



## FEDERATED TEST-BEDS FOR LARGE SCALE INFRASTRUCTURE EXPERIMENTS

## The use case of FELIX for achieving energy efficiency in SDNenabled cloud federations

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Cloud Federations and SDN/NFV: the highways towards improved QoE, Cost and Energy Efficiency

Wednesday, 19th March

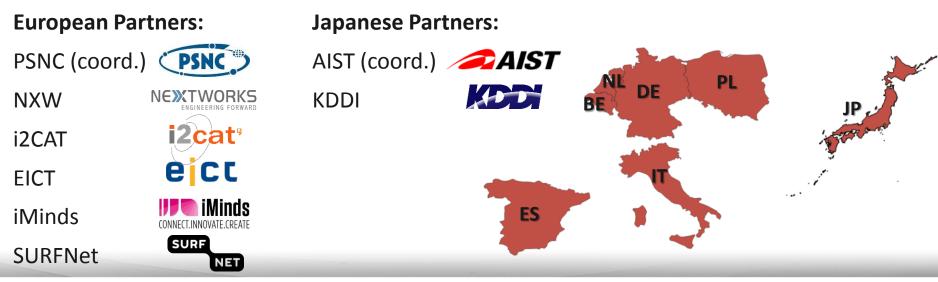
# felix



Total costs requested to EC: Total costs requested to NICT: Duration (36 months): Project resources:

150M ¥ 01.04.2013 – 31.03.2016 302 PM (person months)

1 499K €



# felix



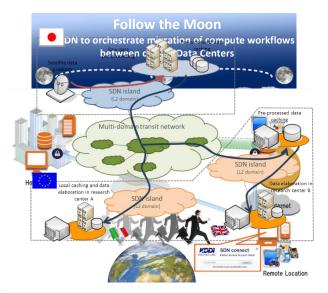
### **Federation of SDN Testbeds**

- To increase mutual benefits of European and Japanese researchers by creating more complex environments for specialized research and experiments
- To create new opportunities for experiments due to geographical dispersion of testbeds

## Joint Europe-Japan experiments (selected)

- A Follow the Moon | Sun Model green energy in Data Centers
  - Research question. How can we move the compute workflow to the nearest & greenest power available in a federation?
- Pre-processing and delivery of nearly real-time [satellite] data to geographically distant locations
  - **Research question.** Can we reduce the size of data to be delivered across the transit network and elaborate at the geographically distributed research centers to improve the overall performance?
- Data Mobility Service by SDN Technologies Inter-Cloud use case
  - **Research question.** Can the cloud system monitor the performance and move data "closer to the remote location"?





## Follow the [Moon | Sun] Motivation behind



## Internet usage curves are following a similar daily pattern everywhere in the world

 there is a natural potential to shift the load of data centres to places in the world where it is currently night

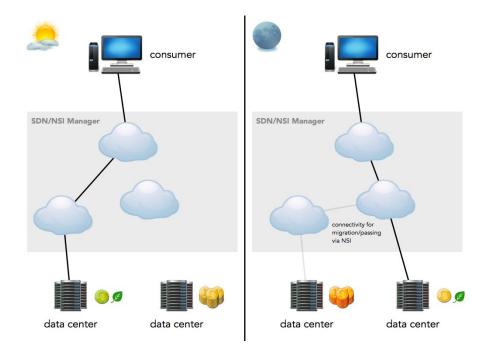
## but also:

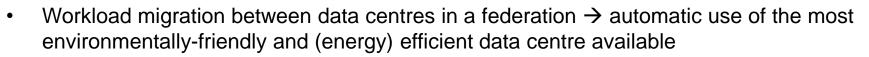
- **Prices of renewable energy** strongly depend on the availability of wind and solar energy
- **Cooling** is reported to amount up to 50% of the total energy bill of data centres
  - large data centre providers have started to place infrastructure in formerly unusual places such as Iceland and Finland
    - low environmental temperatures for cooling
  - Similar projects considered in desert areas
    - the amount of solar energy available may even make up for the additional cooling required





- 1. To minimize the total cost of operation for a virtual data centre while maintaining an acceptable end-user experience
  - mainly determined by the energy costs, but also: CPU/RAM usage and bandwidth costs
- 2. To regulate the usage of resources in a data centre
  - to shape the consumption according to the availability (time and place) of renewable energy sources





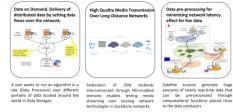
- Complete migration
  - the workload is moved to the more efficient data centre entirely and the consumers' traffic is rerouted
- Delegation
  - The less efficient data centre handes the consumers' requests and delegates the actual processing to the more efficient data centre
- Both scenarios express strong requirements:
  - for establishing dynamic, on-demand end-to-end connections between the data centres
  - the use of SDN mechanisms for (re-)routing of the consumers' traffic, the traffic within the data centres and between them
  - When the workload is moved from one data centre to another, compute resources need to be provisioned.

## Follow the [Moon | Sun]

## Achievements to date and next steps

## **Architecure**

- Six project use cases have been identified and described (September 2013)
- FELIX architecture has been released (February 2014)



possible

in streaming of the high resolution

FELIX should allow to investigate

negative effects in a network.

synchronization of the 3D streams

problems with

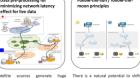
along different and distribute

The platform should enable efficient

between remote sites, providing data

as it is requested: Data on Demand

and dynamic data transmission



Research question. Can we reduce the size of data to be delivered across the

transit network and elaborate at the geographically distributed research centers to improve the overall

The FELIX middleware should allocate

the proper resources at data source

and destination ends and configure

network segments on-demand with

the guarantees to provide an efficient

transfer of data across continents

("follow the sun/moon")

nearest & greenest

Research guestion. How can we

move the compute workflow to the

FELIX investigates tech possibilities

for using SDN in the Follow the Moon

validating the technical viability of

relocating computing loads to less

energy consuming Data Centers



A user of a service provided by the load of data centres to places in cloud system moves to a remote down, in order to continue a variet can be pre-processed through the world where it is currently night location (e.g., due to a business trip) of services on an laaS, all of laat resources have to be migrated to

> Research question. Can the cloud system monitor the performance and move data "closer

Aim is to let the user temporally By introducing "HaaS (Hardware as access his [business] services with

another site, which is not damaged

Disaster recovery by migrating

laaS to a remote data cente

Service)" laver, abstraction of physical resources is realized. IaaS can be migrated to differently configured data center. Abstraction is supported by OpenFlow and nested

#### http://www.ict-felix.eu/wp-content/uploads/2014/03/FELIX-D2.1.pdf

concept in Data Centers and the same level of performance as

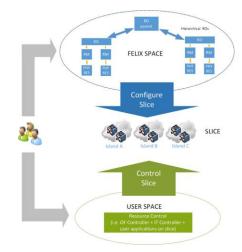
when at home.

## Implementation

Prototype implementations of the architectural framework are expected by Q12015

## **Experimental validation**

FELIX experiments and implementation of project use cases will start from Q12015



http://www.ict-felix.eu/wp-content/uploads/2014/03/FELIX D2.2 General Architecture and Functional Blocks.pdf





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