# Bringing Grid & Web Services Together

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# The Best of Both Worlds

*Web Services & Grid Requirements*

***share*** ***access*** ***manage***

**Applications on demand**

**Secure and universal access**

**Business integration**

**Web Services**

**Resources on demand**

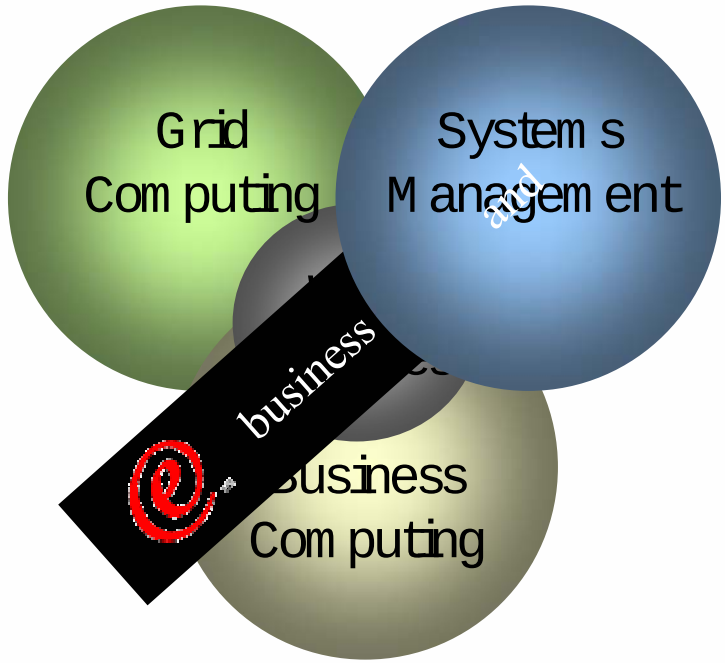
**Global Accessibility**

**Vast resource scalability**

**Grid Protocols**

# What we are announcing today

- Proposals to extend to Web services
- Driven by requirements from:
  - Grid computing
  - Systems Management
  - Business computing
- Key to infrastructure for IBMs On Demand Initiative



# What we are announcing today

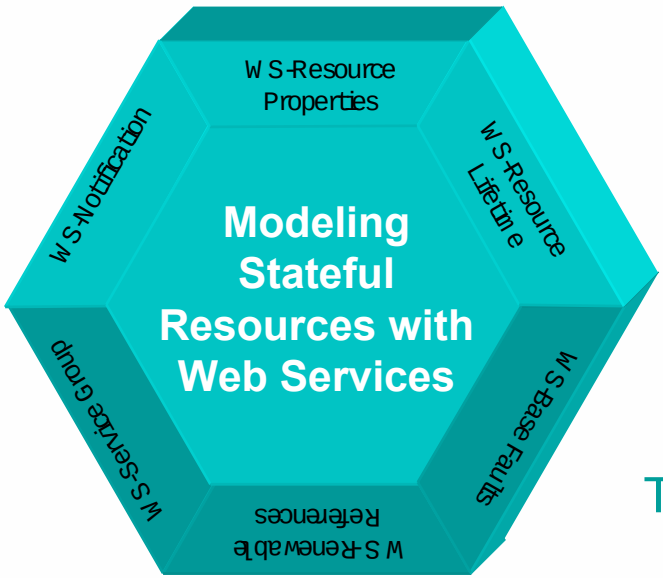
- Why we developed these proposals
  - **To have an architecture that is more clearly aligned with the general evolution of Web services**
  - **To provide a collection of related specifications that can be used either individually or in combinations…**

    **…. and will integrate more effectively with other Web services standards**
  - **To more closely align with existing language and platform programming models and application development tools**

# What we are announcing today

- **A family of Web services specification proposals**
  - **Introduces a design pattern to specify how to use Web services to access "stateful" components**
  - **Introduce message based publish-subscribe to Web services**

Introduced Today




To be developed

# What we are announcing today

- **WS-Notification**
  - **Provides a publish-subscribe messaging capability for Web Services**
- **WS-Resource framework**
  - **A family of Web services specifications that clarify how "state" and Web services combine**
- **Both:**
  - **Build upon existing Web services specifications and technology**
  - **Help align Grid computing, Systems Management and Web services**
- **Contributed to by:**

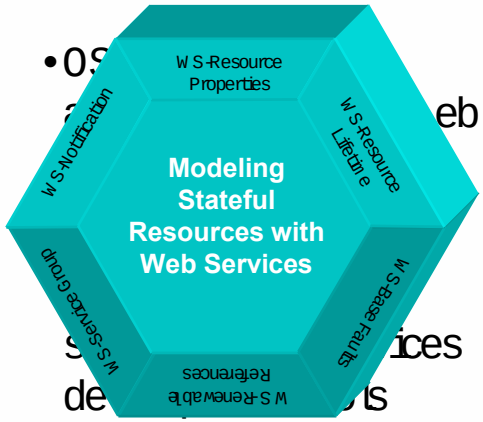
  **WS-Resource Framework: IBM, Globus, HP**

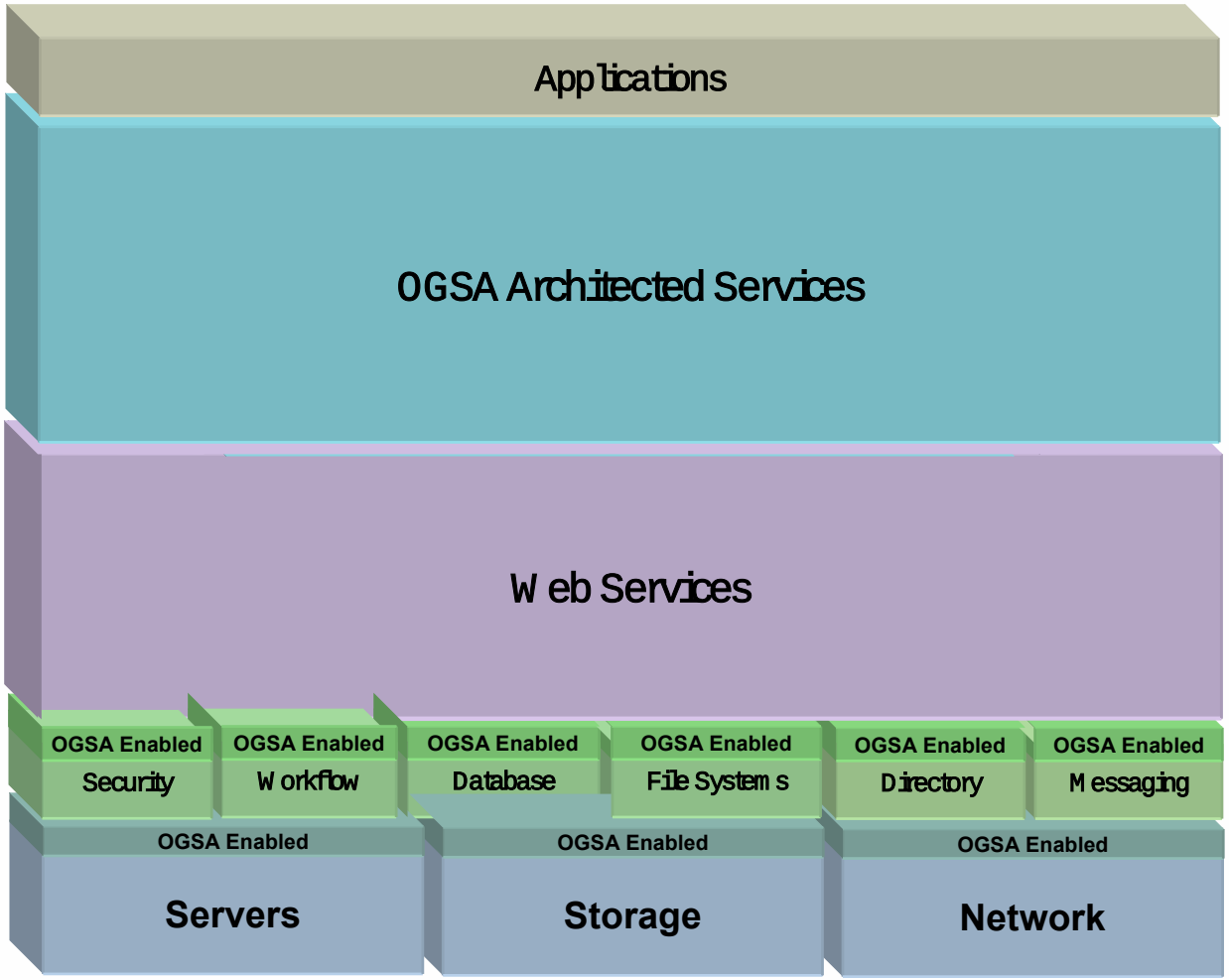
  **WS-Notification: IBM, Globus, Akamai, HP, SAP, Tibco, Sonic**

# How these proposals relate to OGSA

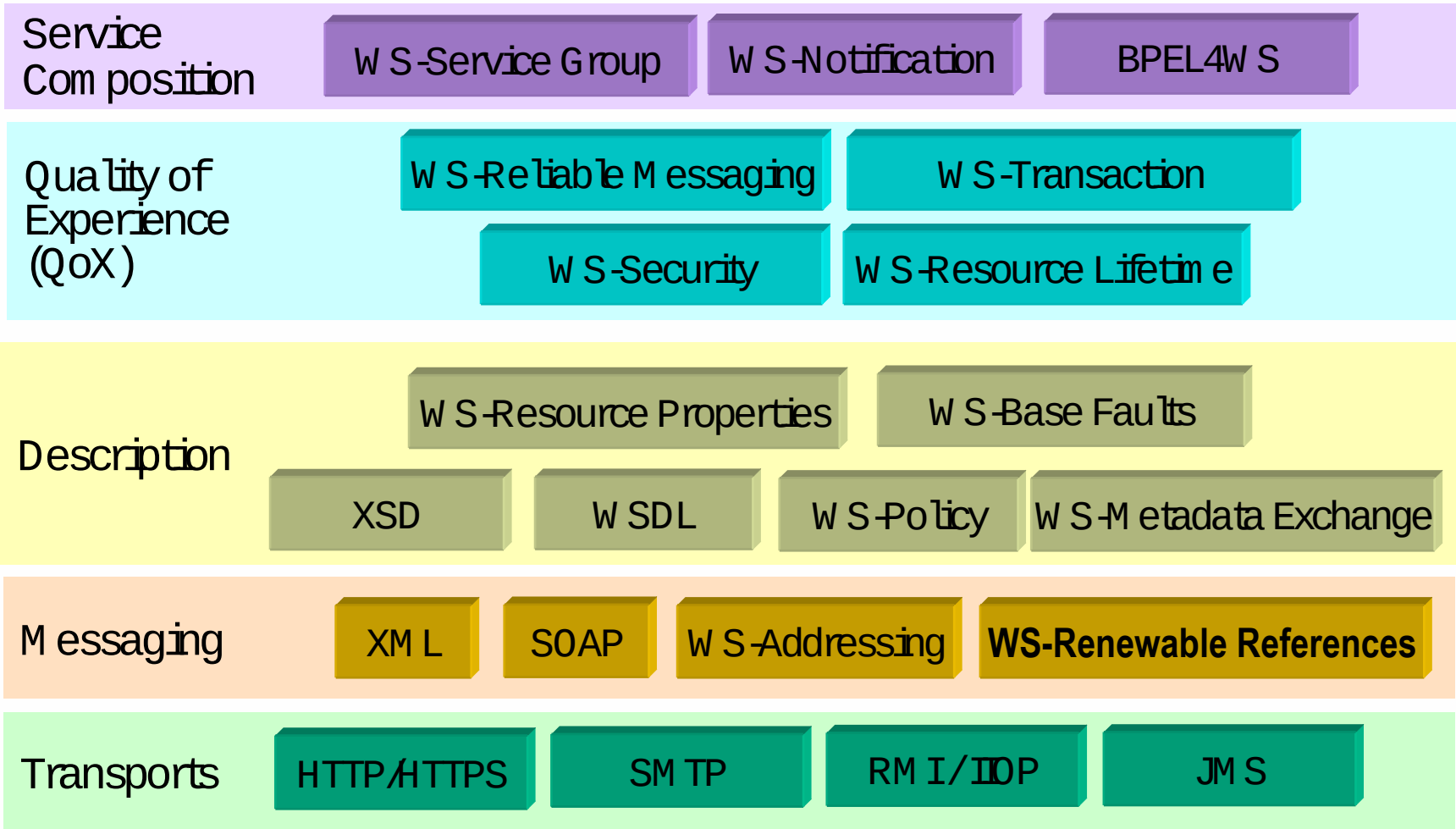
***WS-Resource Framework & WS-Notification are an evolution of OGSI***

- OGSA Services can be defined and implemented as Web services
- OS… …eb …ices de… …ls
- Grid applications will NOT require special Web services infrastructure



# How these proposals relates to other Web services standards:



# WS-Resource Framework Capabilities

- ★ Specifies how to use XML to describe and access a resource's properties
- ★ Clarifies how stateful resources are addressed
- ★ Defines how a resource is created and messages to destroy resources
- ★ Provides a message subscription and notification mechanism for Web services
- ○ Outlines how to organize groups of resources and services
- ○ Adds a fault tolerance capability to WS-Addressing
- ○ Defines a standard, extensible format for Web services error messages

# Web Services and Stateful Resources

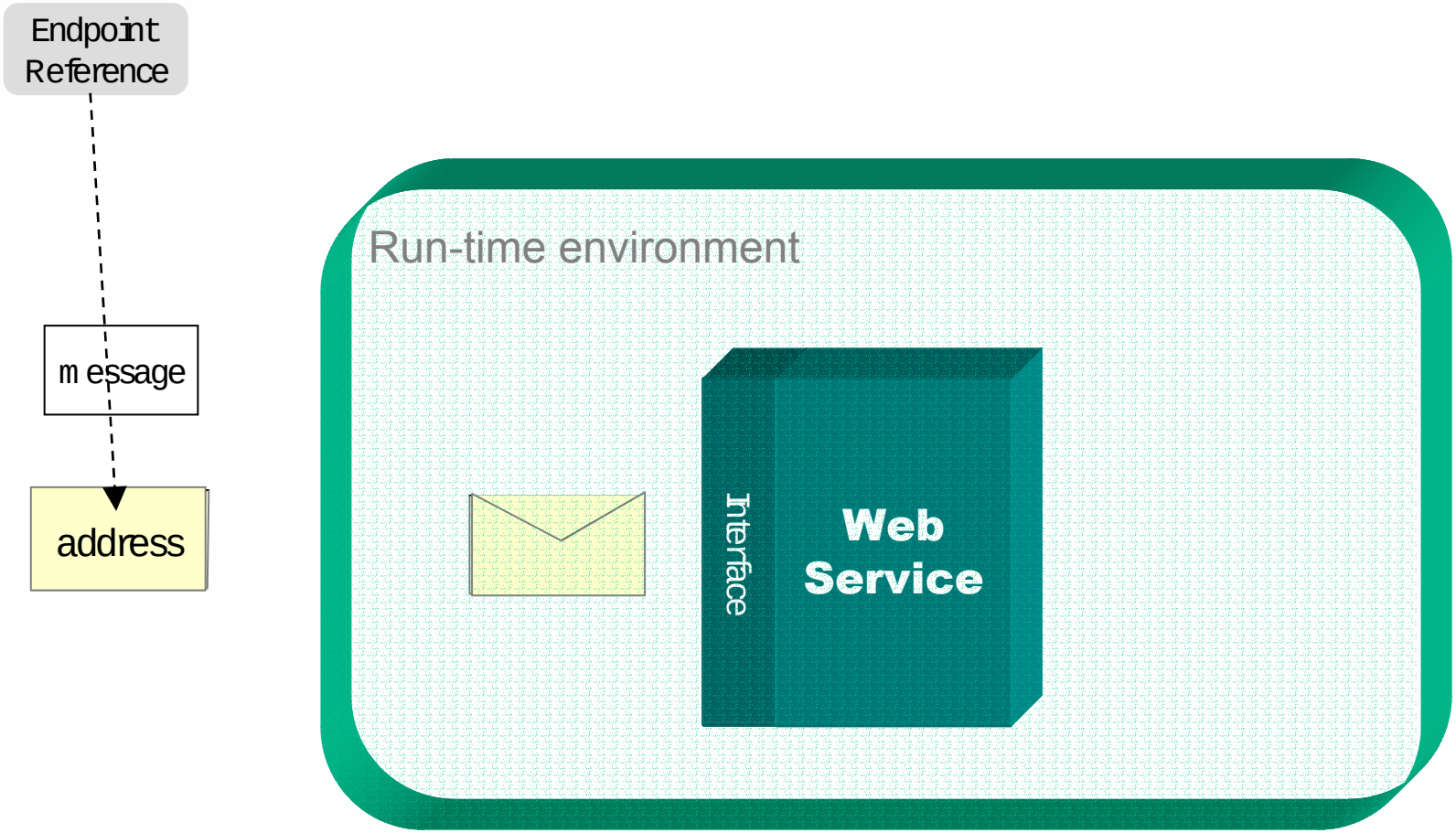
- "State" appears in almost all applications
  - Data in a purchase order
  - Current usage agreement for resources on a grid
  - Metrics associated with work load on a Web server
- There are many possible ways Web services might model, access and manage state
  - The WS-Resource framework proposes to standardize this capability for Web services

# The WS-Resource framework model

## *Web Service*

# The WS-Resource framework model

## *Invoking a Web Service*

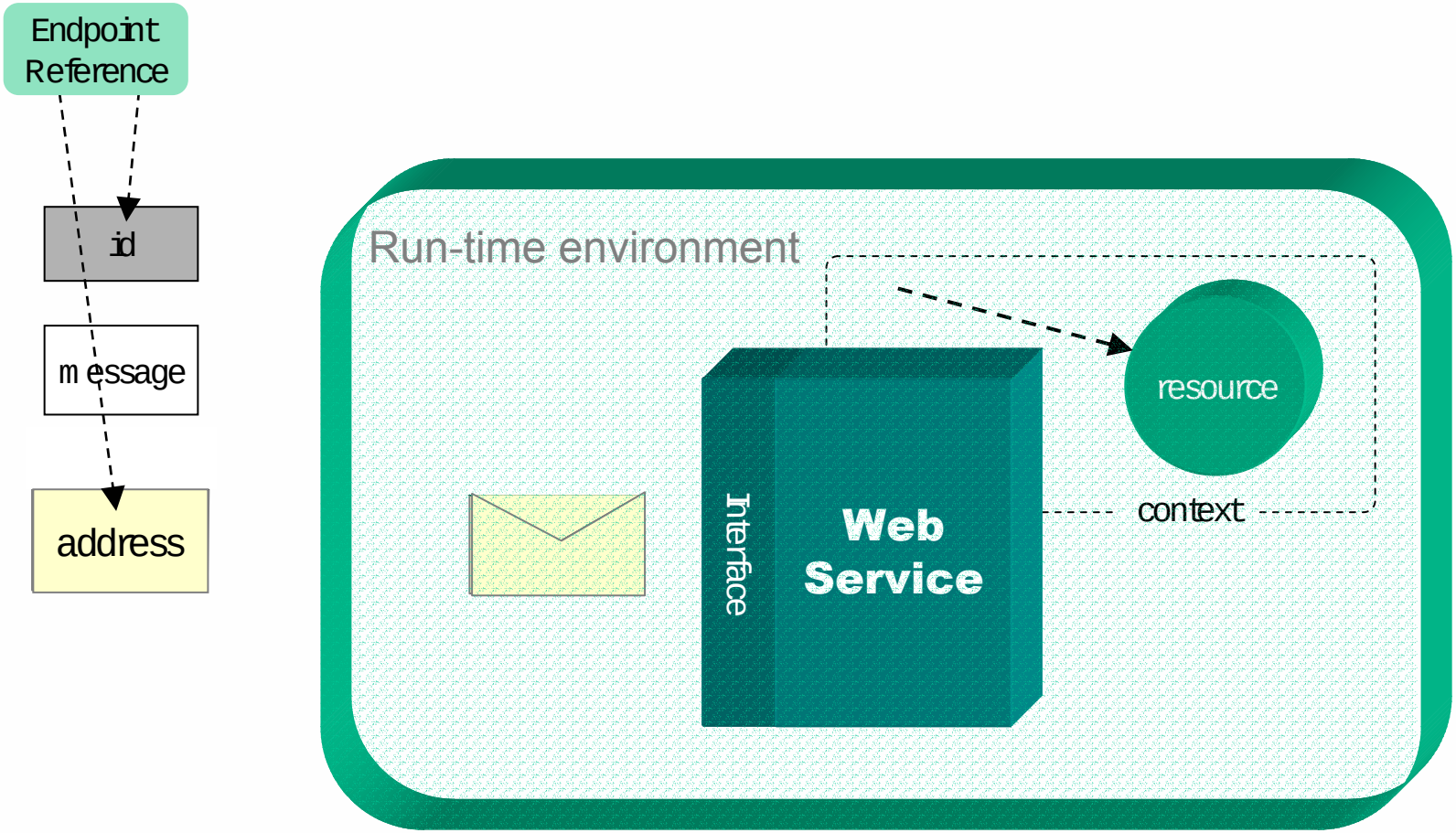


# The WS-Resource framework model

- What is a WS-Resource
  - Examples of WS-Resources:
    - Physical entities (e.g.. processor, communication link, disk drive) or Logical construct (e.g.. agreement, running task, subscription)
    - Real or virtual
    - Static (long-lived, pre-existing) or Dynamic (created and destroyed as needed)
    - Simple (one), or Compound (collection)
  - Unique - Has a distinguishable identity and lifetime
  - Stateful - Maintains a specific state that can be materialized using XML
  - May be accessed through one or more Web Services

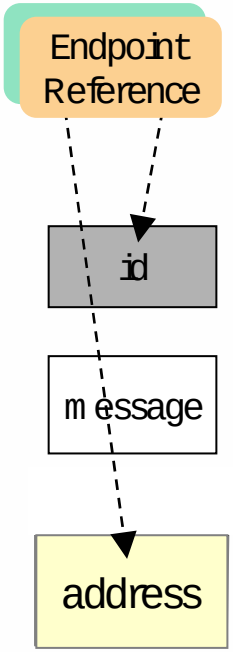
# The WS-Resource framework model

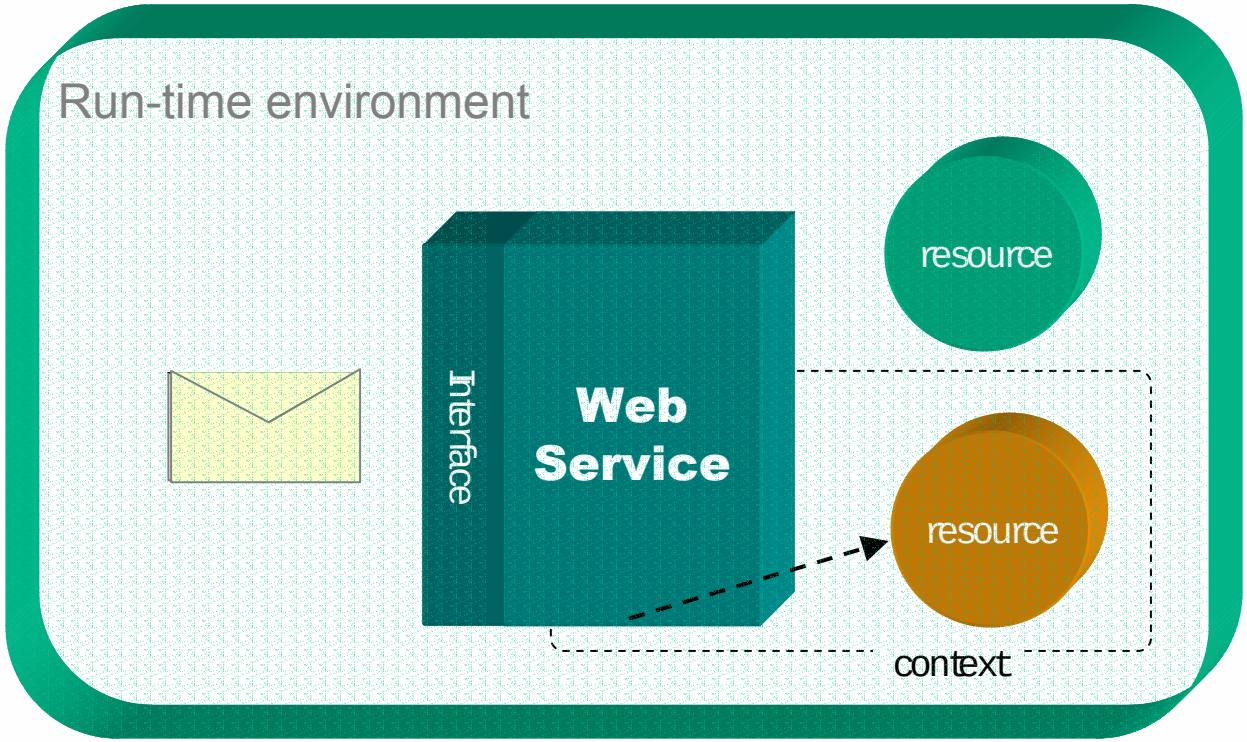
## *Using a Web service to access a WS-Resource*



# The WS-Resource framework model

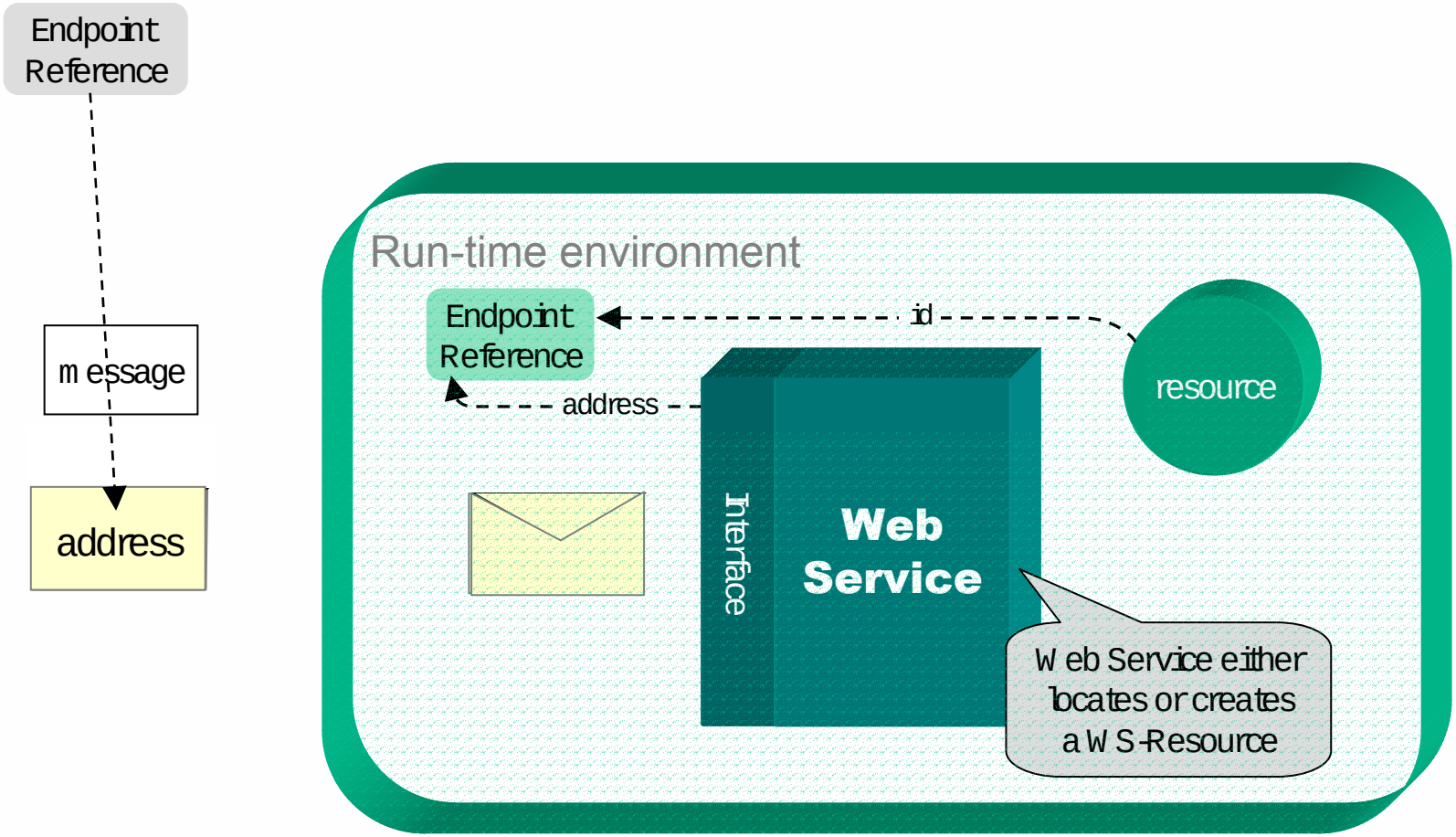
## *Using a Web service to access a WS-Resource*



# The WS-Resource framework model

## *Creating / Locating a WS-Resource*



# The WS-Resource framework model

- **WS-Resource Properties**
  - Resource state and metadata "Projected" as an XML document
  - Query and Set operations
- **WS-Resource LifeTime**
  - Explicit destruction or "Soft state" time-to-live
  - Provides for cleanup of resource instances


```
<ProcessorProperties>
    <ProcID>5A34C1DE03</ProcID>
    <ProcArchitecture>Power6.2</ProcArchitecture>
    <ProcSpeedMIPS>400</ProcSpeed>
    <ProcCacheMB>256<ProcCache>
    <ProcRunning>1</ProcRunning>

</ProcessorProperties>
```

# The WS-Resource framework model

## Architecture rationale

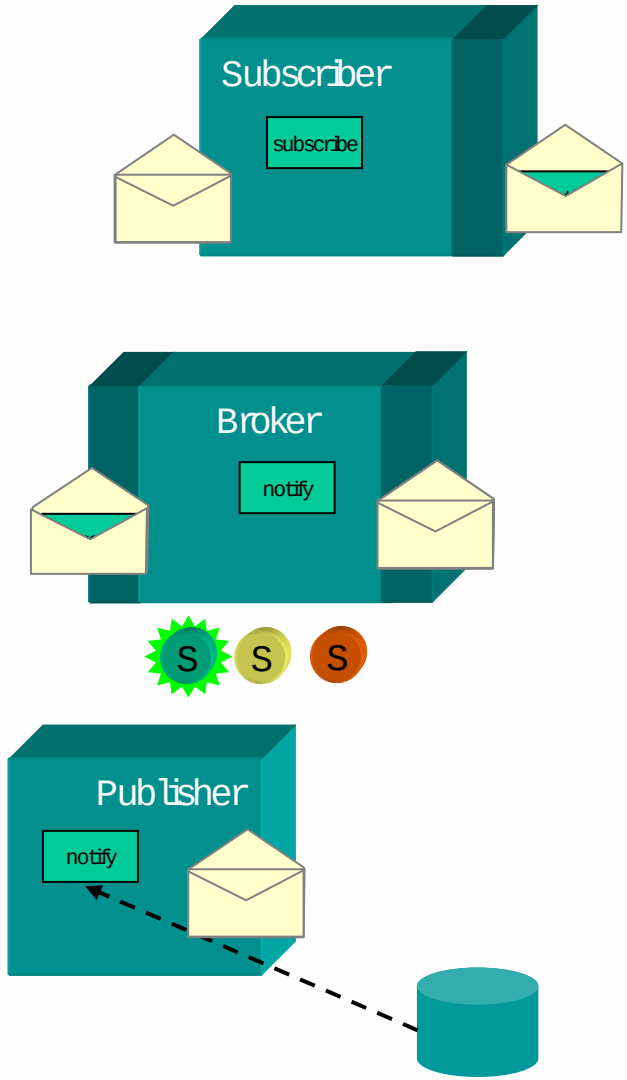
- WS-Resource framework exploits WS-Addressing
  - Web services and WS-Resources are referenced using an “Endpoint Reference”
  - Services that create or locate WS-Resources return Endpoint References
- Web service and WS-Resource are separate:
  - A Web service is stateless
  - A WS-Resource provides a context for stateful execution
  - Different entities, different lifetimes, different capabilities

# WS-Notification

- **WS-Notification**
  - **Brings enterprise quality publish and subscribe messaging to Web services**
    - **Loosely coupled, asynchronous messaging in a Web services context**
  - **WS Notification exploit WS Resource framework and Web services technologies**

# WS-Notification

- Subscriber indicates interest in a particular "Topic" by issuing a "subscribe" request
- Broker (intermediary) permits decoupling Publisher and Subscriber
- "Subscriptions" are WS-Resources
  - Various subscriptions are possible
- Publisher need NOT be a Web Service
- Notification may be "triggered" by:
  - WS Resource Property value changes
  - Other "situations"
- Broker examines current subscriptions
- Brokers may
  - "Transform" or "interpret" topics
  - Federate to provide scalability

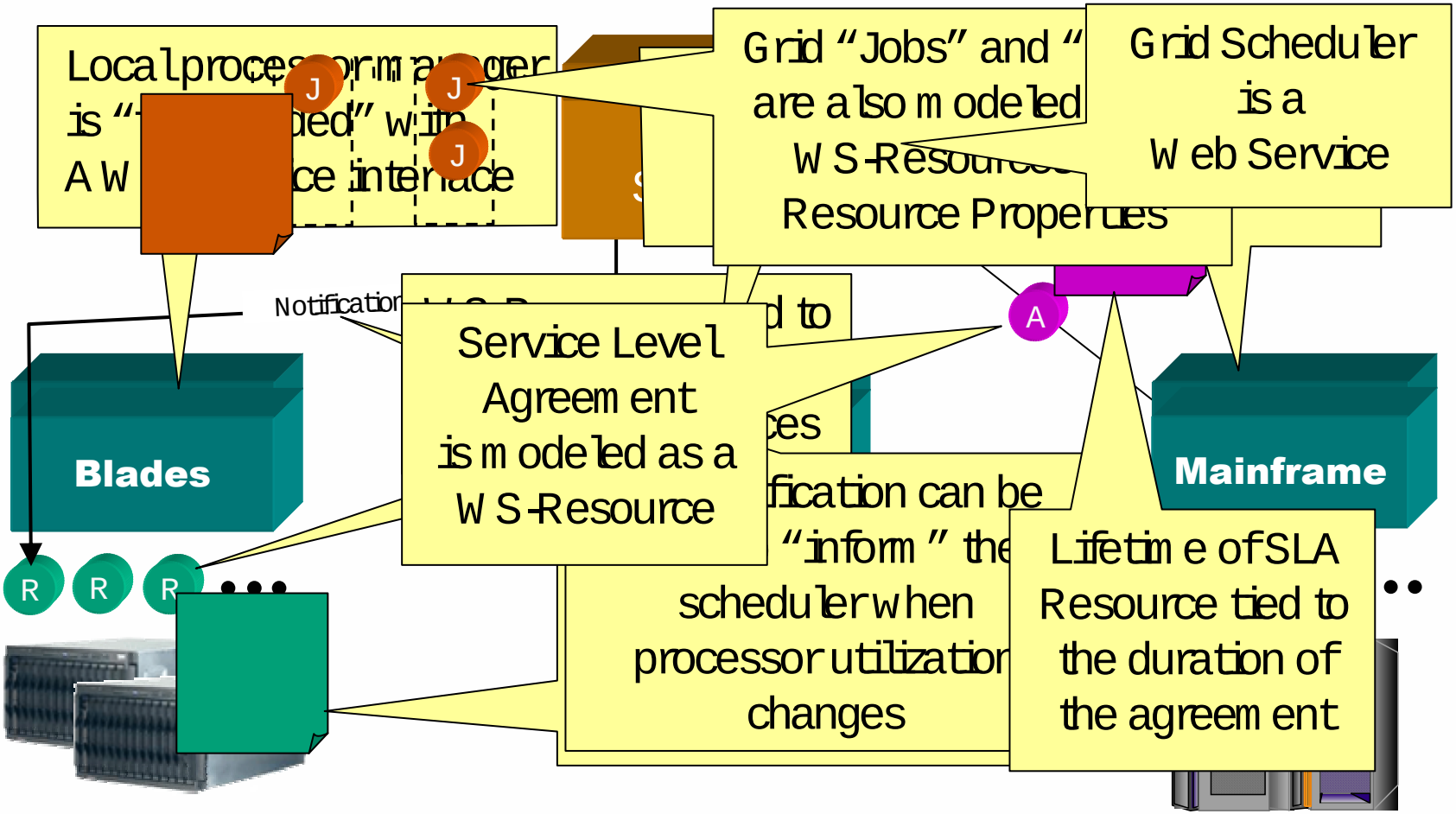


# WS-Notification

- Characteristics of WS-Notification:
  - Web services integration of traditional enterprise publish/subscribe messaging patterns
    - Composes with other Web services technologies
    - Facilitates integration between different messaging middleware environments
  - Standardizes the role of Brokers, Publishers, Subscribers and Consumers
  - Provides two forms of publish/subscribe: direct publishing and brokered publishing
  - Standardizes Web service message exchanges for publishing, subscribing and notification delivery
  - Defines XML model of Topics and TopicSpaces to categorize and organize notification messsages

# WS-Resource framework & WS-Notification

## *Scenario: Grid Resource Management & Scheduling*



# IBM Support for WS-Notification & WS-Resource Framework

***As standards mature and are broadly adopted***

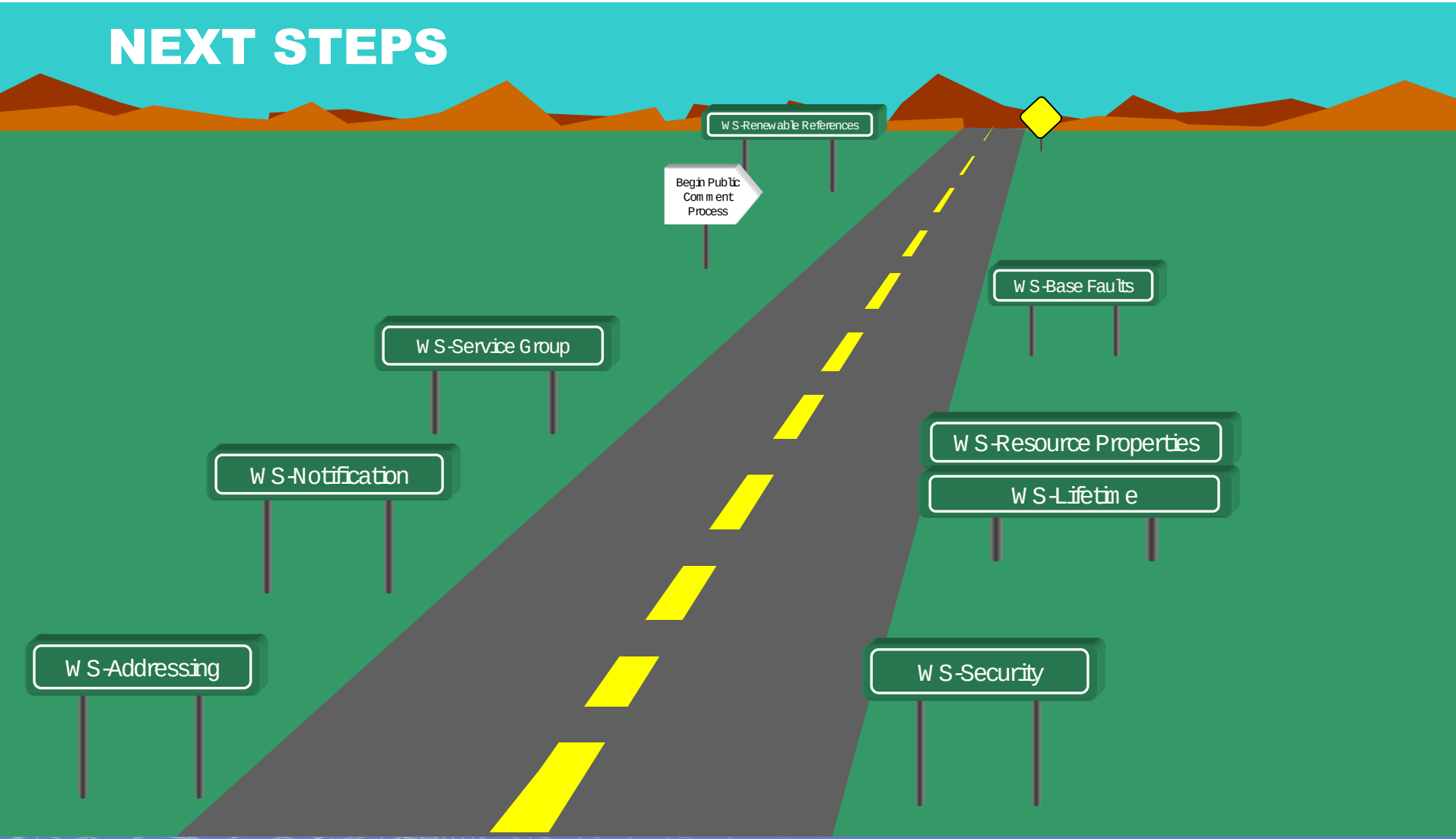
- **IBM WebSphere Family and related Rational tools**
  - **Provide a runtime environment that supports WS-Resource Framework and WS-Notification**
- **WS-* standards and Service Oriented Architecture (SOA) exploited:**
  - **Including WS-Security, WS-Reliable Messaging, WS-Resource Framework, WS-Notification etc.**
  - **Fundamental to IBM's OnDemand operating environment**
    - **System Management, Autonomic Computing**
    - **Data Management and Storage Management**
    - **Knowledge Management and Collaboration**
    - **Business Computing Services**

# WS-Resource framework & WS-Notification

## Value:

- To software developers:
  - Reduced cost / time to develop software
    - Use of existing WS development tools
    - Reuse of common components
    - Permit interoperation with other vendors components
- To customers
  - Increased solution flexibility & interoperability
    - Support heterogeneous distributed computing environment
    - Create solutions from multiple vendor components
    - Interoperability with partners using other software
    - Open reference implementations available

# WS-Resource Framework & WS-Notification



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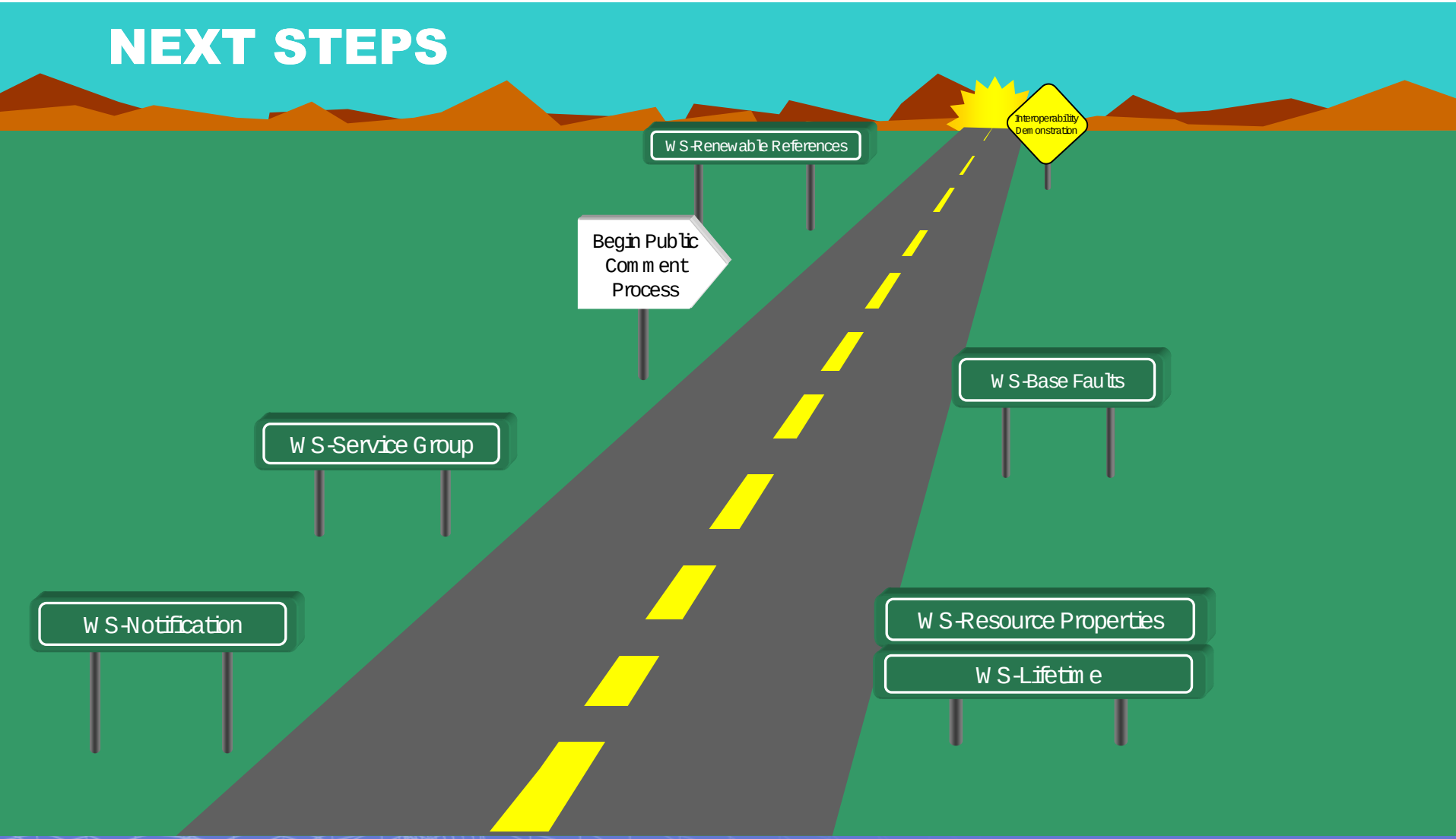

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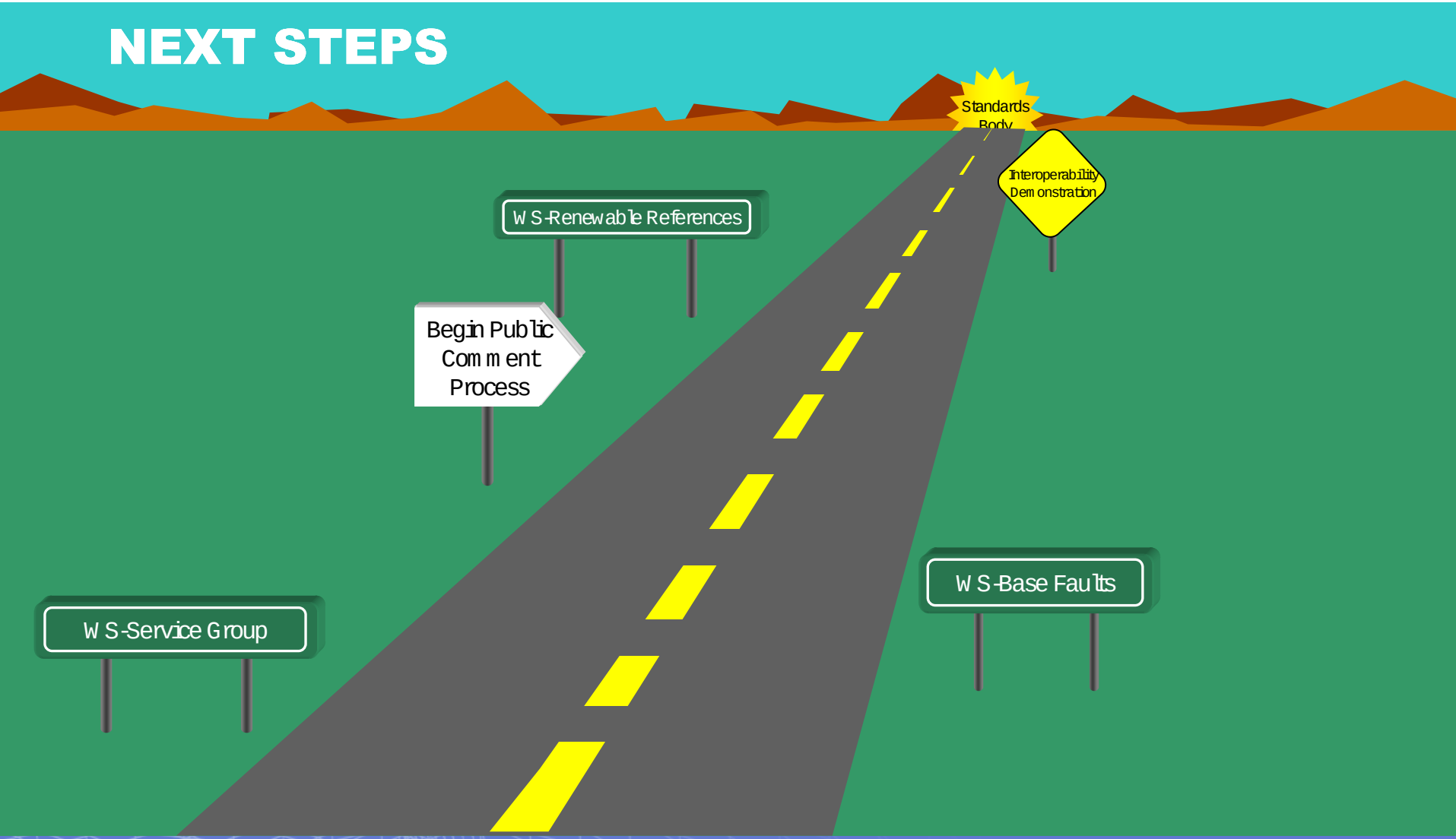

# WS-Resource Framework & WS-Notification