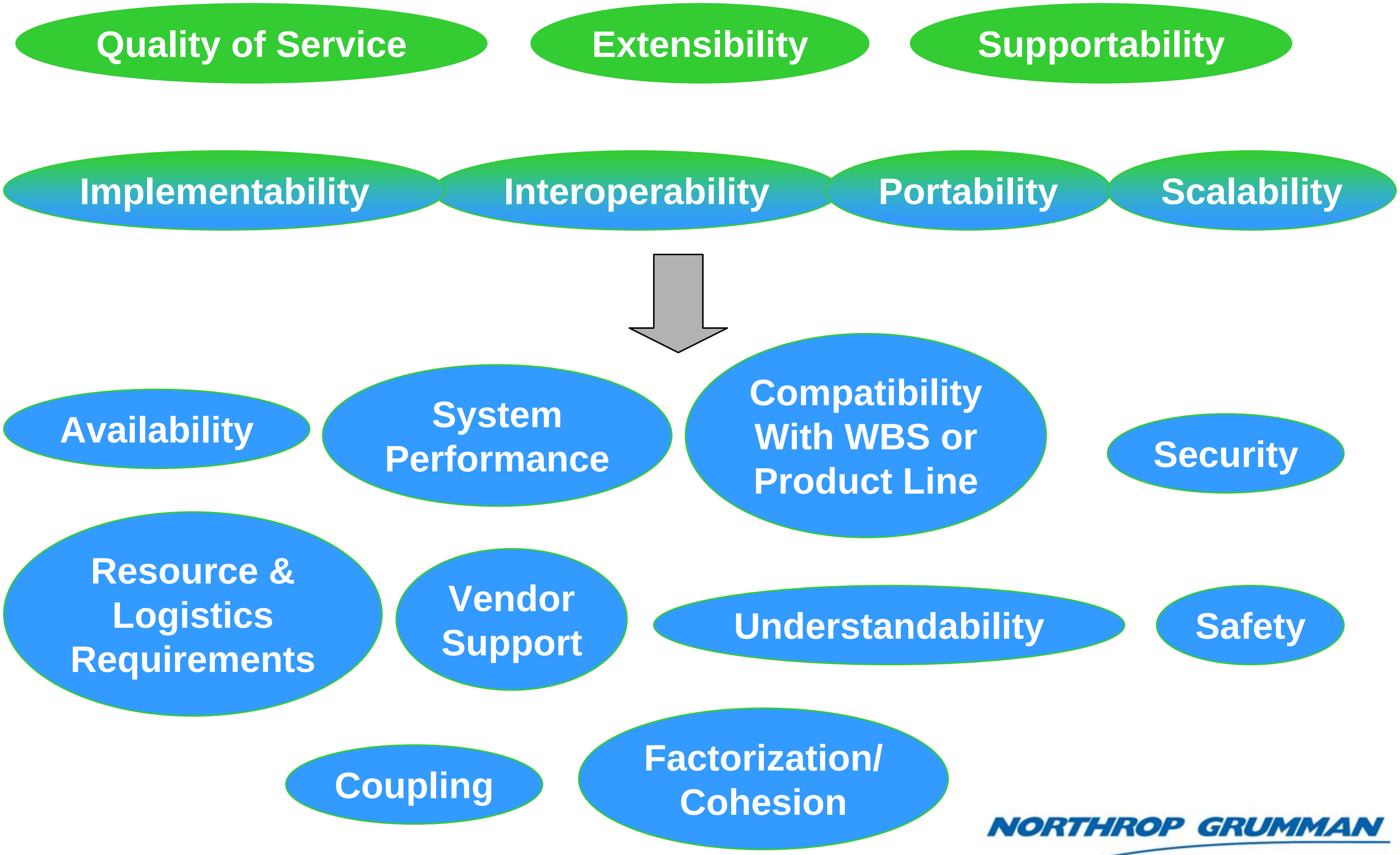
Example Impact Matrix

Intermediate Criteria	Bottom-line Criteria			
	Utility	Dev. Cost*	Dev. Risk	O&M Cost
Quality of Service (performance, availability, etc.)	++	++	+	--/++
Implementability (e.g., reuse, tools avail., skills avail.)	N/A	--	-/+	N/A
Interoperability	++	+/++	N/A	--
Extensibility	++	++	+	--
Portability	+/++	+/++	+	--
Scalability	++	+/++	+	--
Supportability	N/A	++	+	--

***Directly related to Development Schedule**

2. Define Impact Matrix/Tree (cont.)

Example Impact Tree (bottom part)



Quality of Service

Extensibility

Supportability

Implementability

Interoperability

Portability

Scalability

Availability

System Performance

Compatibility With WBS or Product Line

Security

Resource & Logistics Requirements

Vendor Support

Understandability

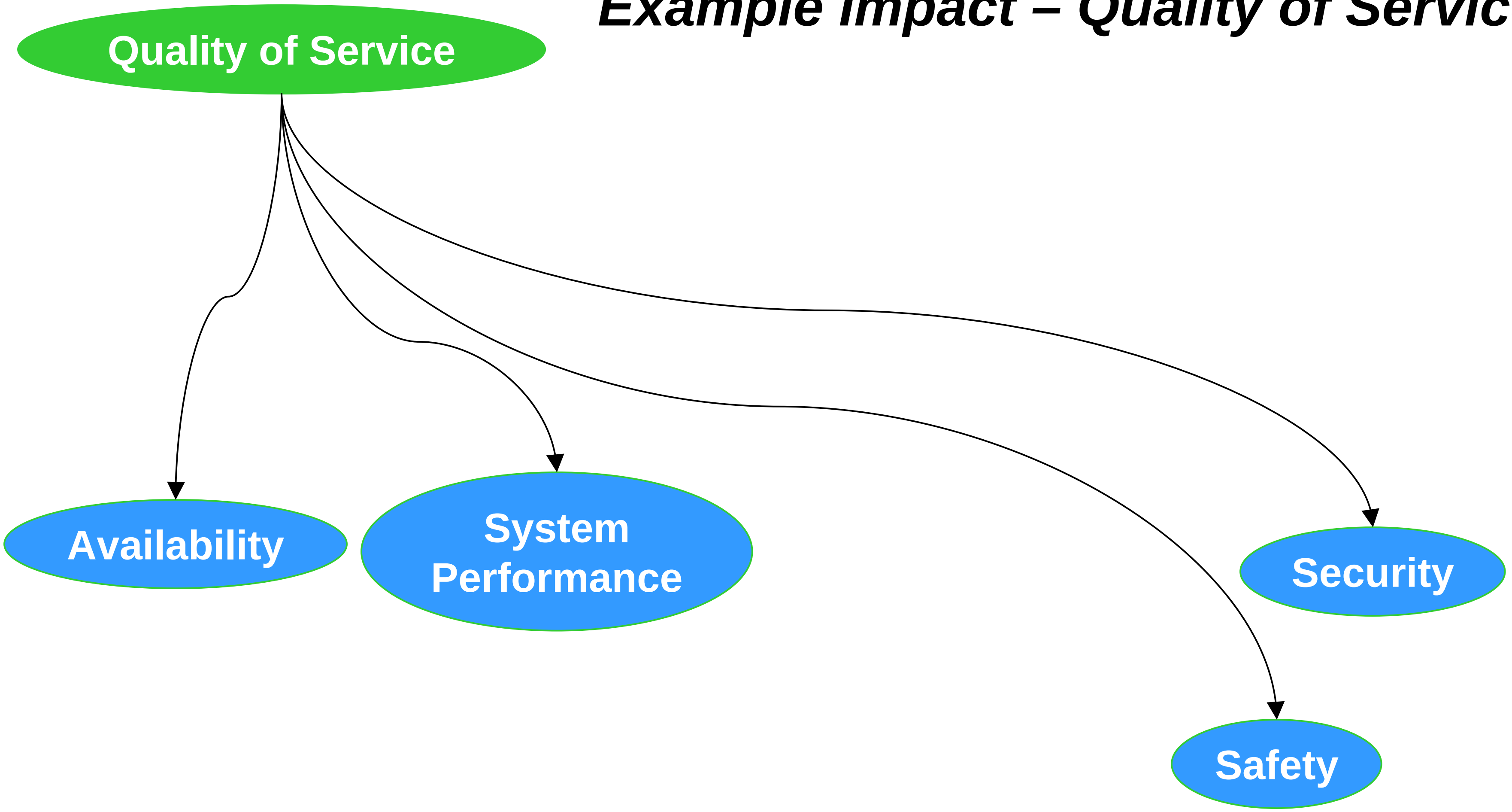
Safety

Coupling

Factorization/ Cohesion

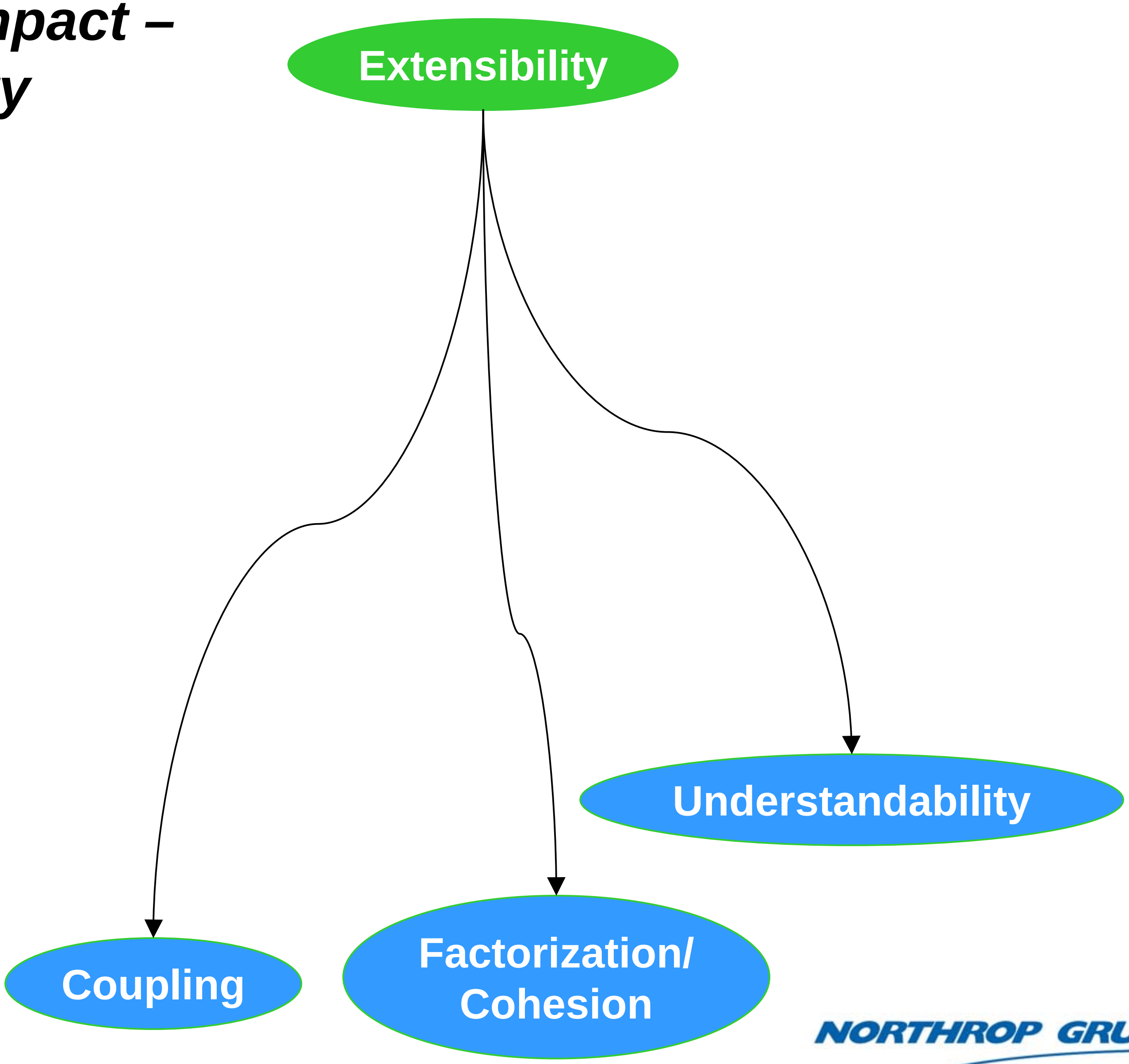
2. Define Impact Matrix/Tree (cont.)

Example Impact – Quality of Service



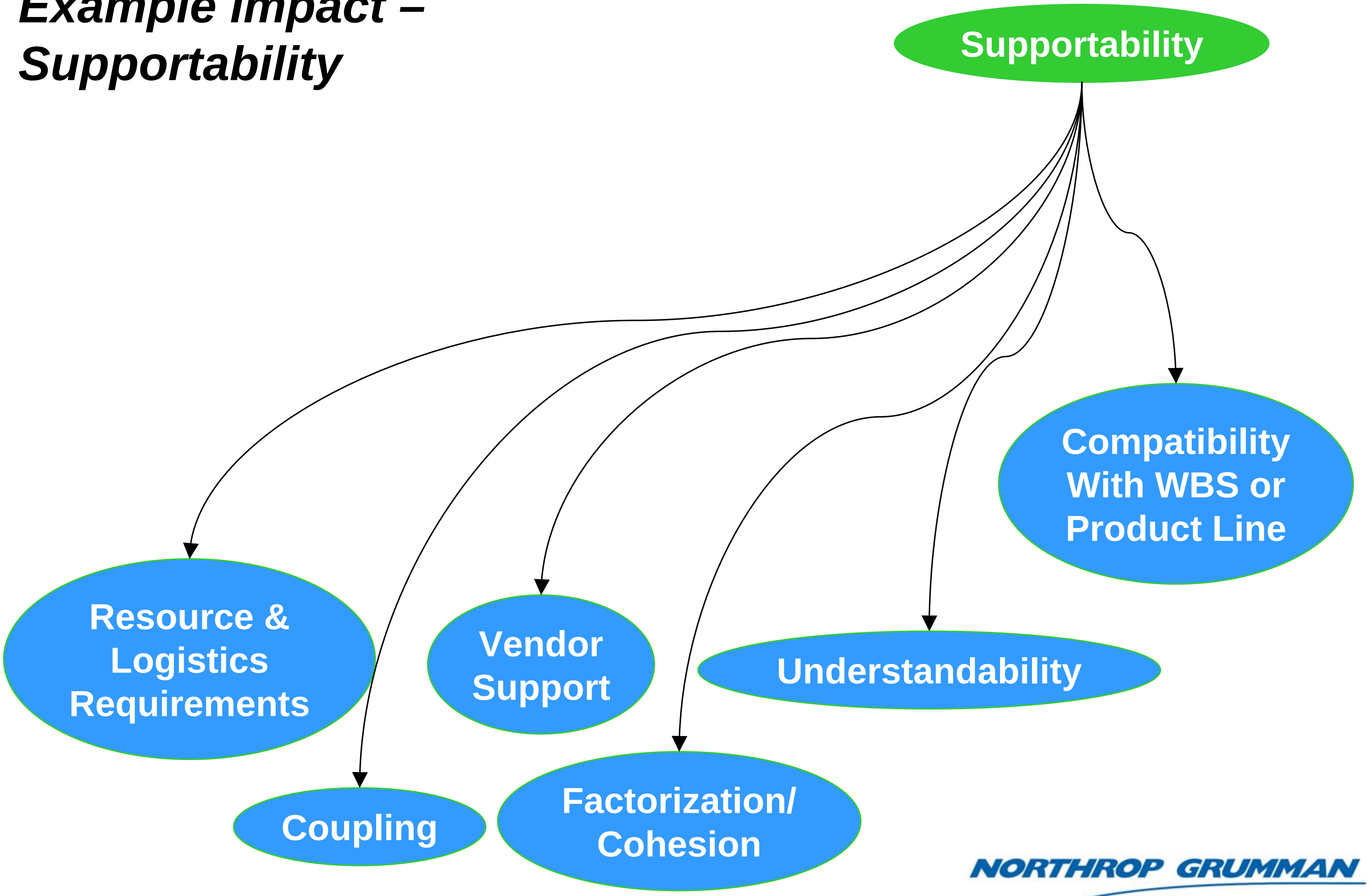
2. Define Impact Matrix/Tree (cont.)

Example Impact – Extensibility



2. Define Impact Matrix/Tree (cont.)

Example Impact – Supportability



3. Select Architecture Evaluation Criteria

- **Evaluation criteria for architecture evaluation criteria:**
  - **Importance** - How strong is the relationship between the criterion and the bottom-line criteria?
  - **Understandability** – Is the operational definition of the criterion clear, unambiguous and agreed-to?
  - **Feasibility** - How feasible is it to evaluate architecture using this criterion? Can automated collection/analysis techniques be used?
  - **Canonical completeness** – Is this a complete basis set of criteria? Is there avoidable redundancy among the criteria?
- **Consider impact of each criterion on each stakeholder:**
  - Software developers
  - Software development managers
  - Software maintainers
  - Operators
  - System administrators

4. Evaluate Architecture Candidates

- **Use only bottom-line criteria for final decision**
- **Transform subjective or “religious” issues into bottom-line criteria**
  - Standard vs. proprietary vs. blend
  - Redundancy/fault handling
  - Reusability
- **Automate whenever feasible**
- **Involve stakeholders appropriately in evaluation (or at least review of evaluation results)**
  - Usually understand impacts to themselves better than architects do
  - Helps secure buy-in for the chosen architecture

Summary – Key Points

- Use only bottom-line criteria for final architecture evaluation
- Critically evaluate the detailed evaluation criteria
- Consider stakeholder needs and involve them whenever possible