

Data Distribution Management
in the
Digital Leaders Reaction Course
Federation

October 28 1998

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Outline

Brief Review of DDM

- **Brief Review of DLRC**
- **DDM in the DLRC**
- **Some Observations and Lessons Learned**



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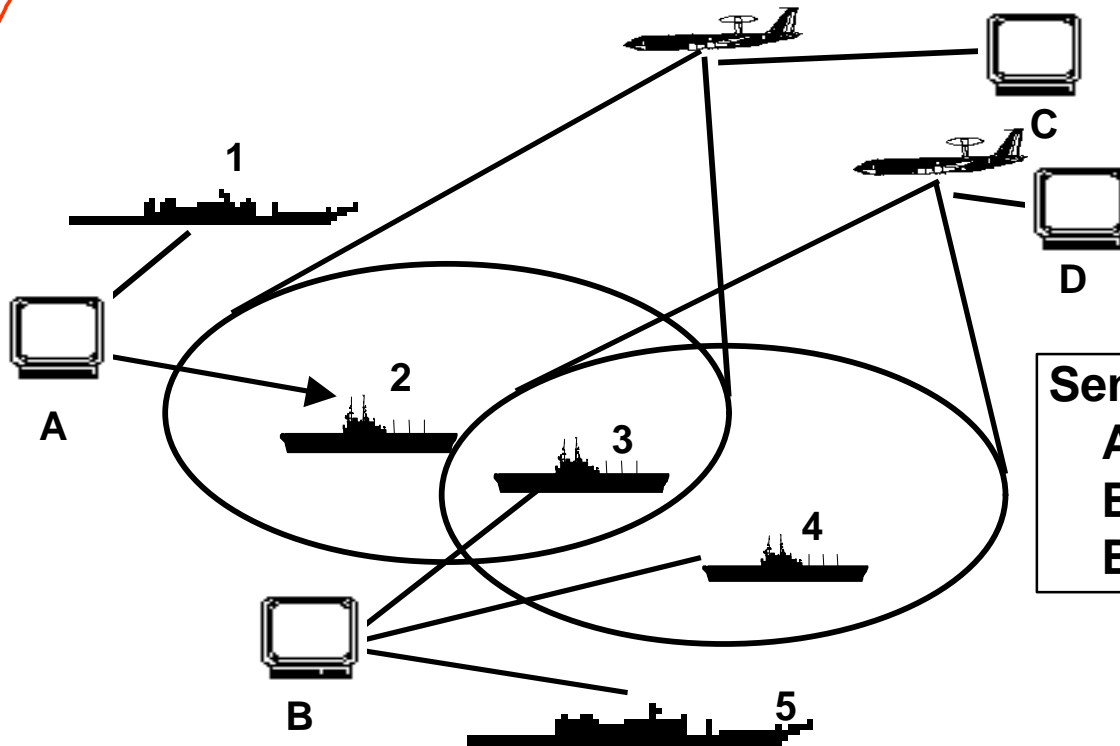
DDM - Goal

- **The goal of HLA DDM services is to limit the messages received by federates in large distributed federations to those messages of interest in order to reduce (1) the data set required to be processed by the receiving federate and (2) the message traffic over the network.**
 - **Efficiency**
 - **Minimum Overhead when using its services**
 - **Scalability**
 - **computational complexity, message traffic, memory requirements**
 - **Interfaces**
 - **Correct filtering functionality in an easy-to-use manner**



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DDM - Overview



Sender	Data	Destination
A	2	C
B	3	C,D
B	4	D

- ★ Establish connectivity based on matching publishers' offers to produce data and subscribers' desire to consume data.
- ★ It allows a Federate to limit the attribute update and interaction data they receive.



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DDM - Overview

Routing Space:

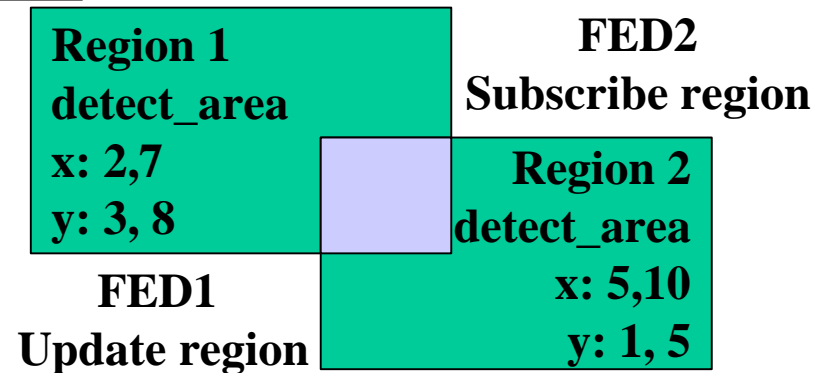
The fundamental DDM construct.

- ★ It is a multidimensional coordinate system through which federates either express an interest in receiving data or declare their intention to send data.
- ★ Federates instantiate “instances” of a routing spaces by defining a region which includes max and min values of each dimension of the routing space.

Generic

```
(spaces  
  (space detect_area  
    (dimension x)  
    (dimension y)  
  ))
```

Specific



When an update region and subscription region of different federates overlap, the RTI establishes communications connectivity between the publishing and subscribing federates



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Purpose/Goal of DLRC

- The DLRC Concept began in Sept 1997 and was initially funded by the Ft. LVN War Lab as an investigation into providing the students at CGSC a realistic Command Post environment to practice their combat decision making.
- In early 1998, it was included as part of the Army Experiment 5 process for testing and validation.

GOAL

Provide an environment for training leaders on how to visualize the battlespace and make tactical decisions in a time constrained, digitized environment.

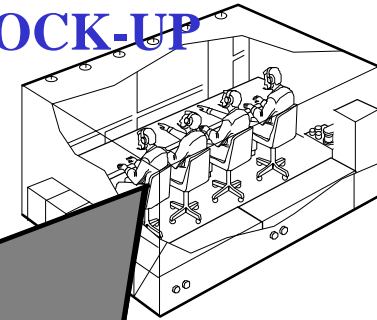
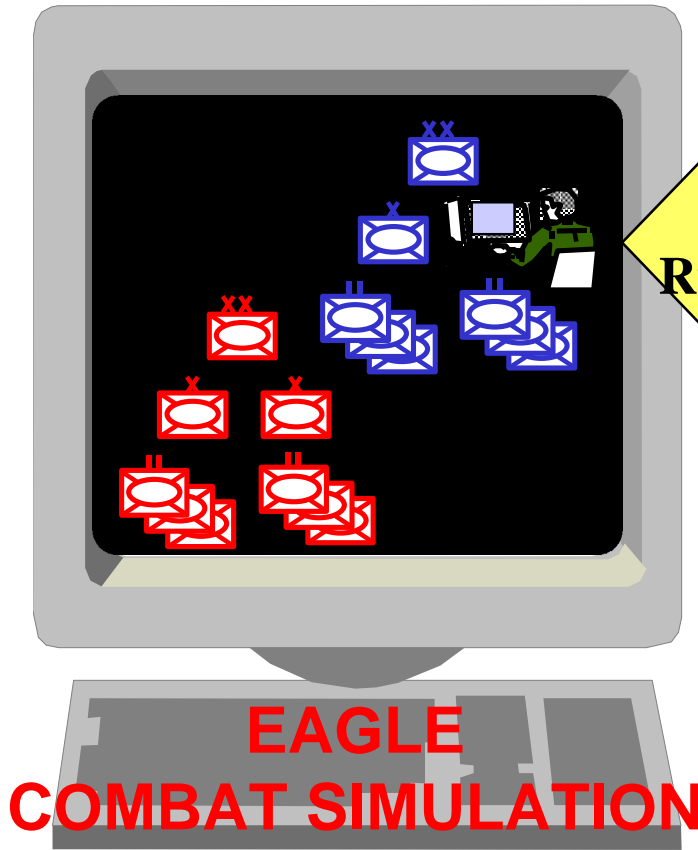


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Prototype

C2V
MOCK-UP



Maneuver



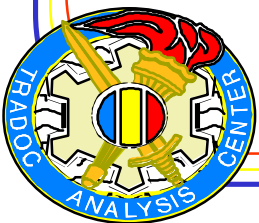
Artillery



Intelligence



**A Live Brigade Staff replaces the
Simulated Staff in selected command Posts.**



"In the Box"



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General Architecture

TSIU/ ASAS



UAV



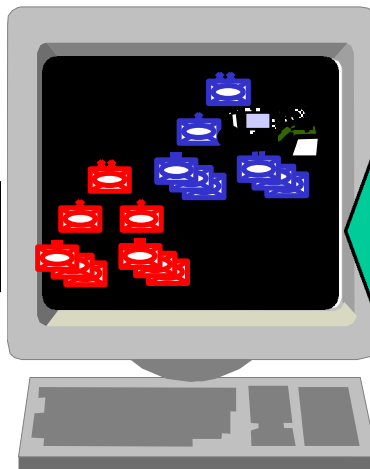
Stealth

C2V Back Door



Stealth

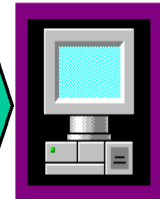
EAGLE COMBAT SIMULATION



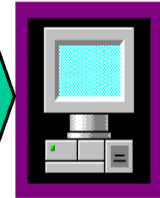
DIS

HLA - RTI

MCS



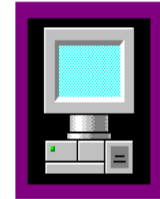
AFATDS



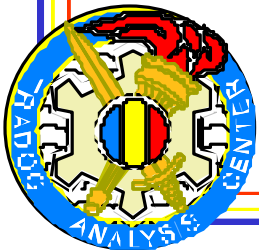
CMD RADIO



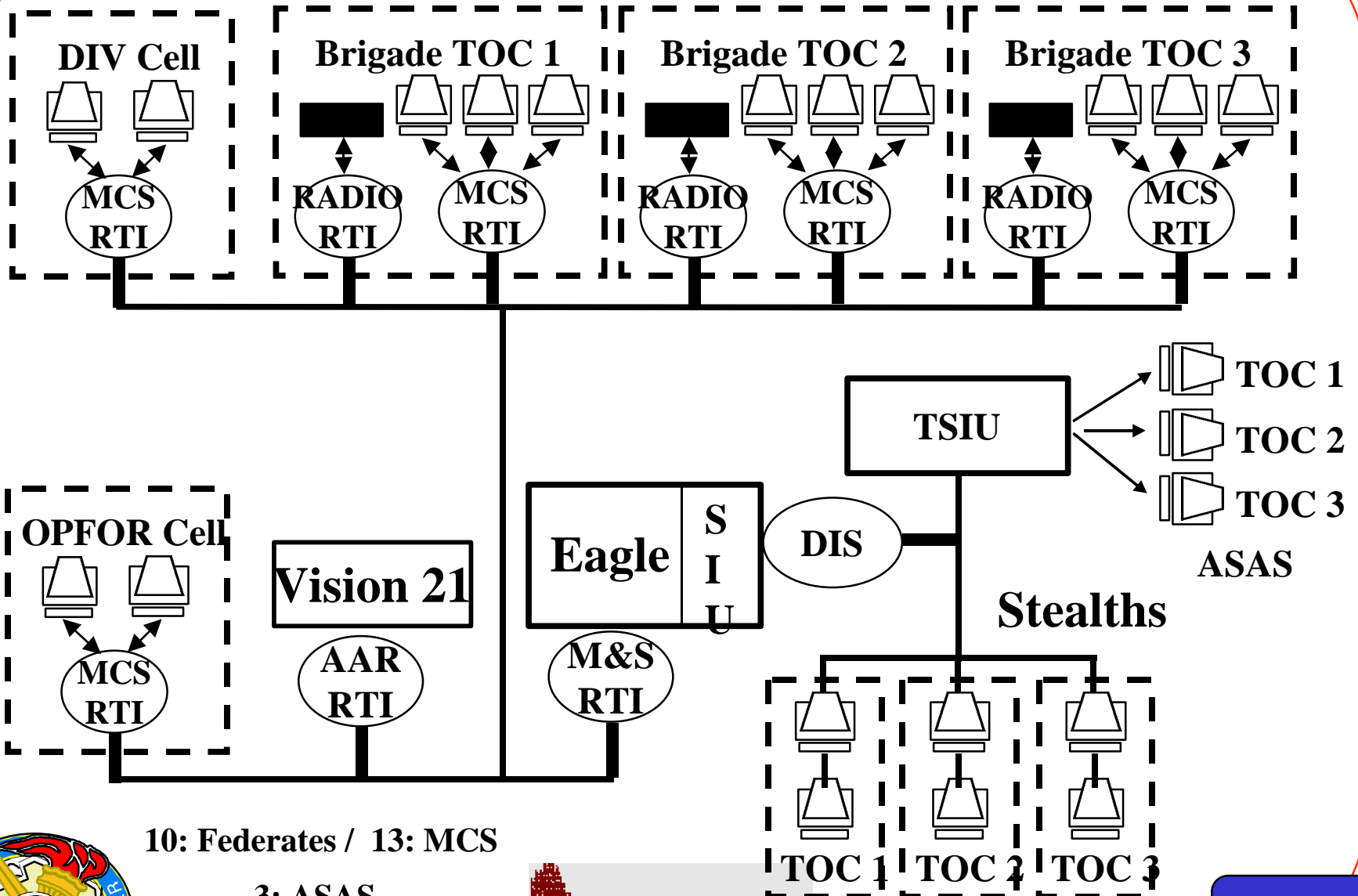
AARS



DLRC is made up of an HLA Federation and DIS interface.

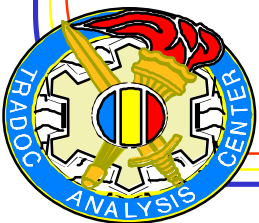


DLRC - Experiment - July



10: Federates / 13: MCS

3: ASAS

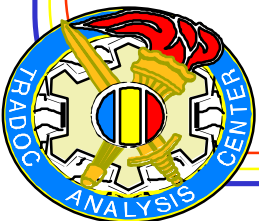


Federation Object Model

Object Classes

	EAGLE	AAR	MCS	RADIO
OBJECTS				
Ground Maneuver	P	S		
AIR Maneuver	P	S		
Fix Wing	P	S		
Systems	P	S		
SRCs	P	S		
Control Measures	P	S		

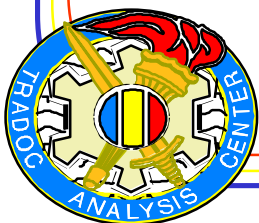
P: Publish / S: Subscribe



Federation Object Model

	EAGLE	AAR	MCS	RADIO	AFATDS
INTERACTIONS					
Direct Fire Attrition	P	S			
Indirect Fire Attrition	P	S			
Voice	P	S		S	
Friendly Sit. updates	P	S	S		
Enemy Sit. updates	P	S	S		
Logistics updates	P	S	S		
Email Messages	P	S	S		
Messages	S	S	P		
Current Time	P	S			
New Entity	P		S		
Graphics	P		S		
AFATDS Unit update	P				S
AFATDS Ammo update	P				S
AFATDS CFF	S				P
AFATDS MFR	P				S
AFATDS CDR	P				S

P: Publish / S: Subscribe



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DDM in the DLRC

- **Keep it simple initially**
- **Focus on Interactions**



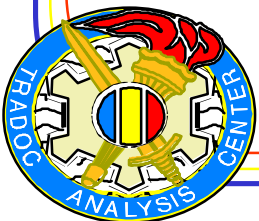
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DDM in DLRC

Focus on the delivery of information to the MCS and RADIO Federates from Eagle

	EAGLE	AAR	MCS	RADIO	AFATDS
INTERACTIONS					
Direct Fire Attrition	P	S			
Indirect Fire Attrition	P	S			
Voice	P	S		S	
Friendly Sit. updates	P	S	S		
Enemy Sit. updates	P	S	S		
Logistics updates	P	S	S		
Email Messages	P	S	S		
Messages	S	S	P		
Current Time	P	S			
New Entity	P		S		
Graphics	P		S		
AFATDS Unit update	P				S
AFATDS Ammo update	P				S
AFATDS CFF	S				P
AFATDS MFR	P				S
AFATDS CDR	P				S

P: Publish / S: Subscribe

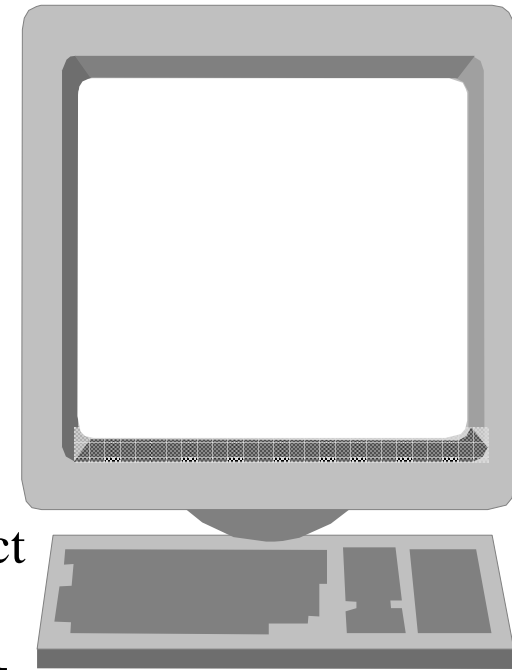


Current Voice Interaction

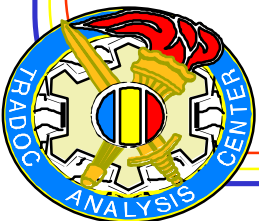
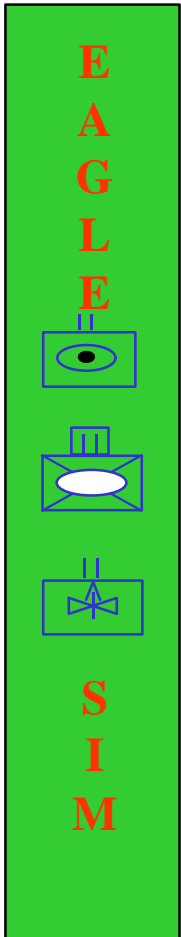
Voice Message

All messages are structured text to the True Talk Process

“1st Brigade this is 2nd Battalion, we are closing on our final objective, in contact with the enemy, currently effective with 96% equipment. Alpha company is in contact with 2 enemy units, receiving light indirect fires and medium direct fire, and is reporting an Amber status,”



Radio Surrogate



Delivery w/o DDM

(class Voice reliable receive
(parameter to)
(parameter string))

**Eagle Publishes Voice.
Eagle Sends Interaction
VOICE**

TO: 2nd Bde

STRING:

“2nd bde this is”

**Radio Subscribes Voice.
Radio Receives Interaction**

Radio 1 Processes Msg

Extract TO: 1st Bde

Compare to owner

No match - Bit Bucket

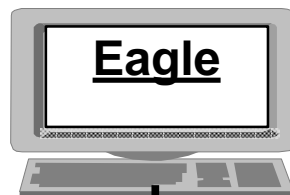
**Radio Subscribes Voice.
Radio Receives Interaction**

Radio 2 Processes Msg

Extract TO: 2nd Bde

Compare to owner

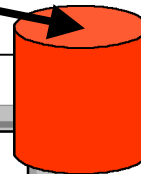
**Match - send String to
speech synthesizer**



Eagle



**Radio
1st Bde**

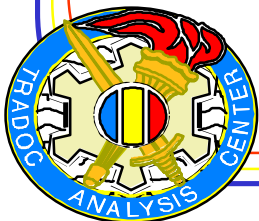


**Radio
2nd Bde**

“2nd Bde”



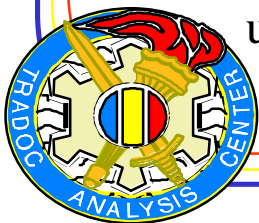
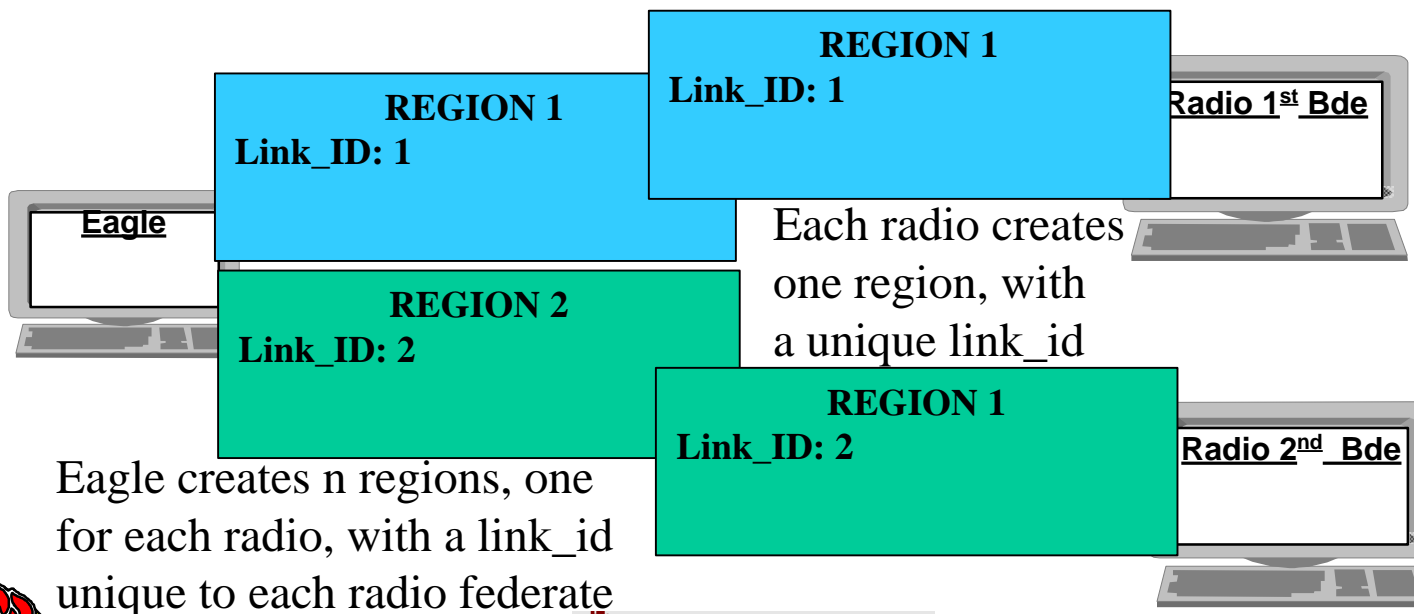
HLA



DDM in DLRC

DDM can be used to eliminate the multiple interactions that each radio receives that are not specifically addressed to it as defined by the parameter "to".

Routing Space Table					
Routing Space	Dimension	Dimension Type	Dimension Range/Set	Range/Set Units	Normalization Function
Info_link	Link_ID	short	[1-20]	N/A	linear (Link_ID)



Delivery with DDM

(class Voice reliable receive Info_link
(parameter to)
(parameter string))

Eagle Publishes Voice.
Eagle Sends Interaction
with Region

VOICE

TO: 2nd Bde

STRING:

“2nd bde this is”

REGION:

Info_link, Link_id = 2

Radio Subscribes with
Region Voice.

Info_link, Link_id = 1

Radio 1 does not receive
Interaction

Radio Subscribes with
Region Voice.

Info_link, Link_id = 2.

Radio **Receives** Interaction

Radio 2 Processes Msg

Extract TO: 2nd Bde

Compare to owner

Match - send String to
speech synthesizer

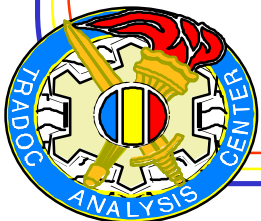
Eagle

Radio
1st Bde

Radio
2nd Bde

“2nd Bde”

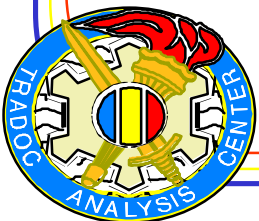
HLA



DDM in DLRC

The following RTI Services were used for this simple example.

DDM SERVICE NAME	USE
createRegion	Creates the region
getRoutingSpaceHandle	translate routing space name to handle
getDimensionHandle	translate dimension name to handle
notifyAboutRegionModification	When the dimensions are changed or initialized, need to notify the RTI
subscribeInteractionClassWithRegion	Will tell the RTI that this federate only wants this interaction when the regions overlap
sendInteractionWithRegion	Used to output an interaction



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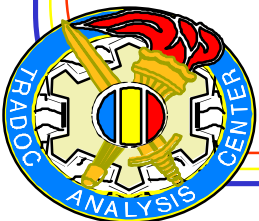


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DDM in DLRC

Type Interaction	Received by RTI interface w/o DDM	Received w/DDM	% reduction
1st BDE Voice	1426	498	65%
2nd BDE Voice	1426	423	70%
3rd BDE Voice	1426	505	65%
1st BDE MCS	28,584	5726	80%
2nd BDE MCS	28,584	5854	80%
3rd BDE MCS	28,584	6740	76%
Div MCS	28,584	7394	74%
enemy MCS	28,584	2870	90%

- **Data from AE5 DLRC Experiment**
 - **Movement to Contact Scenario, 4 Hr. duration**
- **During exercise w/o DDM, units received all subscribed interactions**
- **A review of the data reveals that a significant reduction of interaction traffic would had occurred if DDM was available.**



Observations

- **Use of DDM was very straightforward in this simple example.**
- **Required coordination of Link_ids prior to creating regions.**
- **Use of DDM provides significant reduction in the amount of information that must be processed by a federate**



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