Modeling & Simulation as a Service (M&SaaS)

NASA Phase II SBIR
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Parabon Computation, Inc.

- Founded in 1999
- Launched Frontier® in 2000, making it the first commercial (COTS) grid solution
- Operates the only brokered computation service
- Deploys Frontier Enterprise for secure private grids
- Has customers in the government, academic, non-profit and private sectors
- Is a privately-held business in Reston, VA
Overview

» Primary Objective and Benefit
» Key M&SaaS Concepts
» M&SaaS Architecture
» M&SaaS Video
» Q&A
Objective: Enable most modeling and simulation (M&S) activities – from code development and compilation to runtime execution and post-run analysis and collaboration – to be performed from a standard web browser and powered by cloud- and grid-enabled computing resources.
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“Google Docs++ for M&S”
Primary Objective & Benefit

- **Objective**: Enable most modeling and simulation (M&S) activities – from code development and compilation to runtime execution and post-run analysis and collaboration – to be performed from a standard web browser and powered by cloud- and grid-enabled computing resources.

- **Benefit**: Allow M&S users and developers alike to avoid many of the obstacles that currently confound the delivery, accessibility and usability of traditional, non-service-oriented (“tarball”) software applications, particularly models and simulations.
M&SaaS Concepts

- **Everything is Service-Oriented**
  - **Software as a Service (SaaS)**
    - Delivery model
      - Browser-based access to software
  - **Platform as a Service (PaaS)**
    - Development environment
      - Browser-based development
  - **Infrastructure as a Service (IaaS)**
    - Operational environment
      - Grid-based access to resources
M&SaaS Concepts

- Members coalesce around a code **project**
- Projects consist of:
  - Applications
  - Actors & Roles
  - Tools
  - Libraries
  - Documentation
  - Releases
  - Build Environments
  - Forums / Wikis
  - Application variants
  - Sample Input Data
  - Reference Data
  - Results
  - Repositories / SCM
  - Execution Environments
M&SaaS Concepts

- A **division of labor** exists among **actors**
  - Core Developer
  - Domain Programmer
  - QA Tester
  - End User
- Actors form **code-centric communities**
Code-Centric Community: Actors

Code-Centric Community
Code-Centric Community: Actors

Core Application Developer

- Leverages Toolkits
  - Frontier SDK, JumpStart
  - Eclipse IDE, JavaDocs
  - Source Repositories
    - CVS, SVN, Git, etc.

- Manages Compiler VM(s)
  - Creates VMware Image(s)
  - Standard Compiler(s)
  - Standard OS(es)
Core Application Developer

Leverages Toolkits
- Frontier SDK, JumpStart, Eclipse IDE, JavaDocs
- Source Repositories: CVS, SVN, Git, etc.

Manages Compiler VM(s)
- Standard Compilers, Linkers, Toolchains
- Standard OS(es)
Code-Centric Community: Actors

Core Application Developer

Domain Programmer

Edit Source

```java
public RemoteTask(int inputValue) {
    this.inputValue = inputValue;
}

public Integer run(SerializableTaskContext context) {
    context = context;
    int numProcesses = Runtime.getRuntime().availableProcessors();
    Thread[] threads = new Thread[numProcesses];
    final int candidate = context;
    for (int i = 0; i < numProcesses; i++) {
        threads[i] = new Thread() {
            public void run() {
                boolean b = ExecuteModelForCandidate(candidate);
                try {
                    b = ExecuteModelForCandidate(candidate);
                    b = ExecuteModelForCandidate(candidate);
                    b = ExecuteModelForCandidate(candidate);
                    b = ExecuteModelForCandidate(candidate);
                } catch (TaskStoppedException tse) {
                    setTaskStoppedException(tse);
                }
            }
        };
        threads[i].start();
    }
}
```

Compile Launch
Code-Centric Community: Actors

**Domain Programmer**

- Tweaks Science/Business Application Logic
- Programs in Fortran, R, Scheme, etc.
- Uses Integrated Text Editor
- Creates Branches and/or Variants
- Builds against Standard Compile VMs
- Collaborates via Forums and/or Wikis
Code-Centric Community: Actors

Core Application Developer

Domain Programmer

QA Tester
Code-Centric Community: Actors

QA Tester

Runs Applications and Various Logic Modules against Standard QA Environment(s)
- Selects VM(s) for Compile (Build) Time
- Selects VM(s) for Execution (Run) Time
- Automates Unit Testing

Core Application Developer

Domain Programmer

QA Tester
Code-Centric Community: Actors

- Core Application Developer
- Domain Programmer
- End User
- QA Tester

Run Application

Input File (.xml)

Region
Upper-Left Corner -- Latitude: 39.600 N; Longitude: -76.860 E
Lower-Right Corner -- Latitude: 38.932 N; Longitude: -76.846 E

Flux Capacitor
Power: 1.21 Jiggawatts
Speed: 88 MPH
Date: Nov 5, 1955

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Code-Centric Community: Actors

End User
- Selects Application(s) and Provides Input Data
- Launches Jobs and Analyzes Results

Doesn’t have to touch code!
Doesn’t have to worry about OS configuration!

“It Just Works!”
Code-Centric Community: Actors

Core Application Developer

Domain Programmer

QA Tester

End User
Code-Centric Community: Actors

Division of Labor

- Enhanced Productivity
- Leveraged Skill Sets
- Fewer Bugs
- Pipelined Operation

Code-Centric Community
Parabon’s Frontier® Grid Platform is a turn-key, commercial off-the-shelf (COTS) software solution that unobtrusively harnesses unused and/or dedicated computing capacity across enterprise network(s) – allowing you to securely:

- **Maximize ROI of existing enterprise assets**
  - Use available resources more efficiently
  - **Avoid costly hardware expenditures!**

- **Solve previously intractable problems**
  - Launch *data-heavy* and *compute-intensive* jobs
  - Manage *distributed command & control* apps
  - Host *cloud computing* web services

- **Reduce current processing times**
  - From decades to days, or months to minutes
Frontier’s complete service stack provides Infrastructure, Platform, and Grid Software as a Service layers.
M&SaaS builds upon these service layers to provide a new generation of M&S capabilities.
M&SaaS Video

Frontier® Grid Platform

Modeling & Simulation as a Service
Questions?

For more information contact
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