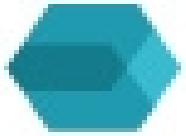

ICT PRISTINE
Project Overview
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Pristine

Project team

WIT-TSSG, (IE), i2CAT (ES),

TID (ES), Ericsson (IE),

Nextworks, (IT), Thales (UK)

Nexedi (FR), Atos (ES),

BISDN (DE), Juniper (IE)

Telecom SudParis (FR),

Brno Uni of Technology (CZ)

Uni of Oslo (NO),

CREATE-NET (IT),

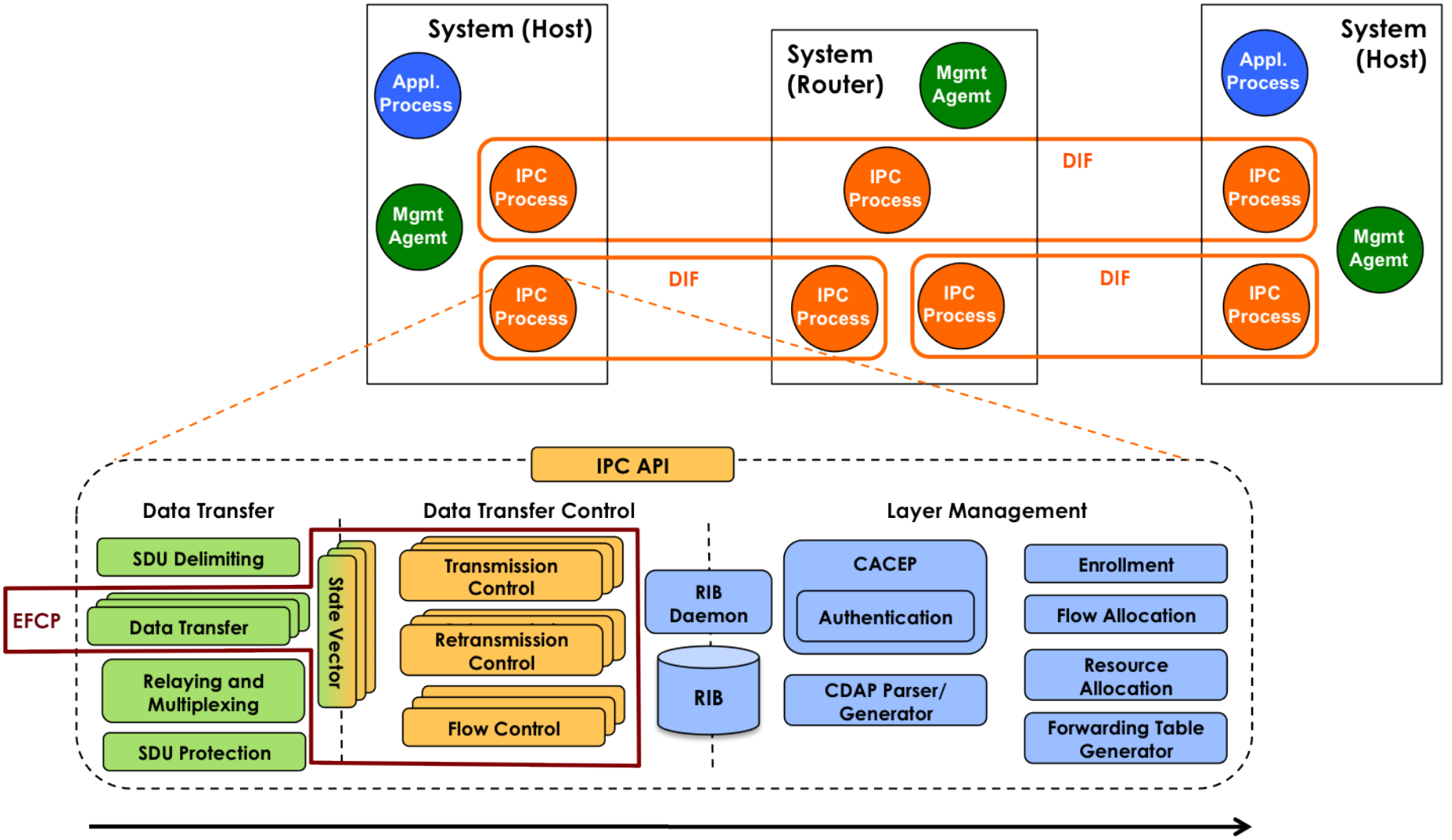
iMinds (BE)

Budget	
Total Cost	5.034.961 €
EC Contribution	3.337.000 €
Duration	**2.5 years**
Start Date	1st January 2014
External Advisory Board	
Cisco Systems, Telecom Italia, Deutsche Telekom, Colt Telecom, BU, Interoute	

Solution space: RINA

- RINA is an emerging clean-slate programmable networking approach, centering on Inter-Process Communication (IPC) paradigm, which will support high scalability, multi-homing, built-in security, seamless access to real-time information and operation in dynamic environments.

RINA architecture overview



PRISTINE Goals

- Design and implement the innovative internals of this the RINA architecture that include the programmable functions for:
  - security of content and application processes,
  - supporting QoS and congestion control in aggregated levels, providing protection and resilience, facilitating more efficient topological routing,
  - multi-layer management for handling configuration, performance and security.

PRISTINE Goals

- Demonstrate the applicability and benefits of this approach and its built-in functions in three use-cases:
  - Distributed cloud
    - Overlay to one or more IPv6 networks, to allow communication between different instances of SlapOS.
  - Datacentre networking
    - RINA-based solutions for intra and inter-data centre communications.
  - Network Service Provider
    - Investigate the use of RINA within service provider networks

Objective 1

- *Software Development Kit for the PRISTINE implementation of RINA*
  - **S**: The SDK will define a set of APIs to modify the behaviour of DIFs
    - data transfer, forwarding, authentication, access control, resource allocation and so on.
  - **M**: Means of verification: Deliverables **D2.3**, **D2.5**. Download tracking.
  - **A**: PRISTINE will modify the IRATI project implementation to allow extension modules to be plugged in and out of the prototype.
    - Key partners: *TID, i2CAT, NXW*.
  - **R**: Enables programmers to exploit in practical customization capabilities provided by RINA.
  - **T**: Milestones **MS6**, **MS16**.

Objective 2 - 4

- Investigate and develop solutions that support more cost-effective networks and deliver a better performance to applications.
  - Aggregate-based congestion control solutions, in which each DIF has its own congestion control loop (Objective 2).
  - Distributed resource allocation strategies that can be tailored to the SLAs associated with a given DIF that a service provider wants to offer, leveraging the unification of connection-oriented and connectionless paradigms \underline (Objective 3).
  - Topological addressing schemes and its associated routing strategies, minimizing the size of routing tables within DIFs (Objective 4).

- **Full S.M.A.R.T objectives 2-4 can be seen in the end slides**

Objective 5 - 7

- Armed with the RINA framework, PRISTINE will improve the security and reliability of the networks described in the project use cases.
  - Designing and programming authentication, access control and encryption strategies customized for each DIF (Objective 5).
  - Investigating and developing security coordination techniques within a DIF, in order to support strong auditing, autonomous detection of attacks and counter-measures to them (Objective 6).
  - Exploiting the multi-homing and distributed resource allocation capabilities of RINA to develop solutions for highly reliable DIFs (Objective 7)..

- **Full S.M.A.R.T objectives for 5-7 can be seen in end slides**

Objective 8

- *Multi-layer management system (DMS) for integrated network management*
  - **S**: Design and develop a DMS capable of managing multiple DIFs (layers) at once.
  - **M**: Deliverables **D5.1, D5.2, D5.3**.
  - **A**: The DMS developed within PRISTINE will take care of configuration, performance and security management.
    - Key partners: *LMI, WIT-TSSG, BISDN*.
  - **R**: The commonality provided by RINA allows multi-layer management to be vastly simplified; thus opening the door to more robust, dynamic, responsive and cheaper network management operations.
  - **T**: Milestones **MS9, MS14, MS20, MS23**.

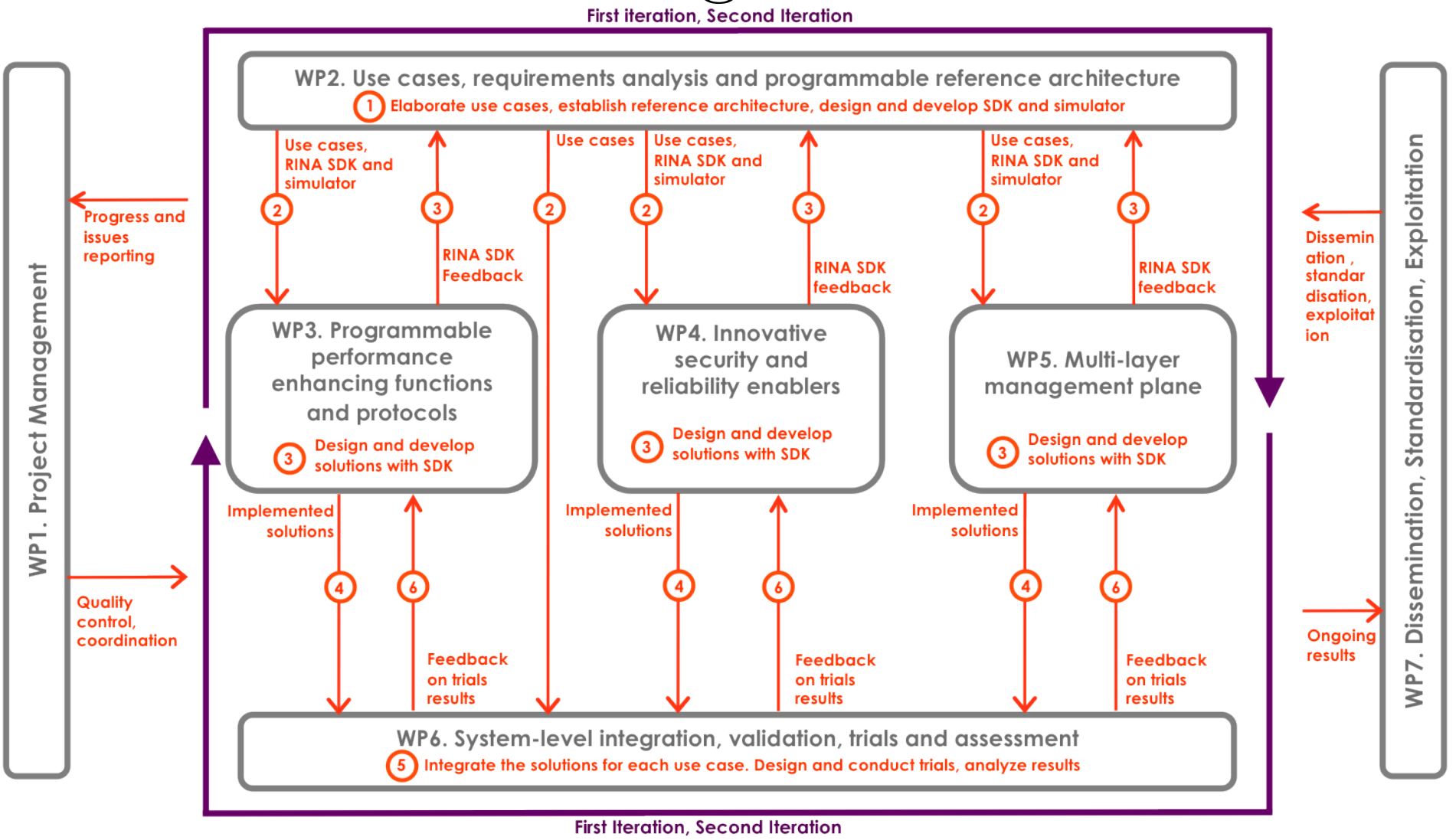
Objective 9

- *Trials of the project use cases: deploying PRISTINE solutions in the real world*
  - **S**: Demonstrate the benefits of the RINA architecture and PRISTINE's solutions by trialing the project use cases in realistic conditions.
  - **M**: Deliverables D6.1, D6.2.
  - **A**: Showcase the technical and business impact of the project results through different trials over a rich infrastructure composed by partner's resources and relevant FIRE facilities.
    - Key partners: *Atos, Nexedi, CREATE-NET, WIT-TSSG, TID, LMI, JUN.*
  - **R**: PRISTINE will bundle the different solutions into three packages, one for each use cases.
  - **T**:Milestones **MS15, MS24**.

Objective 10

- *RINA Simulator to understand the behaviour of the extensions at scale*
  - **S**: Design and develop an OMNeT++ based RINA simulator, utilizing part of the IRATI implementation source code as an input.
  - **M**: Deliverables **D2.4, D2.6**.
  - **A**: A simulator will enable PRISTINE researchers to understand how the solutions for the different problem areas behave at scale.
    - Key partners: *FIT-BUT, CREATE-NET*.
  - **R**: The simulator is a a useful tool for RINA research allowing researchers outside of the consortium to understand how the PRISTINE solutions behave at scale.
  - **T**: Milestones **MS16**

Work Package Structure



Project results

- What results do we aim to achieve by the end of the project.
  - Software Development Kit for the RINA implementation, building on initially developed one by the IRATI project.
  - Specification and implementation of policies that address congestion control, quality of service, addressing, routing, authentication, access control and resiliency.
  - First specification and implementation of a DIF Management System (DMS).
  - Three integrated and validated prototypes (core RINA modules + policies + DMS) for the three use cases: distributed cloud, datacentre networking and network service provider.
  - First RINA Simulator.

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SMART
Objective Details

Objective 2

- *Programmable congestion control for effective data transfer.*
  - **S**: Detect congestion generated within the DIF, and take the appropriate measures to quickly react against it.
  - **M**: Deliverables **D3.1**, **D3.2**. Papers comparing algorithim results.
  - **A**: The different congestion control solutions will be incorporated into the prototype through the use of the SDK.
    - Key partners: *UiO*.
  - **R**: Control loops with different characteristics will be designed, tailored to the requirements of PRISTINE's use cases.
  - **T**: Milestones **MS7, MS12, MS18, MS21**.

Objective 3

- *Distributed resource allocation strategies to support multiple levels of service*
  - **S**: Investigate and program a set of distributed resource allocation techniques that enable a DIF to provide different levels of service to honour the requirements of different applications.
  - **M**: Deliverables **D3.1, D3.2**
  - **A**: The interaction between distributed resource allocation and congestion control techniques within a DIF will be investigated. The SDK will be used to plug the extensions into the prototype.
    - Key partners: *JUN, Atos.*
  - **R**: These techniques will leverage the capabilities that RINA provides in terms of allowing applications to express their desired level of service and the theory unifying connection-oriented and connectionless resource allocation.
  - **T**: Milestones **MS7, MS12, MS18, MS21.**

Objective 4

- *Topological addressing as an enabler of efficient routing*
  - **S**: Research and develop topological addressing schemes and its associated routing mechanisms, in order to minimize the size of the forwarding tables within DIFs.
  - **M**: Deliverables **D3.1, D3.2**.
  - **A**: PRISTINE will investigate what topologies for address spaces make sense, are easily maintained, and scale for the three use cases of the PRISTINE project. Development activities will be carried out through the SDK.
    - Key partners: *IMT- TSP*.
  - **R**: Topological address spaces reflect an abstraction of a connectivity graph within a layer, therefore the forwarding decision can be taken by examining the destination address and the addresses of the directly attached routers.
  - **T**: Milestones **MS7, MS12, MS18, MS21.**

Objective 5

- *Authentication, access control and encryption for secure DIFs*
  - **S**: Investigate, design and implement different strategies to perform authentication, access control and encryption as required by the three PRISTINE scenarios.
  - **M**: Deliverables **D4.1, D4.2**
  - **A**: Application access control, symmetric/assymetric key- based authentication protocols and encryption mechanisms will be investigated and adapted to RINA through the use of the SDK.
    - Key partners: *TRT, BISDN*.
  - **R**: Security is an integral part of an IPC Process and does not need to be handled in separate subsystems such as firewalls.
  - **T**: Milestones MS8, MS13, MS19, MS22.

Objective 6

- *Security coordination within a DIF: self-management, attack identification and mitigation*
  - **S**: Research and program techniques that enable a DIF to coordinate its internal security mechanisms in a distributed an autonomous way.
  - **M**: Deliverables **D4.1, D4.2**.
  - **A**: The analyzed information will be used to decide if a DIF is being attacked, and to take measures to protect from the attack. The developed extensions will be incorporated into the prototype through the SDK.
    - Key partners: *Nexedi, TRT*.
  - **R**: Management and distribution of credentials, as well as logging and analyzing the key events related to security are the most important issues that will be addressed by this objective.
  - Milestones **MS8, MS13, MS19, MS22**.

Objective 7

- *Multi-homing and self-healing as the basis of resilient networks*
  - **S**: Investigate and develop routing algorithms and routing information dissemination strategies that optimally exploit RINA's support of multi-homing for load-balancing and rapid recovery of failures.
  - **M**: Deliverables **D4.1, D4.2**.
  - **A**: Distributed resource allocation techniques will also be used in order to re-create the connectivity graph of the DIF, effectively recovering from malfunctioning links or IPC Processes.
    - Key partners: *iMinds*.
  - **R**: Deploying robust services in a timely and scalable manner is a key issue addressed by technologies such as SDN and NFV. This work will implement and test robust services in RINA and prove it can meet carrier requirements..
  - **T**: Milestones **MS8, MS13, MS19, MS22**.