DDS Scalability: “One size fits all ??.. ”
For OMG RTE-workshop, July 2007

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Agenda

- INTO THE MOOD
- CRITICAL INFRASTRUCTURES
- A MODEL
- DDS APPLICABILITY
- DDS USECASE
- CONCLUSION

“… A paradigm shift …”
“… The Data is the Network © …”
“… For DDS applicability …”
“… One size fits all ?? …”
“… Work in Progress …”
“… Wait & See …”
Into the mood: ‘…Client/server vs. Pub-sub: A mind-shift…’
© ARMS (Doug Schmidt): R&D Challenge
The Move to Net-Centricity

**Current**
- Information stovepipes
- “Welded” interfaces
- Predetermined needs
- Fixed display formats
- Need to know

**Net-Centric**
- Shared information
- Unconstrained
- Unanticipated users
- User-defined info and formats
- Need to share; right to know

Rigid

Agile

Connecting People With Information

© DoD Chief Information Officer, Network and Information Integration, Nov’05

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DDS: a Fielded concept, suitable for mission-critical systems

CHARACTERISTICS

Many different customers: fielded in over 15 Navies world-wide
Many different ships/missions: tens of Ships classes (patrol boats to destroyers)
Large-scale & mission-critical: >150 CPU’s, >2200 applications, >4.000 tracks/sec
Real-time and Fault-tolerant: Battle-damage resistant, deterministic, reliable
- Data-traffic: >4,000 publications per second over the system-data bus
- Programs: 2,200 programs allocated over 150 processors
- Data flows: urgent & non-urgent data (latency), important & less-important data (priority)
A MODEL FOR DDS-APPLICABILITY
Information Grids in Net-Centric Operations (NCO)

Engagement Grid: Weapons Direction
Awareness Grid: Common Tactical Picture
Planning Grid: Common Operational Picture

Combat Execution (CE)
Command & Control (CC)
Command Support (CS)

NCO: Autonomous processes, based upon ubiquitous information at required QoS
A MODEL FOR DDS APPLICABILITY

- Platform-centric
  - "Execution grid"

- Net(work)-centric
  - "Awareness grid"

- System-of-Systems
  - "Planning/support grid"

Soft

Firm

Hard

Realtime

Scale

Small

Large

Ultra-Large
MAIN CHARACTERISTICS

- **Execution-grid**
- **Awareness-grid**
- **Planning/support grid**

**DETERMINISTIC**
- Hard
- Realtime

**EFFICIENT**
- Firm
- Large

**INTEROPERABLE**
- Soft
- Ultra-Large

Scale
EXAMPLES

- **Military**: AAW fire control
- **Civil**: Process control
- **Military**: Track-Management
- **Civil**: SCADA control systems
- **Military**: Mission planning
- **Civil**: Emergency Response
- **Military**: Mission planning
- **Civil**: Emergency Response

**Soft**

**Firm**

**Hard**

**Realtime**

**Planning**

**Awareness**

**Execution**

**Scale**

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DDS-APPLICABILITY
DDS SUITABILITY: FUNCTIONALS (Specification)

Realtime

INTEROPERABILITY
- IDL/CORBA
- XML ??
- SQL ??

EFFICIENCY & AVAILABILITY
- LATENCY_BUDGET
- FT DURABILITY

DETERMINISM
- RELIABILITY
- TRANSPORT_PRIORITY
- OWNERSHIP/LIFELINESS

Partitions / Domains

IDL → XML/JSON ??
DDS SUITABILITY: Standardization Challenges

- **Realtime**
  - Soft
  - Firm
  - Hard

- **EFFICIENCY/SCALABILITY**
  - Shared subscriber caches
  - User-defined storage-keys

- **INTEROPERABILITY**
  - XML based API/topics
  - DBMS: topic/table mapping

- **RT-DETERMINISM**
  - Priority-banding
  - Traffic shaping

- **Corba/RTJava integration**
- **DBMS/Web-service integration**

Scale: Small → Large → Ultra-Large
Use Case: OpenSplice
.... one size fits all ... ???
USE-CASE: OpenSplice, Addressing the challenges

Realtime

PLUGGABLE (GATEWAY) SERVICES

- XML: topic-definition & API
- DBMS: topic/table mapping

IN-MEMORY (O) DBMS BASED CORE

- DLRL data management
- Shared/read-only caches
- User-defined/Dynamic keys

RT NETWORK_SCHEDULER

- RT Priority-banding
- Traffic shaping (size/burst)
- Info-priority pre-emption

Scale

Soft

Firm

Hard

Small

Large

Ultra-Large

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USE-CASE: Creating & Deploying DDS-based systems

Deployment

Development

- Views & Editors
  - UML
  - DDS-DSL
- Modeling-Plug-ins
  - Information Modeling
  - Application Modeling
  - Deployment Modeling
- Roundtrip-Engineering
  - Remote-connect
- Foundation & Framework
  - Eclipse

SECURITY

- Monitor & Control (Tuner)
- Logging & Replay
- Configuration
- DDS API’s
  - C/C++/Java
- COHABITATION
  - Corba/Java/Dbms
- Dynamic XML-based API
- DLRL
- DCPS
- Webservice gateway
- Network Scheduler
- Fault-tolerant Durability
- DBMS Gateway
- Enterprise
  - (Windows, Solaris, Linux, AIX)
- Embedded
  - (vxWorks, QNX, LynxOS)

High-level Services
Middleware-Integration
OMG-DDS Profiles
Pluggable-Services
Supported Platforms

soap
CONCLUSION: ‘One concept’ fits all, we’re not there yet..

Security for DDS  
(node-to-node and end-to-end, encryption available but no standard yet)

Logging & Replay  
(following C4I standardization)

Dynamic Topics  
(requirements: DDS-PSIG)

UML-profile for DDS  
(joint submission with SPARX systems)

Views & Editors
UML  DDS-DSL

Modeling-Plug-ins
Information Modeling  Application Modeling  Deployment Modeling

Roundtrip-Engineering
OpenSplice Tuner & Remote-connect

Foundation & Framework
Eclipse

SECURITY

Monitor & Control (Tuner)  Logging & Replay  Configuration

DDS API’s
C/C++/Java

COHABITATION
Corba/Java/Dbms

Dynamic XML-based API

Minimum  Ownership  Content-Subscription  Persistence

DCPS  DLRL

DBMS Gateway

Web service gateway

Network Scheduler

Fault-tolerant Durability

Enterprise (Windows, Solaris, Linux, AIX)

Embedded (vxWorks, QNX, LynxOS)

Supported Platforms

High-level Services

Middleware-Integration

OMG-DDS Profiles

Pluggable-Services

CONCLUSION: ‘One concept’ fits all, we’re not there yet..

Web service gateway  
(available and used by OpenSplice Tuner™, but no standard yet)

Pluggable Discovery  
(for ultra-large/WAN systems, Several European/US studies)

Dynamic DBMS gateway  
(available, but IDL/table mapping not standardized)

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QUESTIONS

THANK YOU !!
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