



Project Presentation and Website Work Package 7 Task 7.1 Deliverable 7.1

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1 Executive Summary

This report contains a fact sheet providing an overview of the INFORE project, the project presentation and the project public website. The project website www.infore-project.eu is designed to present the work and use cases of the INFORE project to the general public, the scientific community and related industries. The project website is based on the Jekyll platform.

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2 Project Overview

2.1 Overview

At an increasing rate, industrial and scientific institutions need to deal with massive data flows streaming in from a multitude of sources.

For instance, maritime surveillance applications combine high-velocity data streams, including vessel position signals emitted from hundreds of thousands of vessels across the world and acoustic signals of autonomous, unmanned vessels; in the financial domain, stock price forecasting and portfolio management rely on stock tick data combined with real-time information sources on various pricing indicators; at the fight against cancer, complex simulations of multi-cellular systems are used, producing extreme-scale data streams in an effort to predict the effects of drug synergies on cancer cells.

In these applications, the data volumes are expected to dramatically grow in the future. Processing this data often requires not only using an HPC infrastructure, but also having data analysts, who are typically not expert programmers, program complex workflows, with a vast number of parameters to tune through time-consuming repeated programming and testing.

INFORE will address these challenges and pave the way for real-time, interactive extreme-scale analytics and forecasting. The ability to forecast, as early as possible, a good approximation to the outcome of a time-consuming and resource-demanding computational task allows to quickly identify undesired outcomes and save valuable amount of time, effort and computational resources, which would otherwise be spent in vain. Consider, for example, the ability to forecast the outcome of a complex multi-cellular system simulation for tumor evolution, without the need to wait for the simulation to be completed. INFORE will also design and develop a flexible, pluggable, distributed software architecture that is programmable and set up by graphical data processing workflows. The INFORE prototype will be tested on massive real-world data from the life sciences, financial and maritime domains.

2.2 Project Fact Sheet

In the next page we present the project fact sheet.

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INFORE in a Nutshell.

The aim of the INFORE project is to address the challenges posed by huge datasets and pave the way for real-time, interactive extreme-scale analytics and forecasting. Today, at an increasing rate, industrial and scientific institutions need to deal with massive data flows, streaming-in from maritime surveillance applications, financial forecasting applications or cancel cells growth simulations as well as a multitude of other sources. The ability to forecast, as early as possible, a good approximation to the outcome of a time-consuming and resource demanding computational task allows to quickly identify undesired outcomes and save valuable amount of time, effort and computational resources.

Major innovations

INFORE project foresees the following contributions to the current state-of-the-art:

1. Real-time, interactive machine learning and data mining tools, supporting the interactive construction of highly accurate models from extreme-scale data streams and massive data volumes.
 2. Development of innovative techniques for adaptive, low-latency, complex streaming event processing and forecasting.
 3. A flexible, pluggable and extensible architecture which will make the interactive data analytics library easy-to-use and increase its effectiveness.
 4. Construction of a framework for supporting non-programmer data analysts to develop high-level data processing workflows and data analytics tasks.
 5. Data summarization and approximate query processing techniques to allow for real-time response times while exploring representative views of massive, high-velocity input.
 6. Rigorous testing and evaluation, involving controlled experiments and reviews by domain experts, with real life data from the financial, the maritime and the life sciences domains.
- The **life sciences** use case, paving the way for the development of new cancer treatments, by identifying personalized drug combinations to fight cell resistance in target therapies and increase the patients' life expectancy. In-silico models of multi-cellular systems found in in-vivo tumors will be developed. The simulations involve billions of cells and generate approximately 100GB of data per minute and will be carried out in HPC infrastructures.
 - The **maritime** use case aims to improve maritime situational awareness, i.e. the ability to perceive and forecast activities and threats in maritime environments. Global maritime surveillance systems, such as the AIS (Automatic Identification System) will be combined with local autonomous unmanned vehicles, such as Wavegliders to identify and forecast the activities of "dark targets" that (intentionally) hide from traditional monitoring systems. Data streams of approximately of 1TB will be produced per day.
 - The **financial** use case, forecasting price swings of stocks, currencies, commodities and systemic risk, and offering decision support for investment opportunities. The financial data available in the project include a variety of market data, including stock market and crypto-currencies market data, arriving in tens of thousands of correlated, high-velocity streams, for a total of more than 450GB of data per day.

Use cases

The scientific and technological advances that are being developed in the project will be showcased in the following real-world use cases:

Project information

Duration: 1/1/2019 – 31/12/2021
Website: <http://infore-project.eu/>
Coordinator: Prof. Antonios Deligiannakis
Grant No. : 825070
Contact: infore-contact@googlegroups.com

Partners



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3 INFORE Public Website

The INFORE project website (www.infore-project.eu) was designed and implemented by MarineTraffic, the innovation manager of the project. The website is the main communication channel between the project consortium and the general public. It contains information about the project goals and objectives, an overview of the technological advances that are being developed in the context of the project, as well as their application in the three use cases: The Life Science use case, the Financial use case and the Maritime Awareness use case. The website also contains links to the rest of the dissemination channels used to communicate the results of the project, to Deliverables and scientific publications, blog posts, links to social media platforms, contact details and it is based on the Jekyll¹ content management tool.



Figure 1: Overview of project website.

¹ <https://jekyllrb.com/>

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An overview of the project website is provided in Figure 1. The main page of the website is based on an interactive scroll-down page layout with a main menu at the top that allows users to easily navigate to main page sections as well as to other website pages.

3.1 Layout and Structure

The structure of the project website is outlined as follows:

- Home
- About
- Challenges
 - Life Science use case
 - Financial use case
 - Maritime awareness use case
 - Technological Breakthrough
- Dissemination Updates
 - Latest Updates (Section)
 - News
 - Events
 - Publications
- Partners (Section)
- Contact (Section)
 - Information about the funding organization and grant agreement
 - Social media links and contact email address

The tab named “About” gives a high-level overview of the project aims. The “Challenges” tab contains information about each one of the use cases of the project, and it also describes the scientific and technological challenges that are tackled in the context of the project. The tab named “Dissemination Updates” provides information about News, Events and Publications. There is also a view named “Latest Updates” which provides a listing of the most recent pieces of information in the aforementioned categories. The tab with title “Partners” describes the consortium of the project and, last, the menu item with title “Contact” provides contact information.

3.2 Content of the Website

The following sections present how information is organised within the website at the time of writing this document.

3.2.1 Home Page

Home page is designed to include and highlight all important information related to the INFORE project. Home page is organised in horizontal sections. Each section focuses on a different dimension of the project and provides a small introductory text and the corresponding link to dedicated pages where the reader can further deepen into each subject. An overview of the sections’ order is depicted in Figure 2.

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Figure 2: Title and use cases section.

At the top (see Figure 2) there is a section with the project’s title followed by its subtitle. Then follows the use cases section, where each use case is depicted with its corresponding icon and a small descriptive text along with an additional icon dedicated to the technological achievements of the project. Each icon at the use cases section links to the corresponding dedicated page.

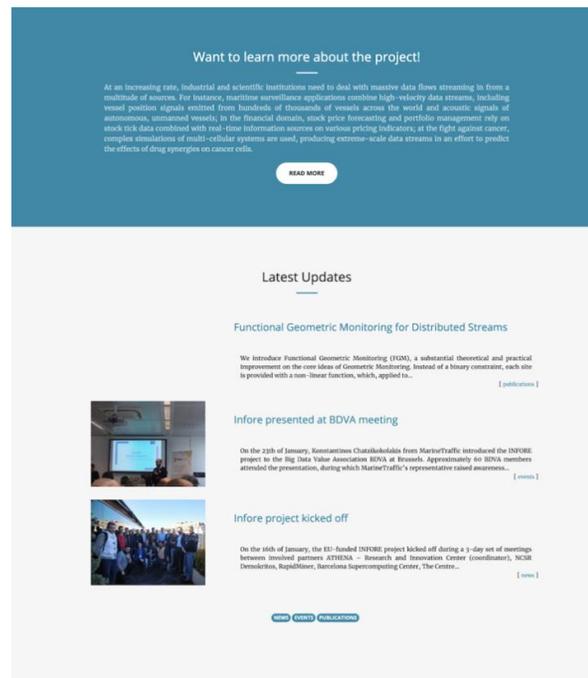


Figure 3: INFORE in a nutshell and latest updates sections.

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Figure 4: Consortium, EU grant acknowledgment and social media.

Just below (Figure 3) the use cases section, there is a small section with the project’s short description and if the reader scrolls further down, they will reach the latest updates section. The latest updates section shows the latest posts from every category (i.e., news, events and publications) that we have uploaded to the website. Each one of these posts redirects to its corresponding page, while at the same time the reader may go to the categories page lists through links that exist at the bottom of the section and at the end of each post.

There are two more sections at the lower part (Figure 4) of the home page, the first one is dedicated to the project’s consortium where all hyperlinks with partners’ logos are displayed and the last, contact section that contains the EU acknowledgement along the grant agreement number as well as links to all social media pages of the project. The email icon allows users to contact the management and dissemination nodes of the project.

3.2.2 About Page

The “About” page (see Figure 5) gives a high level overview of the project objectives and challenges.



Figure 5: About page.

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3.2.3 Financial, Life Science and Maritime Awareness Use Case Pages

There is a dedicated page (see Figure 6) for every use case of the project. Each page provides an overview of the use case, giving information about the challenges encountered in each use case as well as the contributions of the INFORE project in this respect.



Figure 6: Use case awareness pages.

3.2.4 Technological Breakthrough Page

The pages that describe the use cases answers to the questions: “what are the real-world problems tackled” and “how they will be solved using the outcomes envisioned by the INFORE project”. We decided to create an additional page to describe in more detail the technological advances that exist behind the proposed solutions. The “Technological Breakthrough” page (see Figure 7) provides details about the different components that comprise INFORE’s software stack and explains their role on the data processing workflow.



Figure 7: Technological breakthrough webpage.

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3.2.5 News, Events and Publications Lists

There are three different types of posts and their corresponding lists dedicated to particular news items in the website. The first one called “News” corresponds to dissemination material related to the projects progress. The second one is called “Events” and it corresponds to events that project partners attend or INFOR has presence. Last, there are publication post items that host academic publications abstract along with their hyperlinks to project’s open access space at Zenodo. All these can be seen in Figure 8.



Figure 8: News (left), Events (middle) and Publications (right) web pages.

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4 Social Media

Social media platforms are important dissemination channels for the project. We have created a dedicated project account for the following social media platforms: twitter², facebook³, youtube⁴, LinkedIn⁵. In facebook, twitter, and LinkedIn, we upload information regarding the latest project activities (e.g., events, scientific presentations, blog posts, etc.).

Regarding scientific publications, we created a dedicated project account in both Zenodo⁶ and ResearchGate⁷ platforms. Zenodo is an online repository for research outputs and it is integrated into reporting lines for research funded by the European Commission (e.g., H2020 grants) via OpenAIRE. Using Zenodo, one is able to upload research results (e.g., deliverables, datasets, publications), associate them with Horizon 2020 grants, and then they can be automatically exported to OpenAIRE. Since ResearchGate is a widely used platform for publishing research results, we use this as well to upload scientific publications in order to increase their visibility, and we associate them with the project.

² <https://twitter.com/InforeProject>

³ <https://www.facebook.com/infore.project>

⁴ <https://www.youtube.com/channel/UCQRj2coemjbc1UUnkxcSpYw>

⁵ <https://www.linkedin.com/groups/13683100>

⁶ <https://zenodo.org/communities/infore-project/>

⁷ <https://www.researchgate.net/project/INFORE-H2020-EU-grant-No-825070>

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5 Conclusions

In the context of this deliverable, we provided an overview of the project which is summarized in the project fact sheet. We also provided a description of the project website, which is one of the major dissemination channels of the project. We gave an overview of each page of the website, providing decision choices where necessary, to make sure that it communicates in the best way possible all project activities and results. The website will be constantly updated so that it reflects all recent developments of the project and it also contains updated links to all other communication channels, as is also described in this deliverable.

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6 Appendix

The project presentation is provided as follows.

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INFORE project



INFORE

Interactive Extreme-Scale
Analytics and Forecasting



INFORE H2020 ICT project

- Topic: ICT-12-2018-2020
- Type of action: RIA
- Grand Agreement No.: 825070
- Budget : approx. 4.4 Million
- Duration: January 2019 – December 2021
- Coordinator: Prof. Antonios Deligiannakis

Consortium

- Athena Research Center
- National Center for Scientific Research “DEMOKRITOS”
- RapidMiner GMBH
- Barcelona Supercomputing Center
- Fundacio Centre de Regulacio Genomica
- SPRING Techno gmbh & co
- MarineTraffic
- NATO Science and Technology Organisation



Athena Research Center

- The Athena Research and Innovation Centre in Information, Communication and Knowledge Technologies (Athena) is a research and technology body, which was founded under the auspices of the Greek Ministry of Development in 2001.
- Athena RC participates in the project through its Information Management Systems Institute (IMSI). IMSI (former IMIS) was founded in 2007, with the mission to conduct research in the areas of data management and large-scale information systems.
- Senior representative: Prof. Antonios Deligiannakis

NCSR

- NCSR "Demokritos" is the largest self-governing Research Institute under the supervision of the Ministry of Development of the Greek Government.
- The Institute of Informatics and Telecommunications (IIT) of NCSR Demokritos focuses on research and development in the areas of Telecommunications, Networks, Web Technologies and Intelligent Systems.
- The Complex Event Recognition (CER) group of IIT works towards advanced and efficient methods for the recognition of complex events in a multitude of large, heterogeneous and interdependent data streams
- Developed a highly scalable event recognition platform that has been successfully applied to Big Data applications such as maritime monitoring, flight planning, etc.
- Senior representative: Prof. Alexander Artikis

RapidMiner GMBH

- RapidMiner provides a world-leading open source software platform for data science and predictive analytics
- Eases and accelerates the process of creating predictive analytics models and makes it easy to get the results embedded in business operations
- Has more than 500,000 users world-wide and its community has more than 200,000 registered users
- Lead representative: Ralf Klinkenberg

Barcelona Supercomputing Center

- The Barcelona Supercomputing Center (BSC) was established in 2005 and serves as the Spanish national supercomputing facility. The Center hosts MareNostrum 4, one of the most powerful supercomputers in Europe and its mission is to research, develop and manage information technologies in order to facilitate scientific progress
- The Life Sciences Department integrates the independent research of senior scientists that work on various aspects of computational biology, ranging from bioinformatics for genomics to computational biochemistry and text mining
- Lead Representative: Prof. Alfonso Valencia

Fundacio Centre de Regulacio Genomica

- The Centre for Genomic Regulation (CRG) is a non-profit foundation created in 2000 as a partnership between the Catalan Government and the Spanish Ministry of Economy, Industry and Competitiveness and affiliated with the Pompeu Fabra University (UPF).
- Today, with over 400 scientists from 43 countries, CRG is a first-class multidisciplinary research that hosts a total of 30 group leaders, of which ~half hold an ERC grant.
- The CRG hosts 7 scientific and technical cutting-edge core facilities, including the Genomic Unit (one of the largest genomic platforms in Spain), and the Bioinformatics Unit
- Senior Representative: Gian Gaetano Tartaglia

SPRING Techno GMBH & co

- Spring Techno was founded 2003 in Bremen, Germany. Spring Techno covers the whole chain of value from processing and storing the raw data – through recognition of relevant structures and data mining – all the way to data representation in specialized interfaces.
- Specializes in the development of trading applications, algorithms and interfaces for the analysis and prediction of the financial markets.
- Senior Representative: Holger Arndt

MarineTraffic

- The world's leading platform for offering vessel tracking services and actionable maritime intelligence.
- Provides an end-to-end service that tracks vessel positions, based mainly on AIS, and displays them on a map in real-time.
- AIS data is collected from MarineTraffic's own receivers network, comprising of over 2,000 coastal AIS stations around the globe, the world's largest proprietary AIS network. At any given time, MarineTraffic is tracking over 150,000 vessels at real-time with 180,000 vessels reporting daily
- Senior Representative: prof. Dimitris Zissis

NATO CMRE

- The Centre for Maritime Research and Experimentation (CMRE) is a world-renowned NATO scientific research and experimentation facility located in La Spezia, Italy.
- CMRE was established by the North Atlantic Council on 1 July 2012 as part of the NATO Science & Technology Organization
- Conducts cutting-edge maritime scientific research and experimentation, ranging from concept development to prototype demonstration at sea
- Produced global leaders in acoustics, oceanography and other disciplines in addition to pioneering key technologies and approaches that are now employed worldwide.
- Representative: Dr. Raffaele Grasso

Motivation

- Interactive Extreme-Scale Analytics
- Timely detection of events of interest
- Forecasting future occurrence of critical events
- Making the life of data analysts more simple
 - Can specify processing workflows and data analytics tasks with minimal or no programming overhead
 - Can quickly gain insights on the data
 - Optimization of data processing

Problems Addressed by INFORE (1/3)

- Data analysis not only for expert programmers
 - Hard to program data analytics tasks
 - Code may take hours to run
 - *How to test different parameters, configurations, data models etc. when it is so costly to do so?*
 - Hard to optimize code
 - *(e.g., Which platform to run it on?)*

Problems Addressed by INFORE (2/3)

- Most applications simply detect events of interest
- Much more useful to forecast future events of interest
 - Useful to mitigate risks, capitalize on opportunities and allow for **proactive decision-making**
- Example scenarios
 - Forecast the emergence of resistant cells via the detection of small changes in physiological or molecular markers
 - Forecast and proactively respond to hazardous events, such as vessel collisions or groundings in the maritime domain
 - In the financial sector, the possibility of forecasting elevated risks or investment opportunities
- Can we forecast the outcome of a time consuming operation without the need to wait for the simulation to be completed?

Problems Addressed by INFORE (3/3)

Important to quickly gain insights about the data

- In hard problems, humans may help!
- Allow for a synergy between humans and algorithms
- Human explores the data and gains insights about its information
 - I.e., using data synopses
- Human adds its knowledge to a machine learning algorithm
 - First identify an informative feature set for some problem domain
 - Then propose this feature set to a machine learning algorithm
 - This may help improve the algorithm's performance

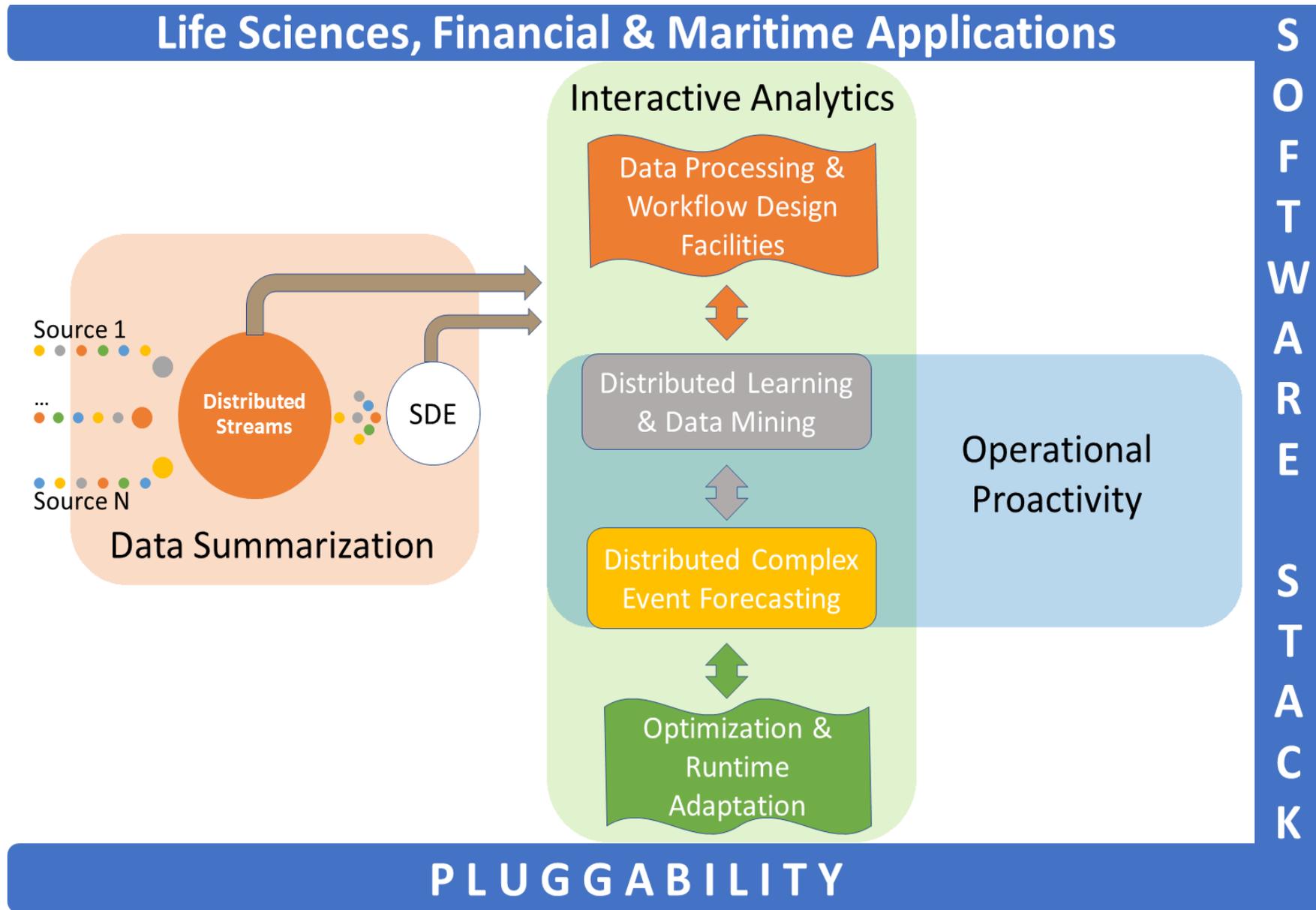
INFORE objectives

- **Data summarization and approximate query processing techniques**
 - Real-time response times
 - Novel, highly-optimized algorithms for generating *data synopses*
- **Real-time, interactive machine learning and data mining tools**
 - Interactive construction of highly accurate models
 - Gaining fast insights on the properties of the data
- **Distributed complex event forecasting**
 - To support interactive data analytics
 - Timely detection of critical events as they occur
 - *Forecast of the future occurrences* of critical events

INFORE objectives

- **A flexible, pluggable and extendable architecture**
 - Easy-to-use interactive data analytics and *machine learning* library
 - Easy to compose data analytics workflows with *no programming overhead*
- **Rigorous testing and evaluation**
 - Controlled experiments and reviews by domain experts, with real life data
 - Benchmarking

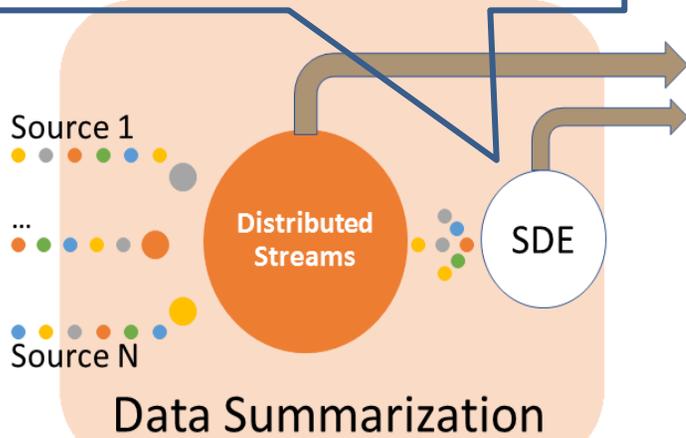
Overall Approach



Overall Approach

Life Sciences, Financial & Maritime Applications

Synopses Data Engine
Extracts compact synopses
Forwards them to toolboxes
Toolboxes maximize performance using these synopses



Maintain & Update Data Models
Algorithms serve as Library for Interactive Data Analytics

- User can try different parameter configurations,
- or different feature sets on existing models
- Continuous Model Updating during analytics

Interactive Analytics

Data Processing & Workflow Design Facilities

1. Easily compose data analytics pipelines from existing models and data processing functions
2. Supports Interactive data analytics
3. Easily pluggable

Distributed Learning & Data Mining

1. Detects critical events
2. Forecasts critical events
3. Patterns may not be known in advance, or changing over time
4. Support for a highly-expressive event pattern specification language

Distributed Complex Event Forecasting

Optimization & Runtime Adaptation

1. Decide location & platform where executed
2. Adapt execution without user involvement

PLUGGABILITY

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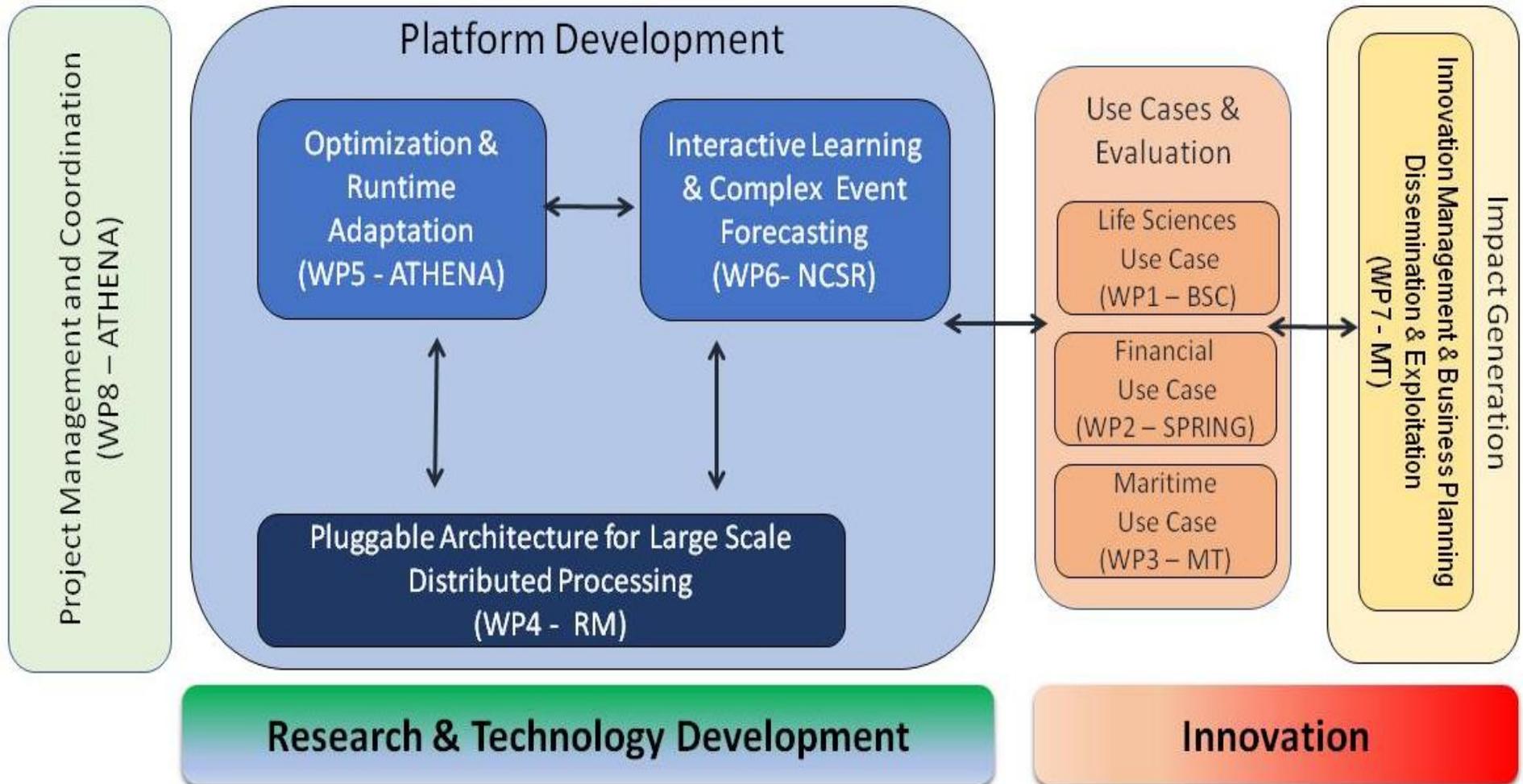
Use cases

- Life Sciences use case
- Financial use case
- Maritime use case

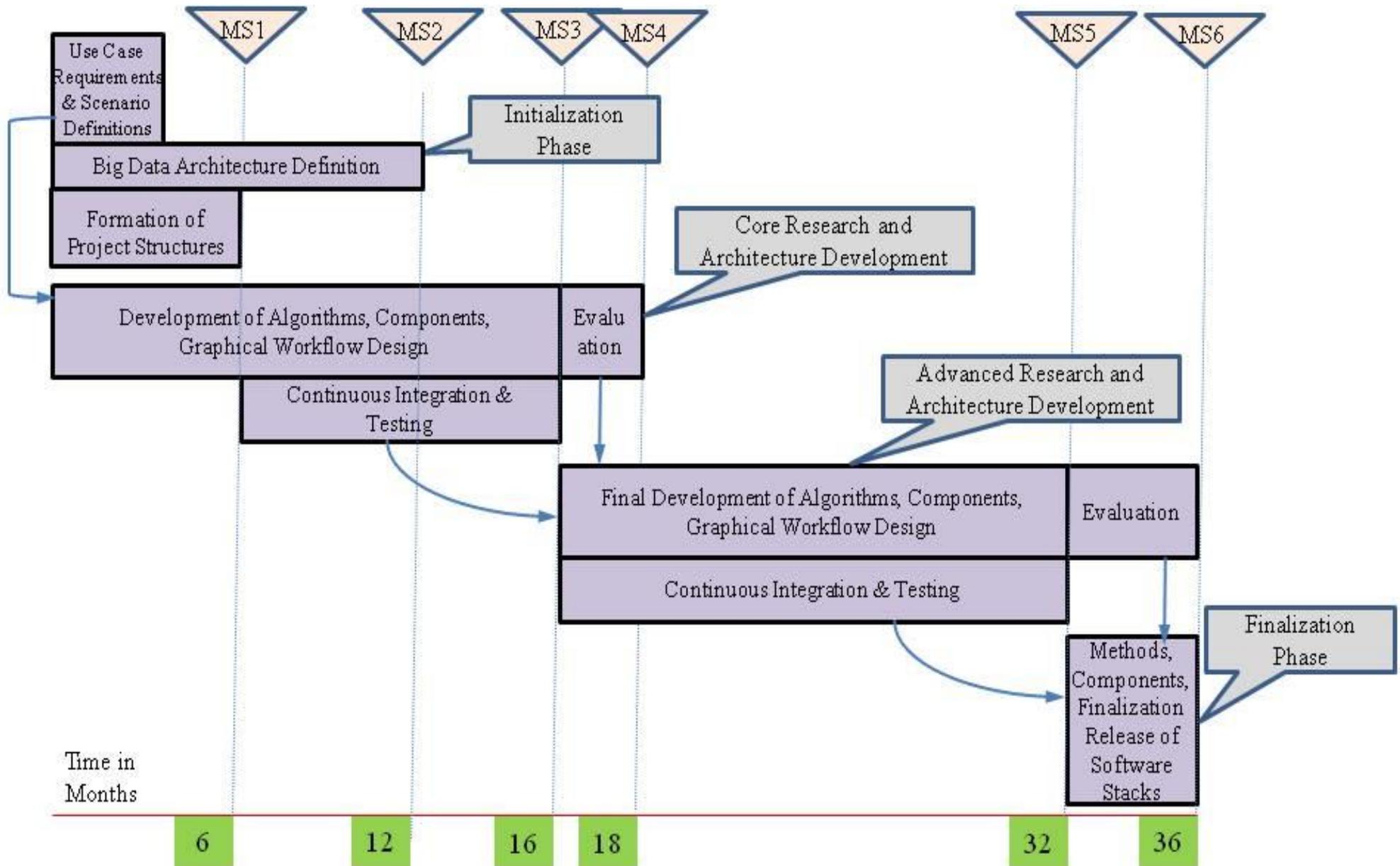
Work Packages

WP	Title	LEAD
1	Life Sciences Use Case	BSC
2	Financial Use Case	SPRING
3	Maritime Use Case	MT
4	Pluggable Architecture for Extreme-Scale Analytics	RM
5	Optimization and Runtime Adaptation	ATHENA
6	Interactive Learning and Complex Event Forecasting	NCSR
7	Innovation Management, Dissemination, Exploitation & Business Planning	MT
8	Project Management and Coordination	ATHENA

Interactions Between WPs



Workplan



Time in Months

6

12

16

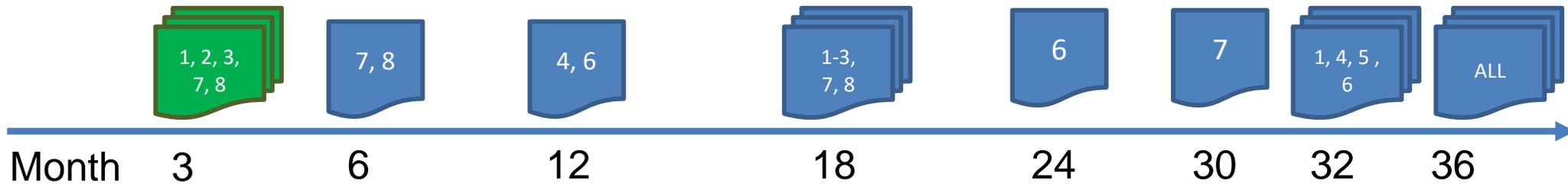
18

32

36



Deliverables Timeline



**Indexes indicate the number of work package involved*

WP1 Objectives

- Provide a "virtual laboratory" for studying tumor growth and evolution
- Use *in-silico* models of cell systems found in *in-vivo* tumors, aiming to facilitate the design, test and optimization of cancer treatments based on combinations of different drugs
- Employ an HPC infrastructure and the technologies of INFORE in order to simulate multi-cellular systems **with the actual number of cells found in *in-vivo* tumors**. The simulations will be supported by
 - **Dynamic cell-cycle models**, obtained via **deep learning techniques**
 - **Complex event forecasting** techniques for the early detection of undesired simulation outcomes,
 - **Interactive learning techniques** enhancing the efficiency of model calibration and parameter selection during the simulation process

WP2 Objectives

- Forecasting price swings of stocks, currencies, commodities and industrial goods
- Real-time systemic risk Prediction and early warning issuing via analyzing, correlations between specified products and trading instruments for the trader or industrial producer to establish and keep a balanced and risk-adjusted portfolio of assets or goods.
- Decision support for investment opportunities via the identification of relative strengths and weaknesses of assets and goods at a given time (on hourly, daily and weekly basis).

WP3 Objectives

- Enhance Situational Awareness (SA) in the maritime domain
 - Detect and forecast events and threats at sea (e.g., illegal fishing, smuggling, terrorism, etc.)
 - Adopt large- scale data fusion and real-time analytics using “global” and “local” views:
 - Global: AIS data, Satellite imagery
 - Local: Radar, autonomous maritime vessels, acting as on-site sensing devices

WP4 Objectives

- Define an architecture for extreme-scale analytics that enables the seamless interaction and interconnection between its data processing components.
- Enable the graphical design of data processing workflows, in order to facilitate the data analyst in specifying and correctly programming the processing that he wishes to perform on the data.
- Enable different visual analytic tools and interfaces to be easily plugged in.
- Materialize the architecture into a working prototype.

WP5 Objectives

- Development of tools and techniques for optimizing the query execution (i.e., in terms of runtime, resources, or even monetary resources) of extreme-scale analytics across different computing platforms.
- Development of techniques that push parts of big data processing workflows to different platforms (big data platforms, supercomputer clusters, sensor)

WP6 Objectives

- Input: WP5 algorithms for adaptive query processing and data monitoring.
- Development of algorithms for real-time, interactive machine learning from massive, distributed data streams
- Development of techniques for complex event forecasting.
- Learning and monitoring of multiple complex models and event patterns will be made possible through the use of small footprint data synopses, which will support the interactive modification of constructed models and accurate, early forecasting of complex temporal phenomena.
- Output: highly optimized algorithms for distributed online learning and event forecasting.

WP7 Objectives

- Dissemination of the INFORE theoretic framework to the scientific community of databases, data mining, complex event processing and distributed systems.
- Dissemination to high-profile early adaptors within the scope of the application scenarios. Ensure future use of obtained results by proper dissemination to the Big Data Value Association (BDVA)
- Outlining the methodological and technical superiority of the proposed solution compared to other approaches.
- Development of detailed exploitation and business plans.

WP8 Objectives (1/2)

- Establishment of a strong project management scheme.
- Establishment of appropriate communication and reporting channels to the European Commission.
- Achievement of a common scientific and technical direction within the project.
- Successful achievement of the project objectives on time and within budget.
- Establishment of an efficient electronic service for communications, and document exchanging.
- Generation of synergies amongst the project members.

WP8 Objectives (2/2)

- Conduction of continuous quality assurance activities for the operation of the project and the production of its scientific and technical results within its lifespan.
- Continuous monitoring of the project's progress
- Coordination of the organization and execution of the various project meetings, and/or participation of the project in various external or self-organized events.
- Coordination of the continuous process aiming to transfer the knowledge generated throughout the project to the relevant scientific communities.

Conclusions

- The aim of the INFORE project is to address the challenges posed by huge datasets and pave the way for real-time, interactive extreme-scale analytics and forecasting by developing:
 - Real-time, interactive machine learning and data mining tools, supporting the interactive construction of highly accurate models from extreme-scale data streams and massive data volumes.
 - Innovative techniques for adaptive, low-latency, complex streaming event processing and forecasting.
- The technological advances of INFORE project will be showcased in three real-world use cases:
 - The Maritime Situational Awareness use case
 - The Life Sciences use case
 - The Financial use case

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