Interoperability
Module 2 – L3

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SEZG651/ SSZG653 Software Architectures Module 2-CS03C

Credits

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These Slides are based on

- Software Architecture in Practice by
  - Len Bass, Paul Clement and Rick Kazman
  - Pearson © 2013

Outline

- What is Interoperability?
  - Interoperability General Scenario
- Tactics for Interoperability
  - A Design Checklist for Interoperability
- Summary

What is Interoperability?

- Interoperability is about the degree to which two or more systems can usefully exchange meaningful information.
- Like all quality attributes, interoperability is not a yes-or-no proposition but has shades of meaning.

Interoperability General Scenario

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Portion of Scenario	Possible Values
Source	A system
Stimulus	A request to exchange information among system(s).
Artifact	The systems that wish to interoperate
Environment	System(s) wishing to interoperate are discovered at run time or known prior to run time.
Response	One or more of the following: • the request is (appropriately) rejected and appropriate entities (people or systems) are notified • the request is (appropriately) accepted and information is exchanged successfully • the request is logged by one or more of the involved systems
Response Measure	One or more of the following: • percentage of information exchanges correctly processed • percentage of information exchanges correctly rejected

Sample Concrete Interoperability Scenario

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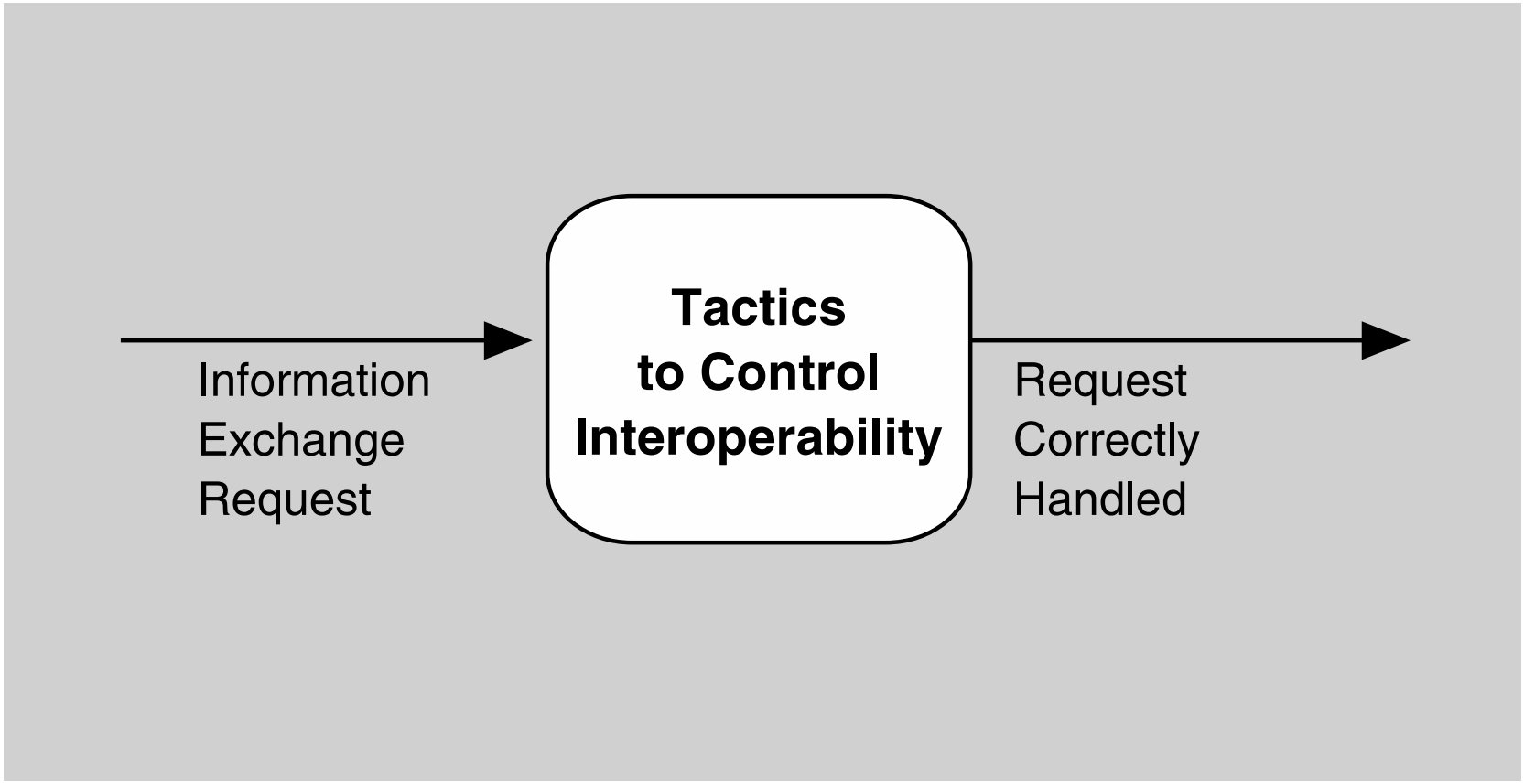
- Our vehicle information system sends our current location to the traffic monitoring system.
- The traffic monitoring system combines our location with other information, overlays this information on a Google Map, and broadcasts it.
- Our location information is correctly included with a probability of 99.9%.

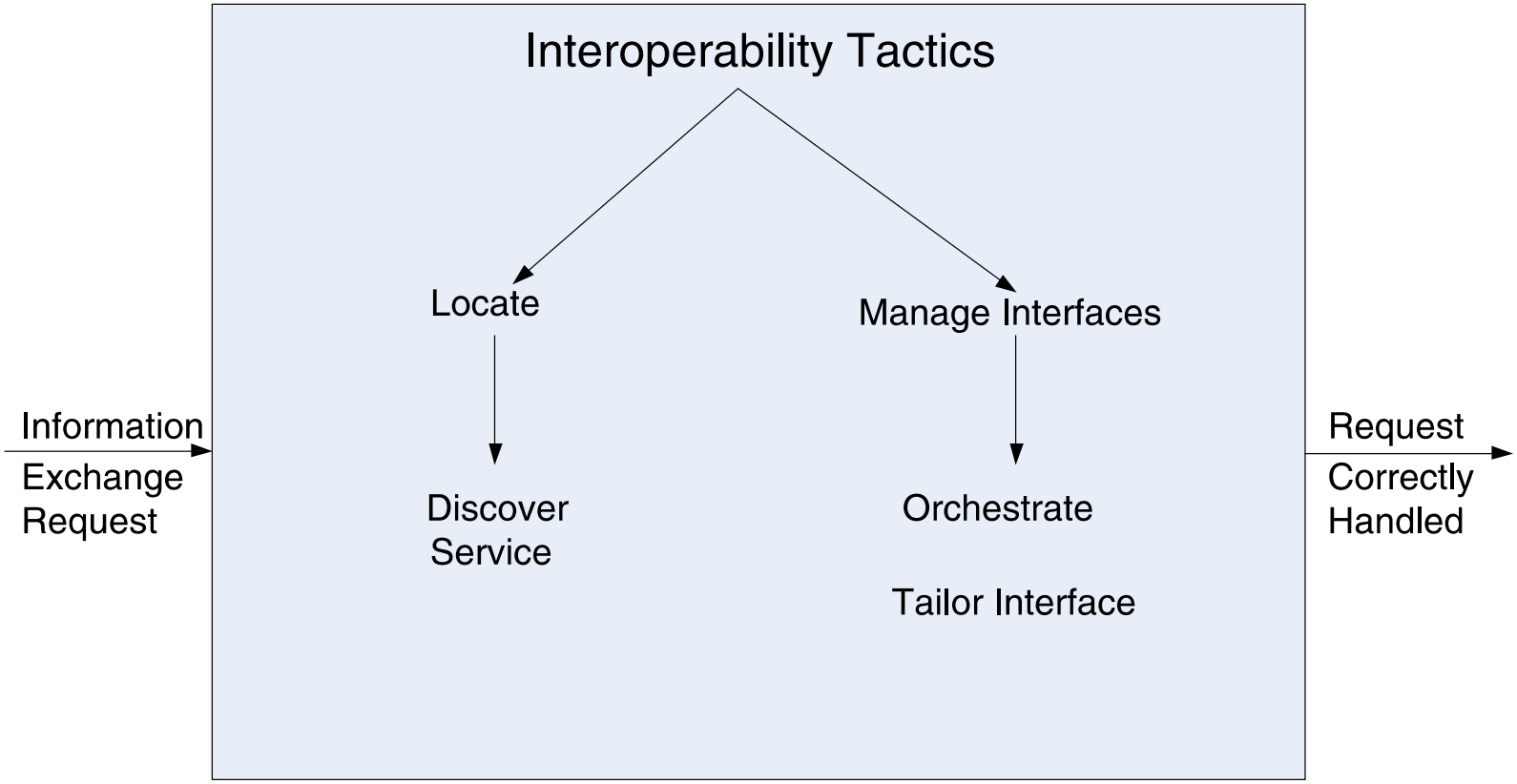
Goal of Interoperability Tactics

- For two or more systems to usefully exchange information they must
  - Know about each other. That is the purpose behind the locate tactics.
  - Exchange information in a semantically meaningful fashion. That is the purpose behind the manage interfaces tactics. Two aspects of the exchange are
    - Provide services in the correct sequence
    - Modify information produced by one actor to a form acceptable to the second actor.

Goal of Interoperability Tactics



Interoperability Tactics



Locate

- Discover service:
  - Locate a service through searching a known directory service.
  - There may be multiple levels of indirection in this location process
    - ✓– i.e. a known location points to another location that in turn can be searched for the service.

Manage Interfaces

- Orchestrate: uses a control mechanism to coordinate, manage and sequence the invocation of services. Orchestration is used when systems must interact in a complex fashion to accomplish a complex task.
- Tailor Interface: add or remove capabilities to an interface such as translation, buffering, or data-smoothing.

Design Checklist for Interoperability

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Allocation of Responsibilities

- Determine which of your system responsibilities will need to interoperate with other systems.
- Ensure that responsibilities have been allocated to detect a request to interoperate with known or unknown external systems
- Ensure that responsibilities have been allocated to
- accept the request
- exchange information
- reject the request
- notify appropriate entities (people or systems)
- log the request (for interoperability in an untrusted environment, logging for non-repudiation is essential)

Design Checklist for Interoperability

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Coordination Model

- Ensure that the coordination mechanisms can meet the critical quality attribute requirements. Considerations for performance include:
- Volume of traffic on the network both created by the systems under your control and generated by systems not under your control.
- Timeliness of the messages being sent by your systems
- Currency of the messages being sent by your systems
- Jitter of the messages arrival times.
- Ensure that all of the systems under your control make assumptions about protocols and underlying networks that are consistent with the systems not under your control.

Design Checklist for Interoperability

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Data Model

- Determine the syntax and semantics of the major data abstractions that may be exchanged among interoperating systems.
- Ensure that these major data abstractions are consistent with data from the interoperating systems. (If your system's data model is confidential and must not be made public, you may have to apply transformations to and from the data abstractions of systems with which yours interoperates.)

Design Checklist for Interoperability

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Mapping Among Architectural Elements

- For interoperability, the critical mapping is that of components to processors. Beyond the necessity of making sure that components that communicate externally are hosted on processors that can reach the network, the primary considerations deal with meeting the security, availability, and performance requirements for the communication.
- These will be dealt with in their respective chapters.

Design Checklist for Interoperability

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Resource Management

- Ensure that interoperation with another system (accepting a request and/or rejecting a request) can never exhaust critical system resources (e.g., can a flood of such requests cause service to be denied to legitimate users?).
- Ensure that the resource load imposed by the communication requirements of interoperation is acceptable.
- Ensure that if interoperation requires that resources be shared among the participating systems, an adequate arbitration policy is in place.

Design Checklist for Interoperability

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Binding Time

- Determine the systems that may interoperate, and when they become known to each other. For each system over which you have control
- Ensure that it has a policy for dealing with binding to both known and unknown external systems.
- Ensure that it has mechanisms in place to reject unacceptable bindings and to log such requests.
- In the case of late binding, ensure that mechanisms will support the discovery of relevant new services or protocols, or the sending of information using chosen protocols.

Design Checklist for Interoperability

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Choice of Technology

- For any of your chosen technologies, are they “visible” at interface boundary of a system? If so, what interoperability effects do they have? Do they support, undercut, or have no effect on the interoperability scenarios that apply to your system? Ensure the effects they have are acceptable.
- Consider technologies that are designed to support interoperability, e.g. Web Services. Can they be used to satisfy the interoperability requirements for the systems under your control?

Summary

- Interoperability refers to the ability of systems to usefully exchange information.
- Achieving interoperability involves the relevant systems locating each other and then managing the interfaces so that they can exchange information.