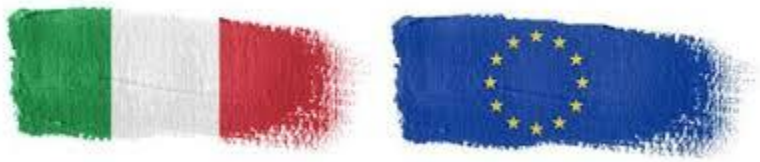
SEE
Simulation Exploration Experience

UNIVERSITÀ DELLA CALABRIA



<<Virtute Siderum Tenus>>

The SEE HLA Starter Kit

An introduction tutorial

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Outline

- Main Objectives and Information
- The “Services” provided by the Kit
- The Starter Kit software Framework (SKF)
- Live Demo: Let’s build a SKF-based Federate from the scratch…

What is the **SEE HLA Starter kit** ?

The idea of a *SEE Starter Kit* was born in Tampa during the "Review and Analysis" meeting of the 2014 edition of the SEE (Wednesday the 16th of April 2014).

What is the **SEE HLA Starter kit** ?

The key point: *"How to improve the reliability of SEE Federates and thus reduce the problems arising during the final integration and testing phases of the SEE project?"*

After Tampa, a working team at DIMES Department (UNICAL) was set up

- Alfredo Garro (coordinator)
- Alberto Falcone (main developer)
- Andrea Tundis (developer)

and started working in cooperation with Edwin (Zack) Crues (NASA JSC)

Work started at the end of **April 2014**

First Beta Version released on the 29th of **July 2014**

Version 1.0.0 released on the 3rd of **November 2014**

Version 1.1.0 released on the 14th of **January 2015**

Current software license: Lesser GNU Public License (**LGPL**)

Current Code Repository: **Google Code -** https://code.google.com/p/see-hla-starterkit/

and soon reachable from the official SEE 2015 website and repository…

What is the **SEE HLA Starter kit** ?

The **SEE HLA Starter Kit aims to ease the development of HLA federates in the context of the SEE Project by** providing a **software framework** (**SKF** - Starter Kit software Framework) with related **documentation**, **user guide** and **reference examples**.

The SEE HLA Starter Kit allows teams to focus on the specific aspects of their own SEE Federates rather than dealing with the common HLA issues (*such as the management of the simulation time, the connection to the RTI, the information publishing/subscribing*) **that are handled by specific SKF classes and services.**

What is the **SEE HLA Starter kit** ?

Expected Results:

- ✓**Much Faster learning curve**
  (especially for new teams/team members)**;**
- ✓**Reduction of the development time**
  (both for *full-fledged* and *Dummy/Tester* Federates)**;**
- ✓**More compact and much easier to test code;**
- ✓**Enhancement of the SEE-oriented capabilities of the Federates;**
- ✓**Improvement of the reliability of the SEE Federates;**
- ✓**Write once run anywhere**
  (*on PITCH, VT MÄK, PoRTIco, CERTI, …*).

What does the **SEE HLA Starter Kit** provide?

The **SEE HLA Starter Kit** provides the team with the following main components:

1)A **Java software framework** (called **SKF**) for developing SEE Federates;

2)The **Javadoc** documentation **of the SKF**;

3)A set of **reference examples** of SEE Federates created by using the SKF (including *Dummy* and *Tester* Federates);

4)A **technical report** that **describes the** SEE HLA Starter **Kit** and **guides the teams in its effective exploitation**.

All the materials listed above can be downloaded by the current website of the SEE HLA Starter Kit:

https://code.google.com/p/see-hla-starterkit/

…soon reachable from the official SEE 2015 Project website.

What does a SEE team need to use the **SEE HLA Starter Kit** ?

To use the **SEE HLA Starter Kit** a team needs:

- ✓**a HLA RTI** (*e.g. PITCH, VT MÄK*);
- ✓**a JDK** (*version 1.7 or higher*);
- ✓**a Java Integrated Development Environment** (*e.g. Eclipse IDE for Java Developers, NetBeans*);
- ✓**the core SEE components/resources** (*Environment Federate, Space FOM, etc.*).

Note: *The SKF has been developed according to the concept of **Object HLA**, thus the development of the Federates could benefit also from the Object HLA features and functionalities provided by the Pitch Developer Studio or similar IDE.*

The **SEE HLA Starter Kit** Target Main Services

CONNECTION MANAGEMENT services (RTI-Coordination Services):

- management of the connection parameters of the VPN;
- management of the connection of the federates to a SEE Federation execution;
- management of the resign of the federates from a SEE Federation execution;
- ...;

FOM MANAGEMENT services (RTI-Information Services):

- FOM module publication services;
- ...;

INTERACTION MANAGEMENT services (RTI-Information Services):

- publishing services;
- subscribing services;
- ....;

The **SEE HLA Starter Kit**
Target Main Services

SIMULATION TIME MANAGEMENT services (RTI-Synchronization Services):

- simulation time handling;
- time standard conversions;
- ...;

COORDINATES FRAME MANAGEMENT services:

- transformations among SEE Coordinate Systems;
- publication and subscription of SEE Reference Frames;
- ...;

OWNERSHIP TRANSFER services:

- ...;

DATA DISTRIBUTION MANAGEMENT services:

- ...;

The **SEE HLA Starter Kit**
Target Main Services

LOGGING services:

- management of SEE-specific logs;
- ...;

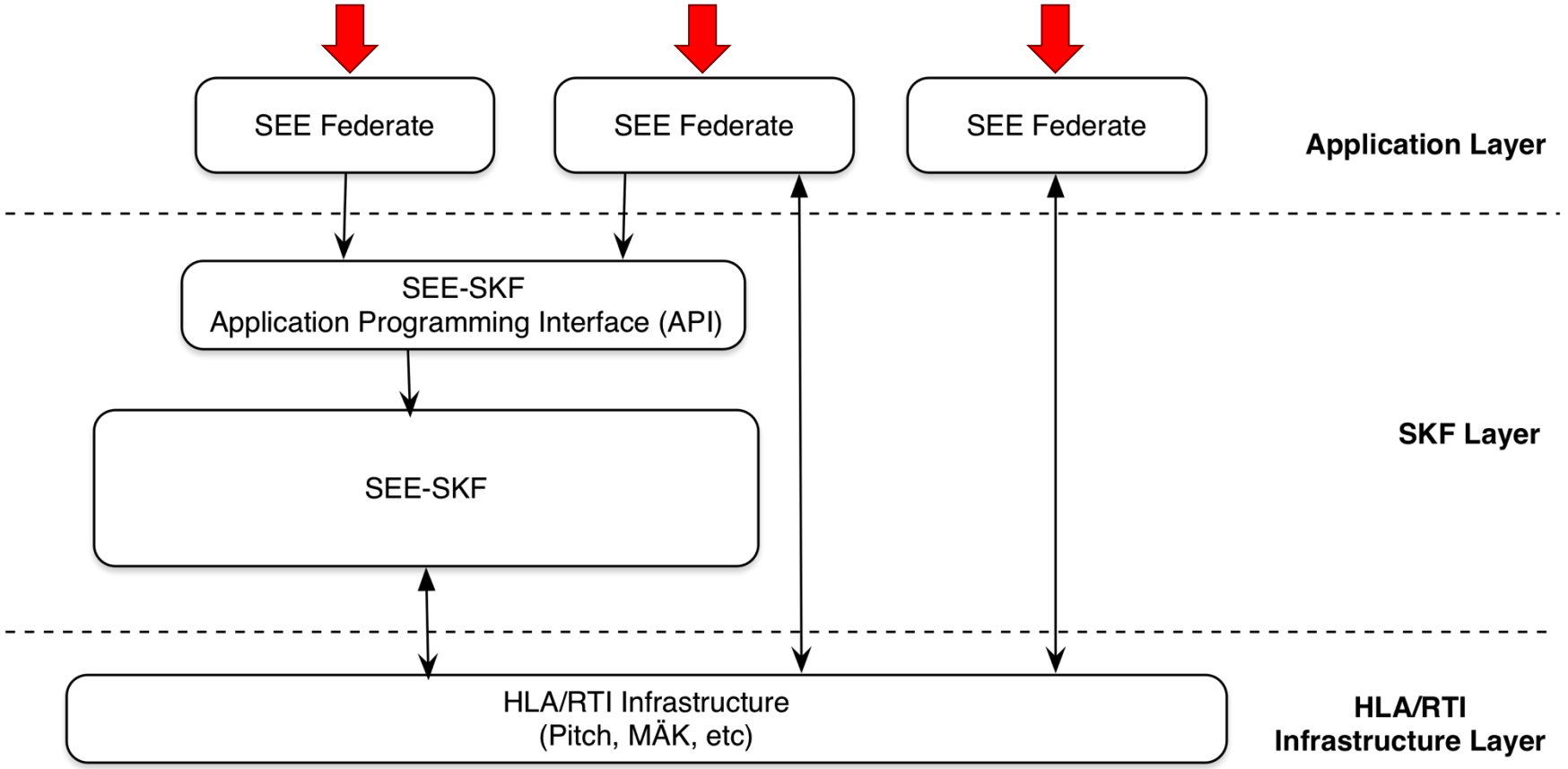
TESTING services:

- IP Configuration testing;
- MS Windows Firewall testing ;
- LRC/CRC parameters testing;
- ...;

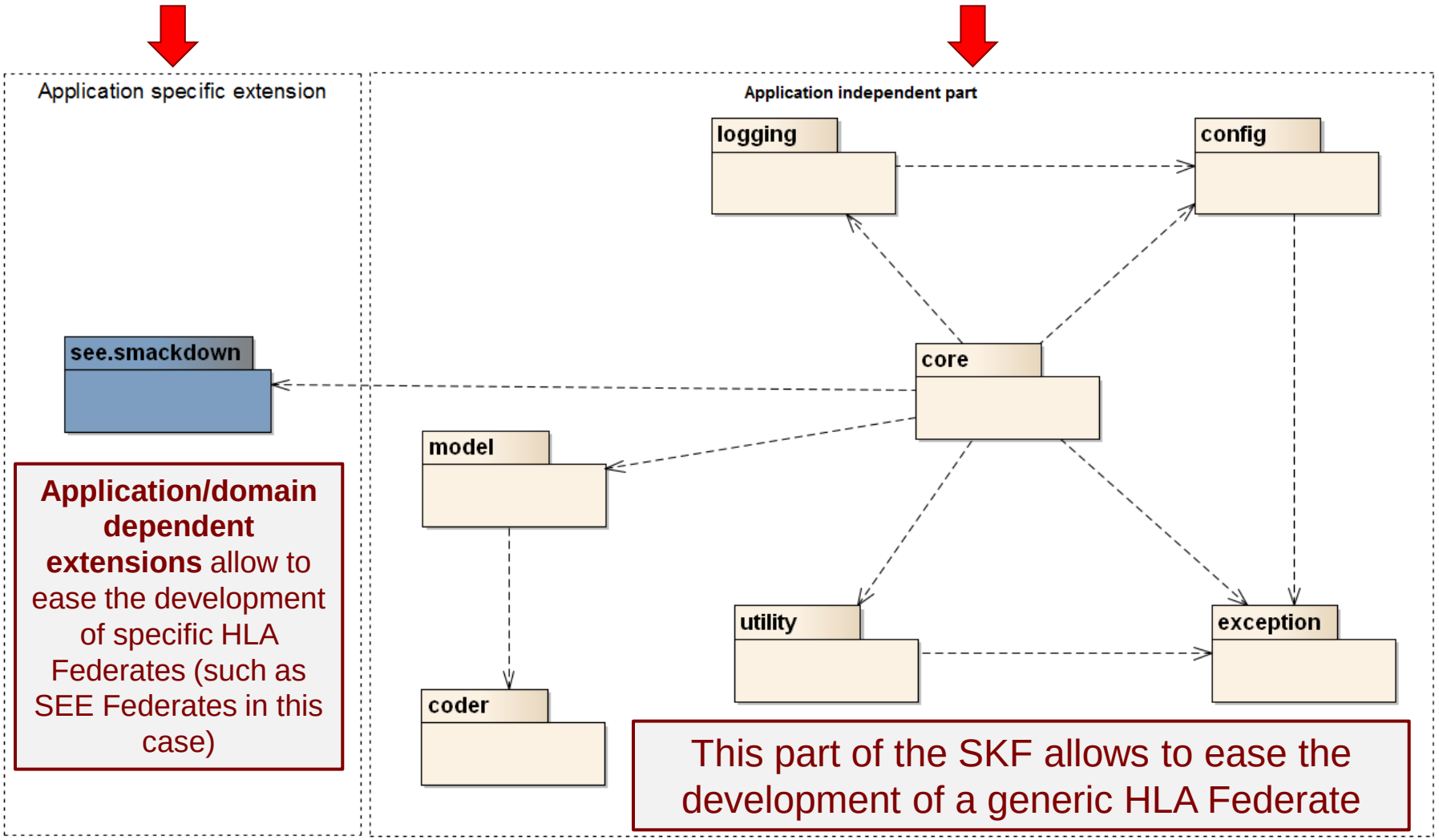
The **SEE HLA Starter Kit**
Features Available (Version 1.1.0)

Feature	Available
Mechanisms to manage the connection (set-up, hold-up and close-up) of a SEE Federate on the RTI.	☒
Mechanisms to facilitate the management and the publication of FOM modules.	☒
Mechanisms to facilitate the management of the configuration parameters.	☒
Mechanisms to facilitate publishing and updating of information on the RTI.	☒
Mechanisms to manage the simulation time.	☒
Mechanisms for time standard conversions.	☒
Mechanisms to manage the transformations among SEE Coordinate Systems.	☐
Functionalities for subscribing SEE Reference Frames.	☒
Check of the IP Configuration.	☒
Check of the MS Windows Firewall state.	☒
Logging.	☒
Ownership transfer and data distribution management.	☐

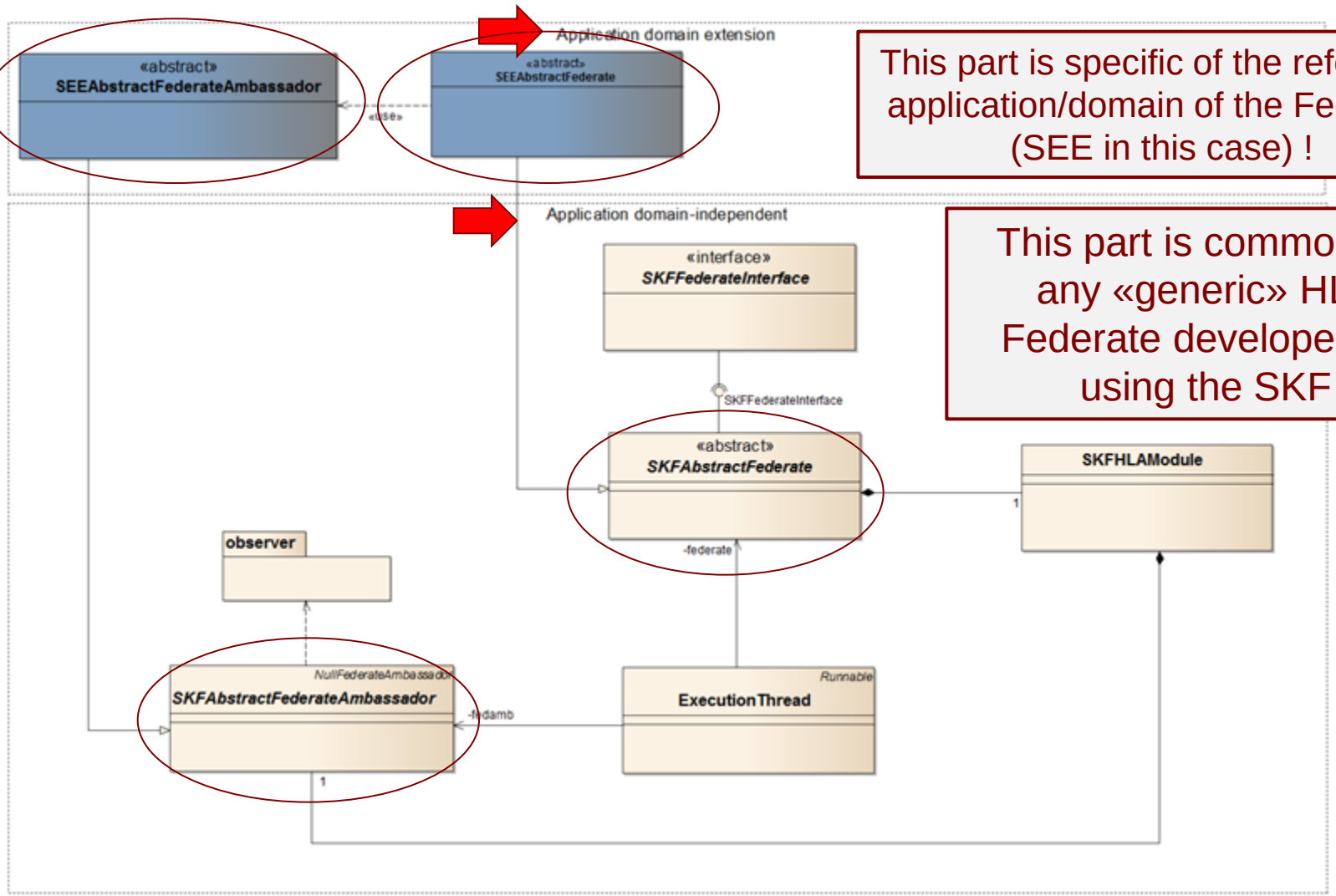
SEE Federations and SKF-based Federates



The Architecture of the SEE HLA Starter Kit software Framework (SKF)



The example architecture of a **SEE *SKF-based Federate***



This part is specific of the reference application/domain of the Federate (SEE in this case) !

This part is common for any «generic» HLA Federate developed by using the SKF

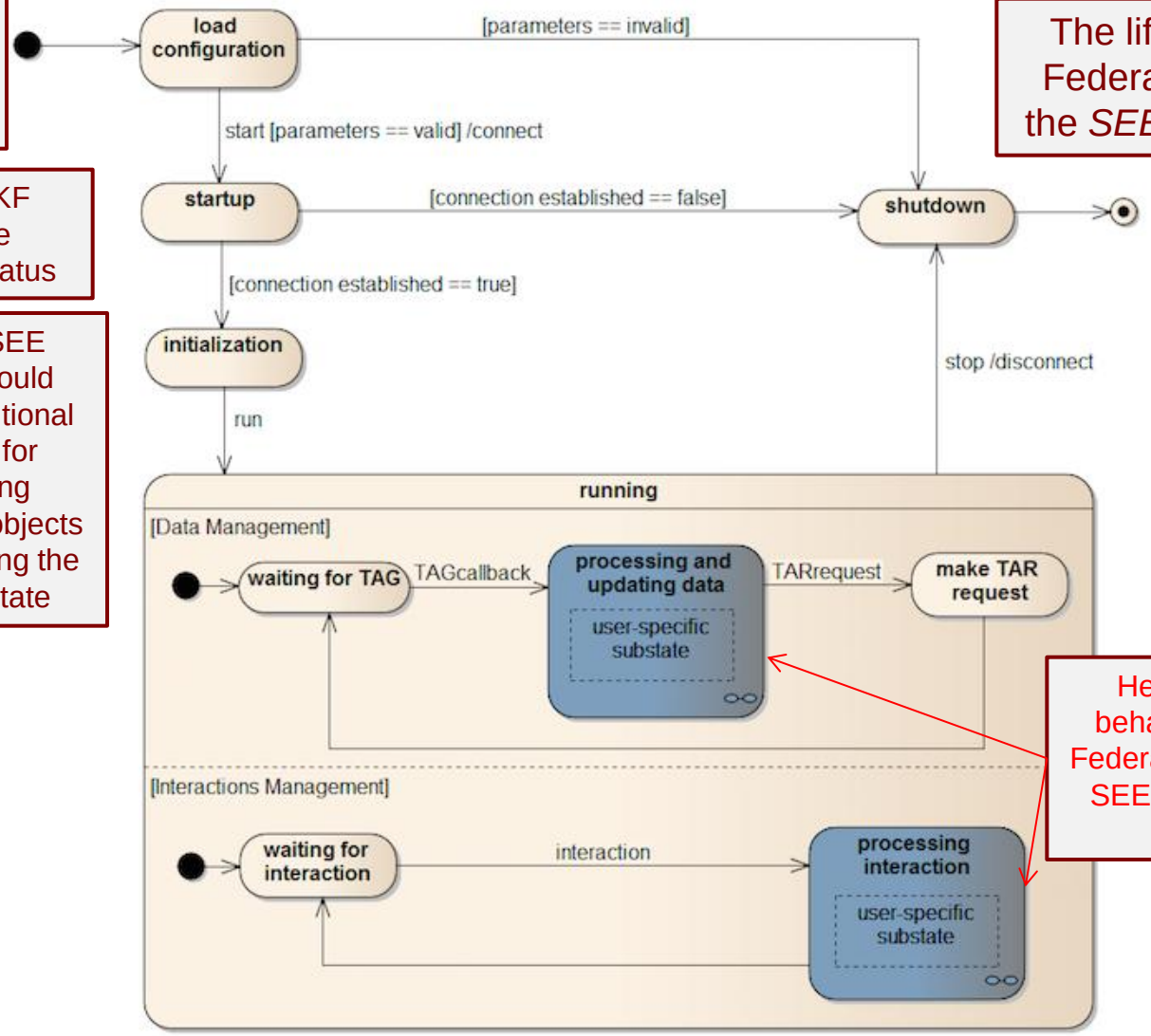
The example life cycle of a **SEE *SKF-based Federate***

Here the SKF loads the configuration parameters from a **.json** file

Here the SKF checks the connection status

Here the SEE Federate could perform additional operation for exchanging initialization objects before entering the "running" state

The life cycle of a SEE Federate is provided by the *SEEAbstractFederate*



Here the specific behavior of the SEE Federate defined by the SEE working team is executed !

The **SEE HLA Starter Kit**
LIVE DEMO !!!!!

Let's build from the scratch a dummy *Lunar Rover* moving on the Moon surface!

- The ***Lunar Rover*** entity inherits from ***PhysicalEntity*** (see *SISO_SpaceFOM_entity.xml*) and redefines four attributes:

1. ***entity_name***: a non-empty string that identifies the vehicle in the SEE Federation.
2. ***parent_reference_frame***: a non-empty string that identifies the reference frame with respect to which the kinematic state attributes of this vehicle are calculated.
3. ***position***: a 3-vector that specifies the position of the vehicle body frame origin with respect to the parent reference frame.
4. ***entity_type***: a non-empty string that identifies the entity type.

The **SEE HLA Starter Kit**
LIVE DEMO !!!!!

- During the simulation scenario the position of the ***Lunar Rover*** is updated every simulation step of 10 meters along the x axis so as to reflect its moving on the Moon.

- To develop the ***Lunar Rover*** by using the SKF we need to implement:
  - the ***LunarRover model***, which defines the structure and attributes of the vehicle;
  - a ***Federate***, which defines the life cycle of the ***LunarRover***;
  - a ***FederateAmbassador***, which allows the Federate to interact with the RTI.

LET'S DEVELOP IT !!!

Acknowledgments

- Edwin Z. Crues and the SEE NASA people (Michael Conroy, Dan Dexter, Priscilla Elfrey, Daniel Oneil, Stephen Paglialonga)
- Björn Möller (PITCH Technologies)
- The Alberta and Brunel SEE 2015 teams that are experimenting the SEE HLA Starter Kit
- and… all of you!

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