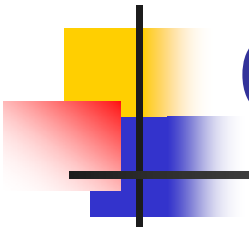
The WSDM of Autonomic Computing

Experiences in Implementing Autonomic Web Services

P. Martin, *W. Powley,* ***K. Wilson***,
W. Tian, T. Xu and J. Zebedee

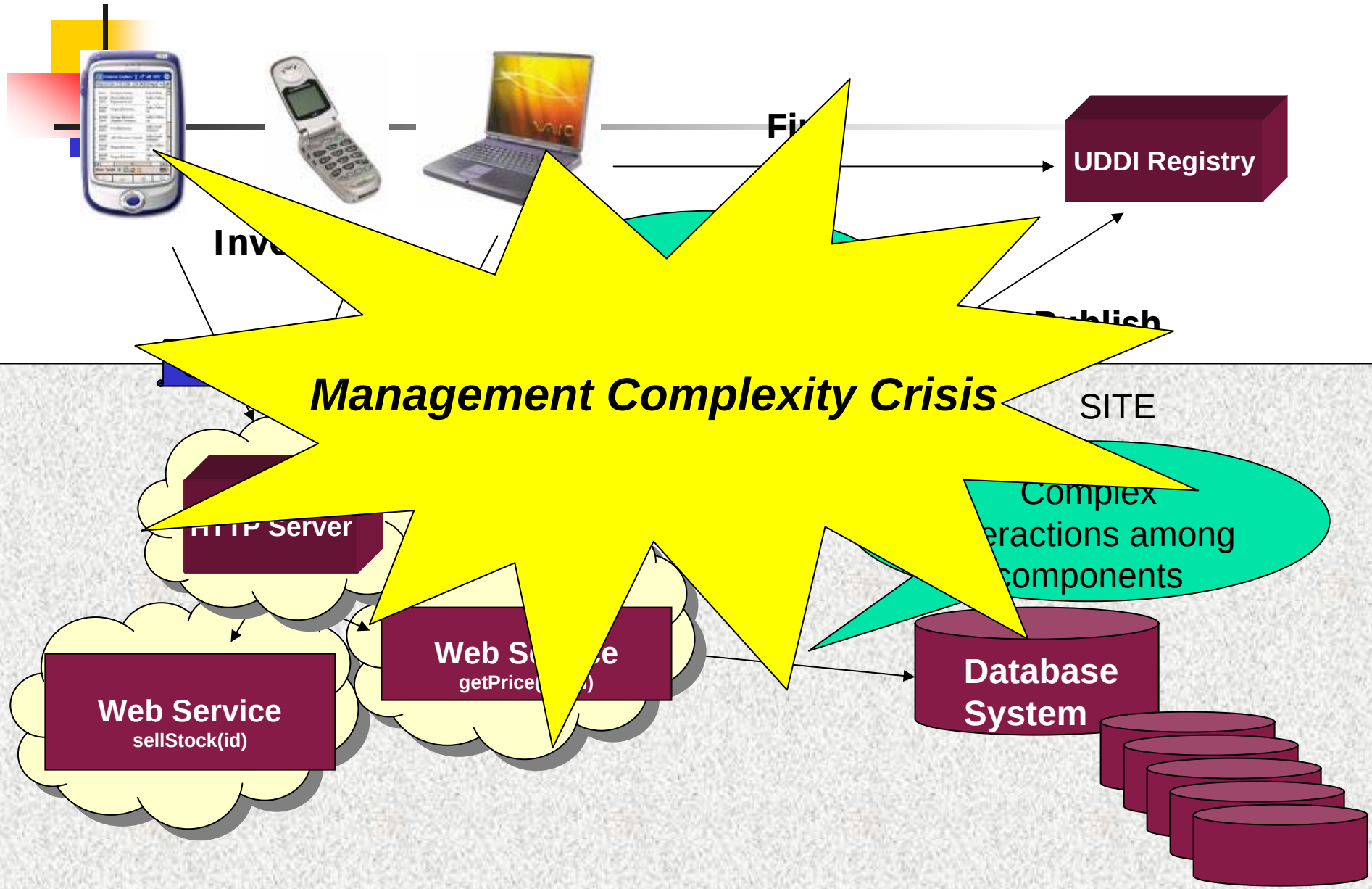
(Research support from OCE CCIT)



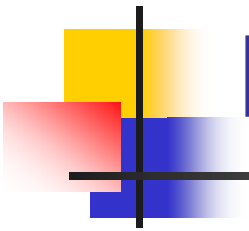
Outline

- Autonomic Web services environment
- WSDM
- AWSE + WSDM
- Lessons learned

Web Services

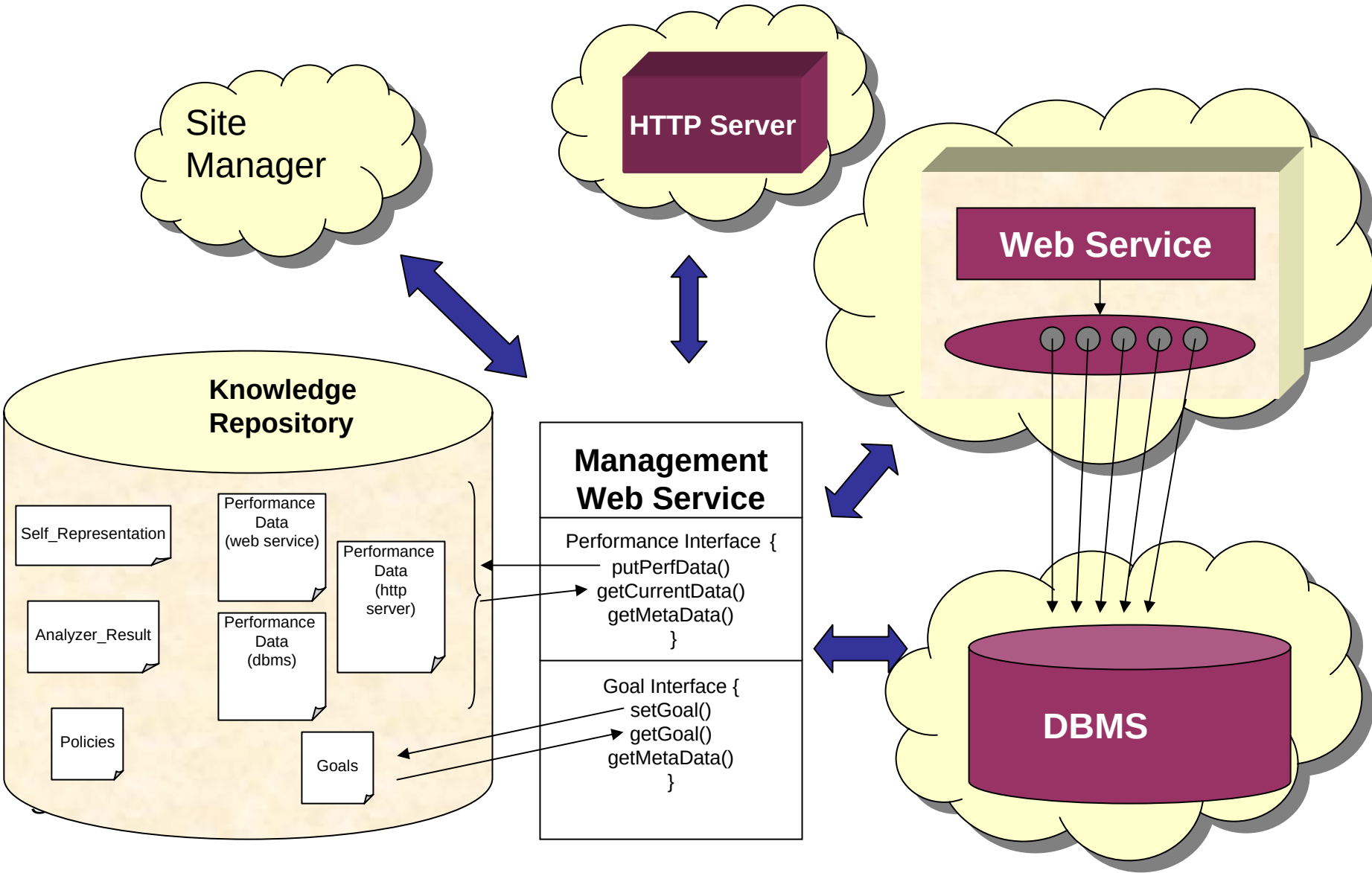


Autonomic Web Service Environment (AWSE)

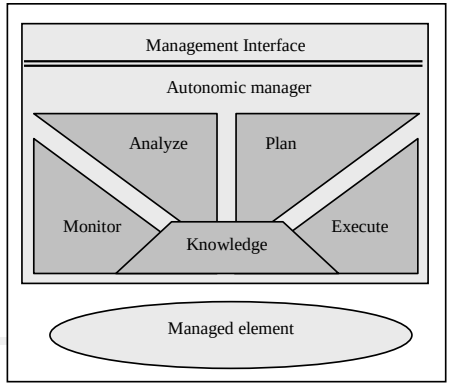


- Framework for developing autonomic Web services
- Reflective, database-oriented approach
  - Components present a self-representation that can be inspected and adapted at run-time
  - MAPE loop implemented via DBMS facilities

AWSE


Site Manager
HTTP Server
Web Service
Knowledge Repository
Self_Representation
Performance Data (web service)
Performance Data (http server)
Analyzer_Result
Performance Data (dbms)
Policies
Goals
Management Web Service
Performance Interface {
putPerfData()
getCurrentData()
getMetaData()
}
Goal Interface {
setGoal()
getGoal()
getMetaData()
}
DBMS

MAPE Loop in AWSE



Execute

Plan

Analyze

Self_Representation

trigger

trigger

Performance Data (buffer pools)

trigger

Analyzer_Result

Policies

Goals

Management Web Service

Performance Interface {
putPerfData()
getCurrentData()
getMetaData()
}

Goal Interface {
setGoal()
getGoal()
getMetaData()
}

Monitor

Monitoring API

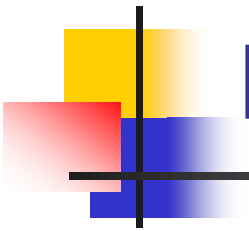
Configuration API

Buffer Pools

DBMS

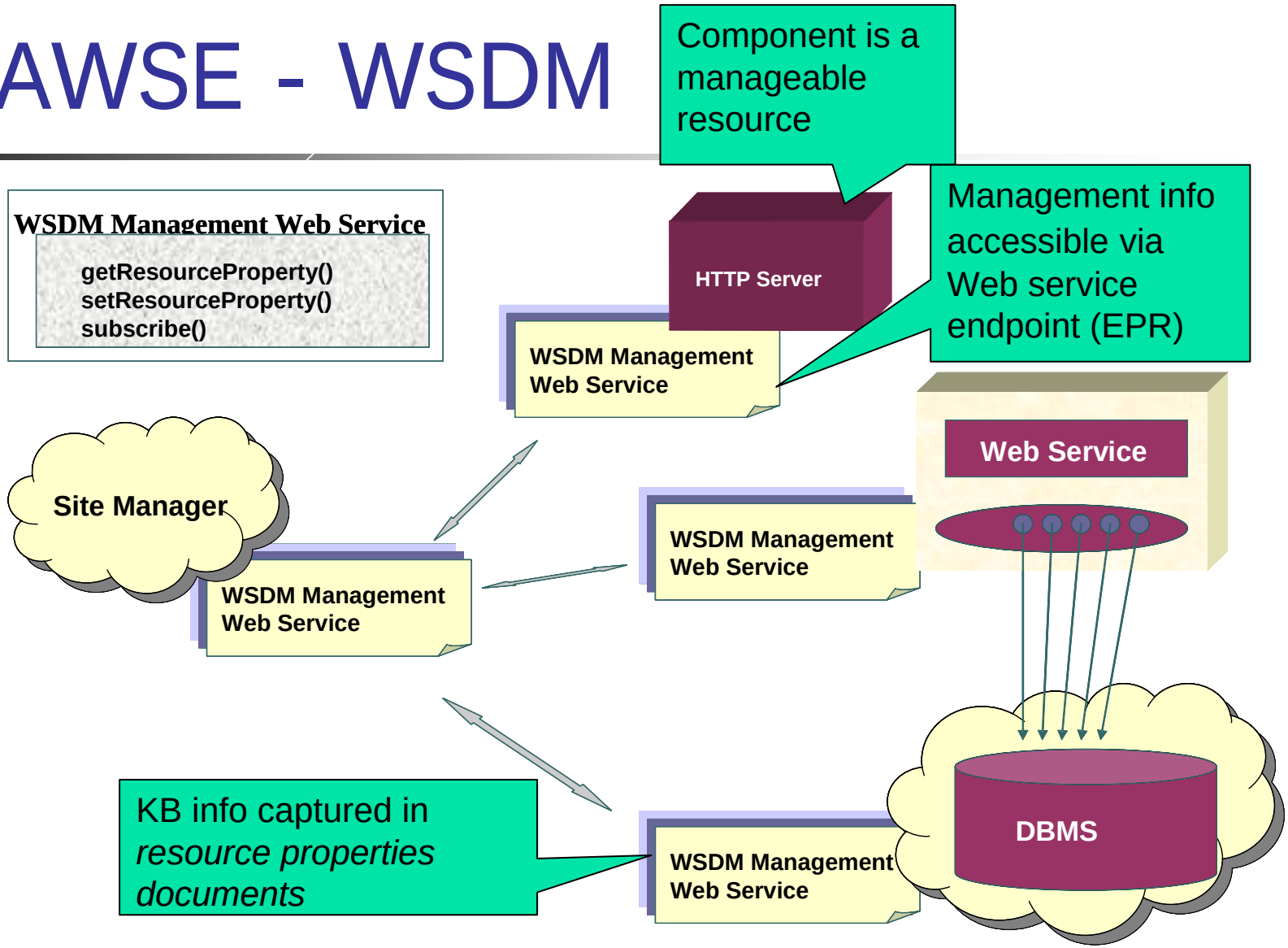
Managed Resource

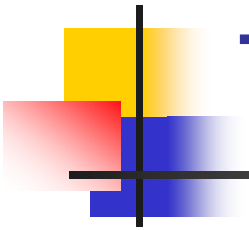
WSDM: Web Services Distributed Management



- Manageability of resources available through Web services
- Describes a set of management capabilities that may be exposed by resources (eg OperationalStatus, Metrics, Configuration)
- Used as basis of architecture for AC

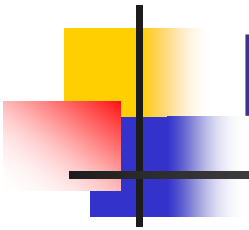
AWSE - WSDM


Component is a manageable resource
WSDM Management Web Service
getResourceProperty()
setResourceProperty()
subscribe()
HTTP Server
Management info accessible via Web service endpoint (EPR)
WSDM Management Web Service
Web Service
Site Manager
WSDM Management Web Service
WSDM Management Web Service
DBMS
KB info captured in *resource properties documents*
WSDM Management Web Service



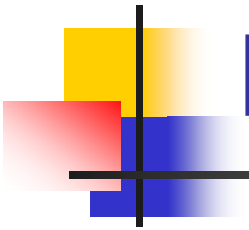
Transition Experience

- Open source development tools
  - Apache MUSE
- Steep learning curves
- Increased code sophistication
- WSDM support for *Metrics* and *Notifications*



Evaluation

1. Impact on System Architecture
   - Myth of implementation independence
     - Interfaces constrain possible implementations
     - WSDM suits a distributed architecture
   - Notifications forced architecture changes
     - Database-oriented MAPE loop didn't match resource encapsulation of WSDM



Evaluation (2)

2. Support for MAPE Loop
   - WSDM useful for interactions among autonomic managers
   - WSDM does not affect communication among parts of an autonomic element
   - WSDM provides natural representation of AWSE management interface
   - Metrics and notifications enhance processing

Evaluation (3)

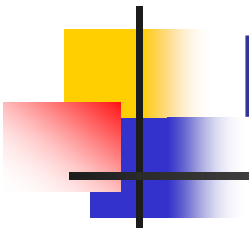
3. Amount of Complexity

Step 1: WSDM and XSD documents	270 lines (written)
Step 2: Java stubs (MUSE)	680 lines (generated)
Step 3: Stub modifications	80 lines (written)
Step 4: Backend object	350 lines (written)
Step 5: Callback objects	500 lines (written)

33% of code automatically generated

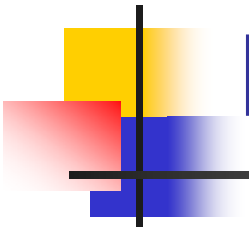
38% of written code was actually original code

100% increase in lines of code



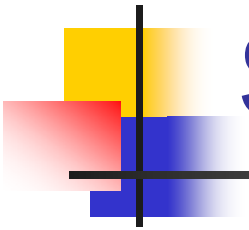
Evaluation (4)

- Performance
  - Approximately 7% performance decrease in throughput with AWSE-WSDM
  - Each interaction involves calls to 6 layers (as opposed to 4)
  - Supporting notifications added overhead to monitoring



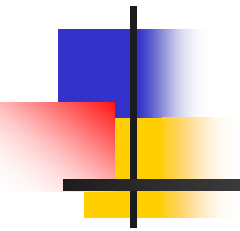
Lessons Learned

- Steep learning curve to adopt WSDM
  - Tools often behind the standards!
  - MUSE 2 a big improvement!
- WSDM improved communication in AWSE
- Need to appreciate the “paradigmatic” architecture implicit in WSDM
  - AWSE’s database-oriented approach not a good match to WSDM



Summary

- Success of AC hinges upon adoption of common standards like WSDM.
- WSDM added significantly to amount of code, but new code is not hard to produce.
- Overhead due to WSDM not significant.
- Implementation strategy is important.



Questions ?