High Level Architecture
Module 1
Basic Concepts

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Lesson 2
Basic Structure of HLA Simulations
Logical View of an HLA Federation

RTI Components At-a-Glance

RtiExec  FedExec  Federate(s)  ...  Federate(s)

libRTI  libRTI

Inter-Process Communications

RTI Provided  Federate Provided
FedExec - The Federation Executive

- One running process per executing federation
  - Created by first federate to successfully join federation
- Manages multiple federates joining and leaving the federation execution
  - Assigns unique handles to each federate
- Facilitates data exchange between federates
- Console interface for manual operations
RtiExec - The RTI Executive

- Manages the creation and destruction of multiple federation executions (with different names)
  - Ensures that each FedExec has a unique name
- Global process executes on one platform
- Listens to a well known port
- Console interface for manual operations
libRTI - The RTI Library

- Makes HLA service methods available to federates
  - Methods communicate with RtiExec, FedExec, and other federates through them
- Written in C++ with interfaces in C++, Java, CORBA IDL, Ada
What’s in a Federate?

The Federate’s Code provides internal functionality.

The Federate’s code must implement the abstract RTI_FederateAmbassador class.

The Local RTI Components (LRC) provide external functionality as specified by the IFSpec.

The LRC include the methods for the RTI_RTIambassador class.
RTI and Federate Ambassadors

(Figure from the Hands-on Practicum)
The Big Picture
When a federation is run, the RTIExec is started first. Then a federate, acting as a manager, creates a federation execution by invoking the RTI method “createFederationExecution” on its RTI Ambassador. The RTI Ambassador then reserves a name with RTIExec, and spawns a FedExec process, and that FedExec registers its communication address with RTIExec. The federation execution is underway.

Once a federation execution exists, other federates can join it. That RTI Ambassador consults RTIExec to get the address of FedExec, and invokes joinFederationExecution on FedExec. Additional federates can join via the same process.
Content of an IF Specification

- Interface name and brief description of service
- Supplied arguments
- Returned arguments
- Pre-conditions
- Post-conditions
- Exceptions
- Related services
Sample RTI Service Request

```cpp
try
{
    rtiAmb.timeAdvanceRequest(requestTime);
}
catch (RTI::Exception& e)
{
    cerr << "FED_HW: ERROR:" << &e << endl;
}
```
Possible Exceptions Thrown

• The federation time is invalid.
• Federation time already passed.
• The TimeAdvanceRequest is already pending.
• The federate is not a federation execution member.
• Save in progress.
• Restore in progress.
• RTI internal error.
Using “Tick”

• Tick used to wait for service completion
  – Allows RTI a chance to execute and respond to request
  – Waits for not more than 1.0 sec’s, nor less than .01 sec’s

• timeAdvGrant is a global variable, initialized to false, set true in callback routine TimeAdvanceGrant†

```cpp
    timeAdvGrant = RTI::RTI_FALSE;

    while (!timeAdvGrant)
    {
        rtiAmb.tick(0.01, 1.0);
    }
```
HelloWorld Code Responsibilities

• 1. Create and destroy the federation.
• 2. Join and Resign from the federation.
• 3. Declare data to be published and subscribed to by the federation.
• 4. Send/Receive data to/from other federates.
Obtaining the RTI

1- See a complete list of the software and documents available for download

2- You must register to be able to download the RTI

3- Once activated, download the RTI

www.hla.dmsomil ("Software Distribution Center" bullet)

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(Figure from the Hands-on Practicum) 11/14/01
The RTI Distribution

RTIExec, FedExec for each supported platform

Examples
Examples (and their sub-dir)

RTI.rid file
example FED files

Examples Header files
Libraries
Executables (for each language)

RTI, lang, C++

demofedfederate

cfg

FoodFight bin Platform-specific

FoodFight++ bin Platform-specific

TestFederateNT bin Platform-specific

TestFederate bin Platform-specific

MyFedTime bin Platform-specific

hello bin Platform-specific

config

doc

bin

inc

src

Platform-specific

Platform-specific

Platform-specific

Platform-specific

Platform-specific

Platform-specific

Platform-specific

(Please note that the diagram is a simplification of the actual distribution structure and does not include all details of the directory structure and file types.)