Scenario-based Distributed Virtualization Management Architecture for Multi-Host Environments

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Business Oriented Infrastructure

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- Operation

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01 Introduction (1/3)

Scenario-based virtualization management principles

- Scenario-based virtualization management tools
  - Aimed at processing **scenario specifications** in order to be deployed in physical infrastructure (hosts) and provide further management (e.g. monitoring, execute command sequences, undeploy, etc.).
  - Scenario specification can be defined as a format representation (e.g., XML) of a **set of virtual machines** along with their **interconnections** in a given topology.
- Some tools nowadays are scenario-based, focused on **experimentation environments**, such as research and educational testbeds
  - VNUML, NetKit, MLN
- Conventional virtualization management tools (e.g. VMware VirtualCenter) for production environments use not to be scenario-based (out of our scope)

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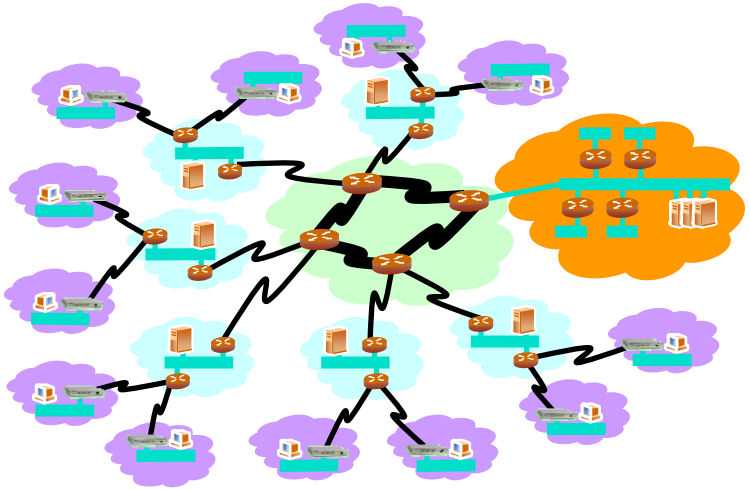
01 Introduction (2/3)

Scenario-based management example: VNUML

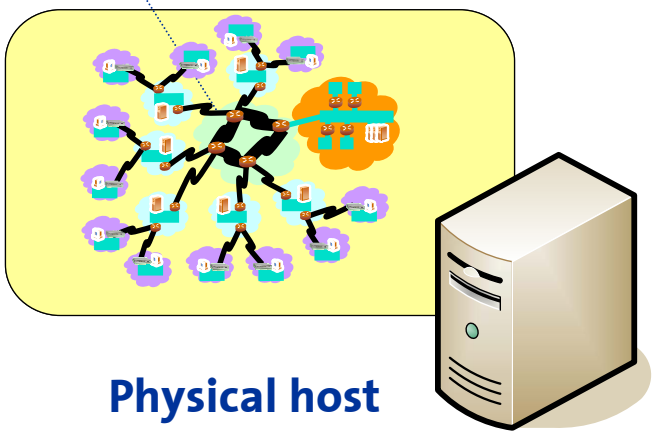


Desired scenario (designed by the user)

VMs and interconnection virtual networks

Scenario specification (in XML)

Scenario-based tool (e.g. VNUML)



Physical host

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01 Introduction (3/3)
Problem Statement

- Scenario-based virtualization tools use to consider just **one physical host** deployment
  - Scalability problems (e.g. a 1000 VM scenario)
- We have designed and implemented a distributed virtualization management tool named EDIV which purpose is to deploy scenarios in a **cluster of *N* physical hosts**.
  - Based on VNUML (in other words, VNUML scenarios can be used in EDIV without modifications)
  - Modular and extensible partition algorithm
  - A partnership project between Telefónica I+D and Universidad Politécnica de Madrid (Spain) which prototype results are publicly available (GPL).

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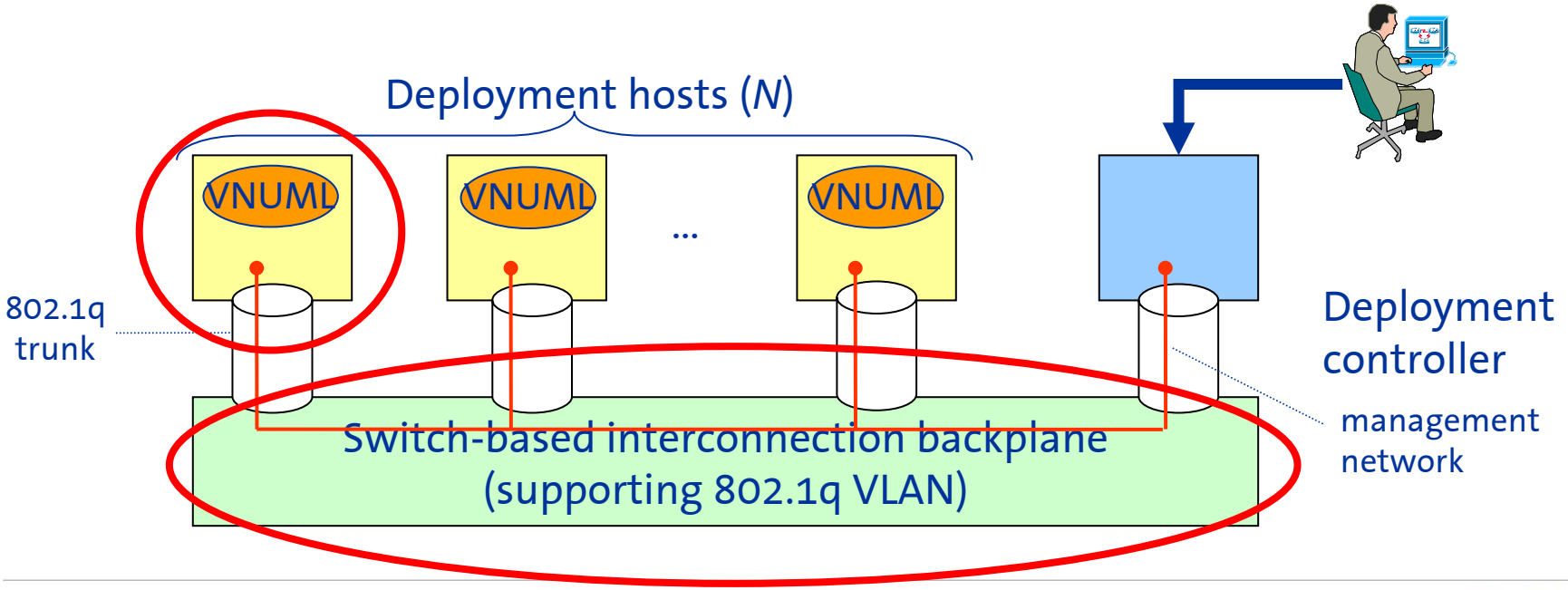
02 General Architecture

- Deployment hosts
  - GNU/Linux systems with VNUML installed along with other utilities (vconfig, sshd, etc.)
  - VNUML provide three operations: deploy, execution and undeploy
- Switch-based interconnection backplane
  - One or serveral Ethernet switches providing end-to-end 802.1q trunks
  - A management network (physical of VLAN) must be implemented



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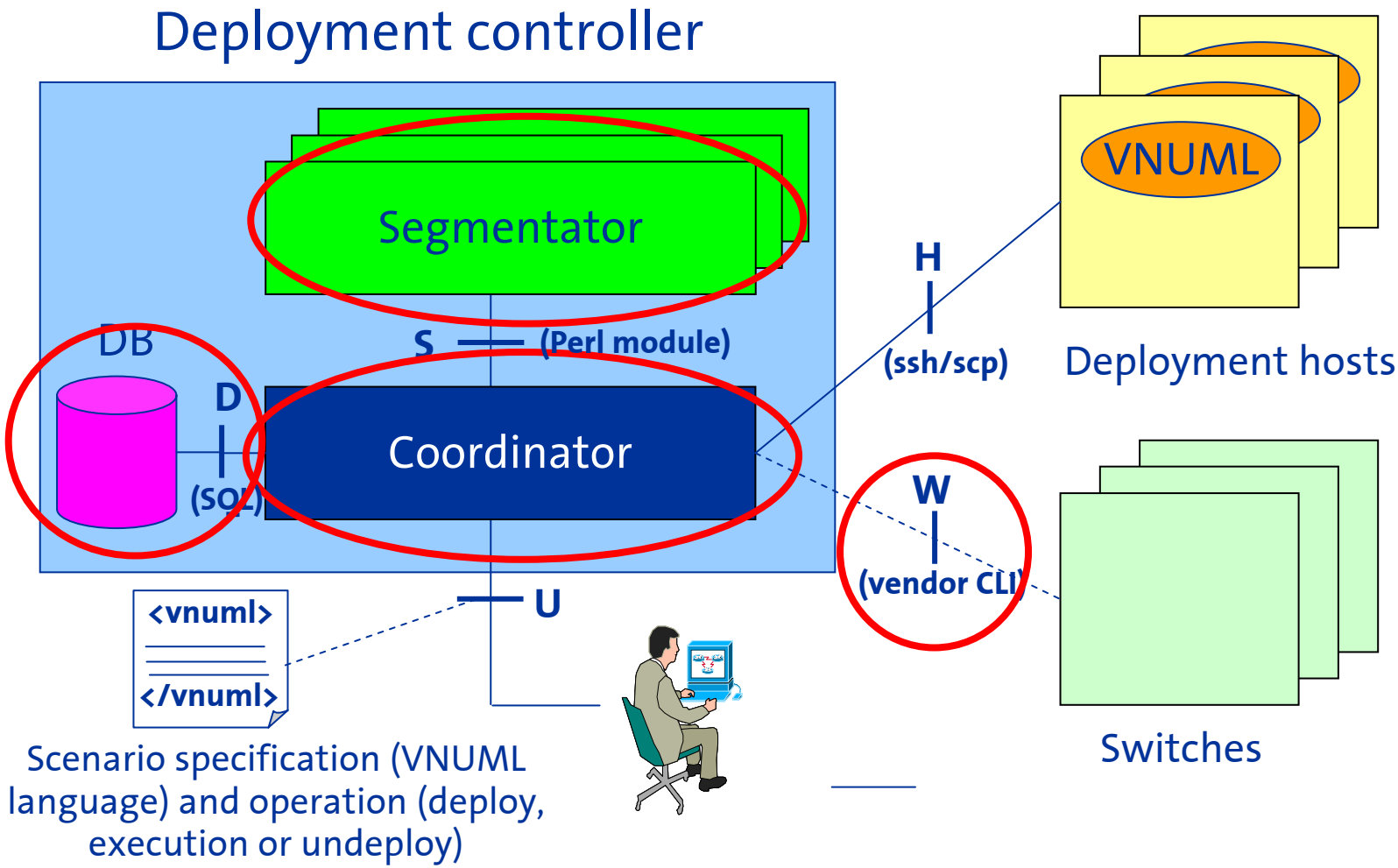
02 Deployment Controller



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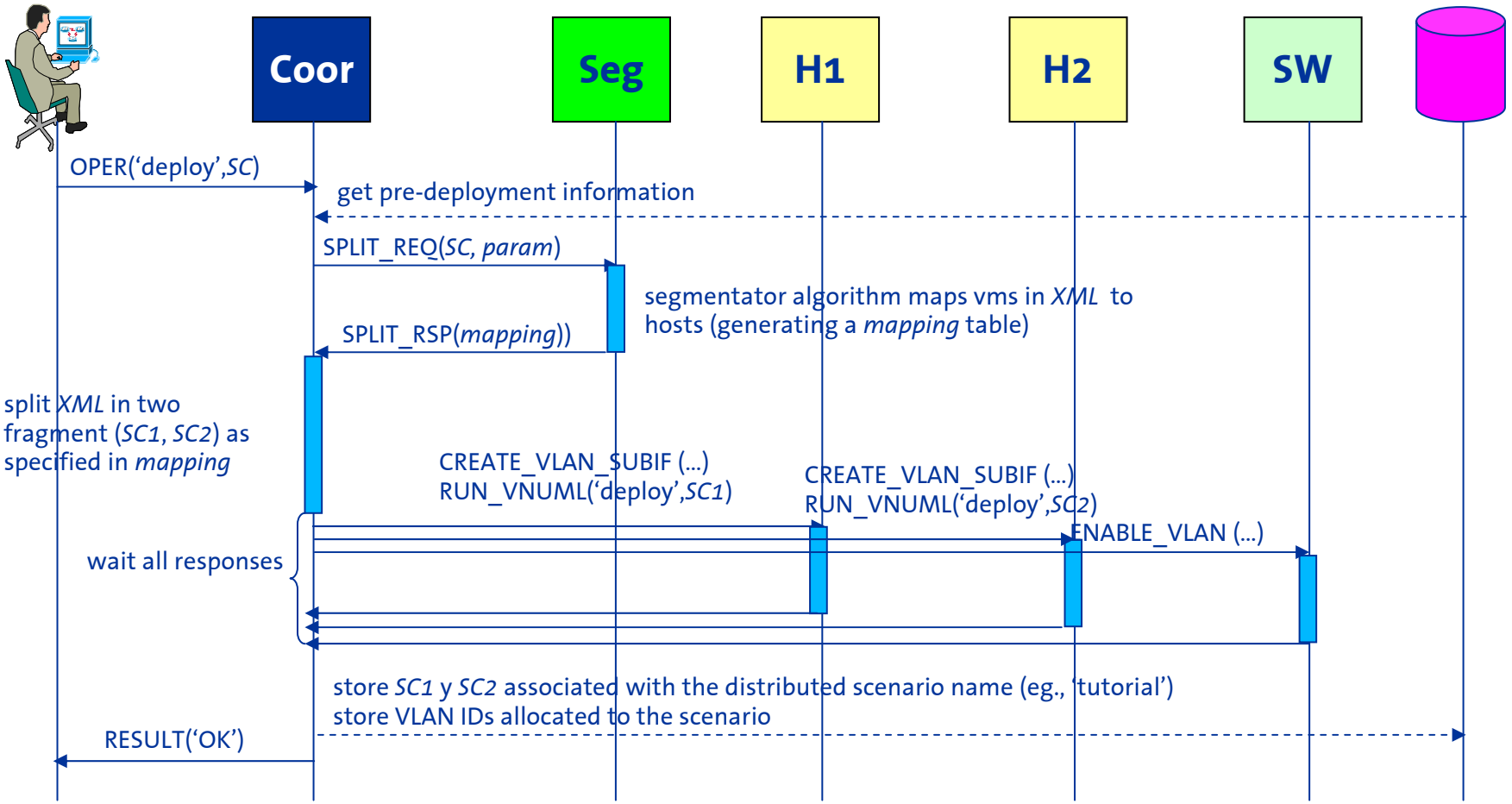
02 Operation
Deployment



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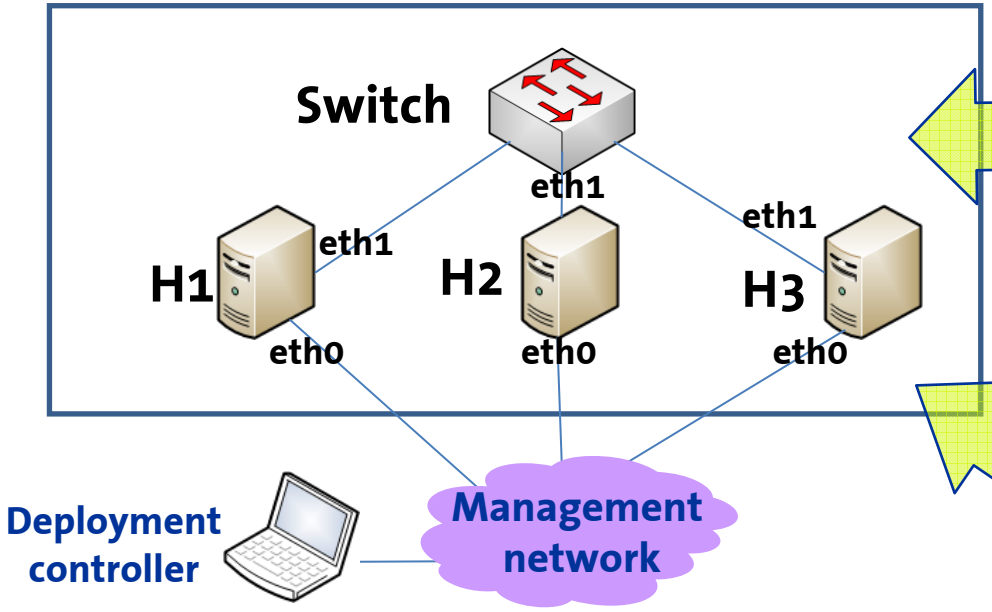
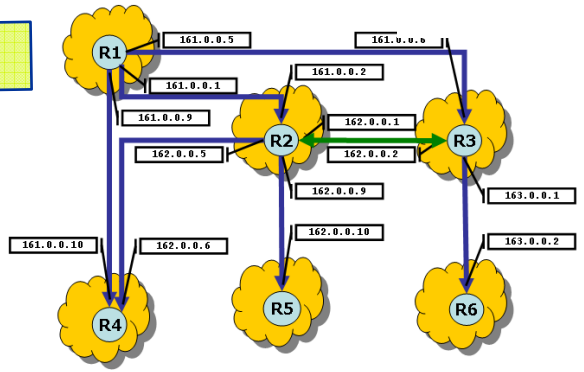
03 Practical Results

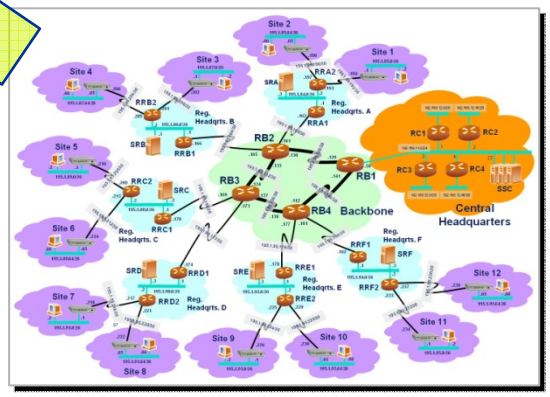
Experiment Setup



Small scenario (6 VMs)



Large scenario (51 VMs)



- EDIV tool implemented in Perl
- Physical management network
- Partition algorithms
  - Round robin
  - Weighted round robin (based on CPU load)
  - Deployment constraints ("VM A and B in the same physical host")

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03 Practical Results

Virtual machine distribution

	Deployment host loads			Round-Robin			Weighted Round Robin		
	L1	L2	L3	H1	H2	H3	H1	H2	H3
Small scenario (6 VMs)	L	L	L	2	2	2	2	2	2
	M	M	M	2	2	2	2	2	2
	H	L	L	2	2	2	1	3	2
	H	M	M	2	2	2	2	2	2
Large scenario (51 VMs)	L	L	L	17	17	17	17	17	17
	M	M	M	17	17	17	17	17	17
	H	L	L	17	17	17	7	22	22
	H	M	M	17	17	17	13	19	19

L (*low*) ⇒ 0% load **M (*medium*) ⇒ 50% load** **H (*high*) ⇒ 100% load**

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03 Practical Results
Time comparison

- How much does it take to deploy each scenario?
  - With VNUML
    - Small scenario: **42 s**
    - Large scenario: **282 s**
  - With EDIV (low mean load)
    - Small scenario: **17 s**
    - Large scenario: **130 s**
  - With EDIV (high mean load)
    - Small scenario: **43 s**
    - Large scenario: **135 s**

EDIV can achieve a **50-60%** saving regarding the mono-host case with VNUML

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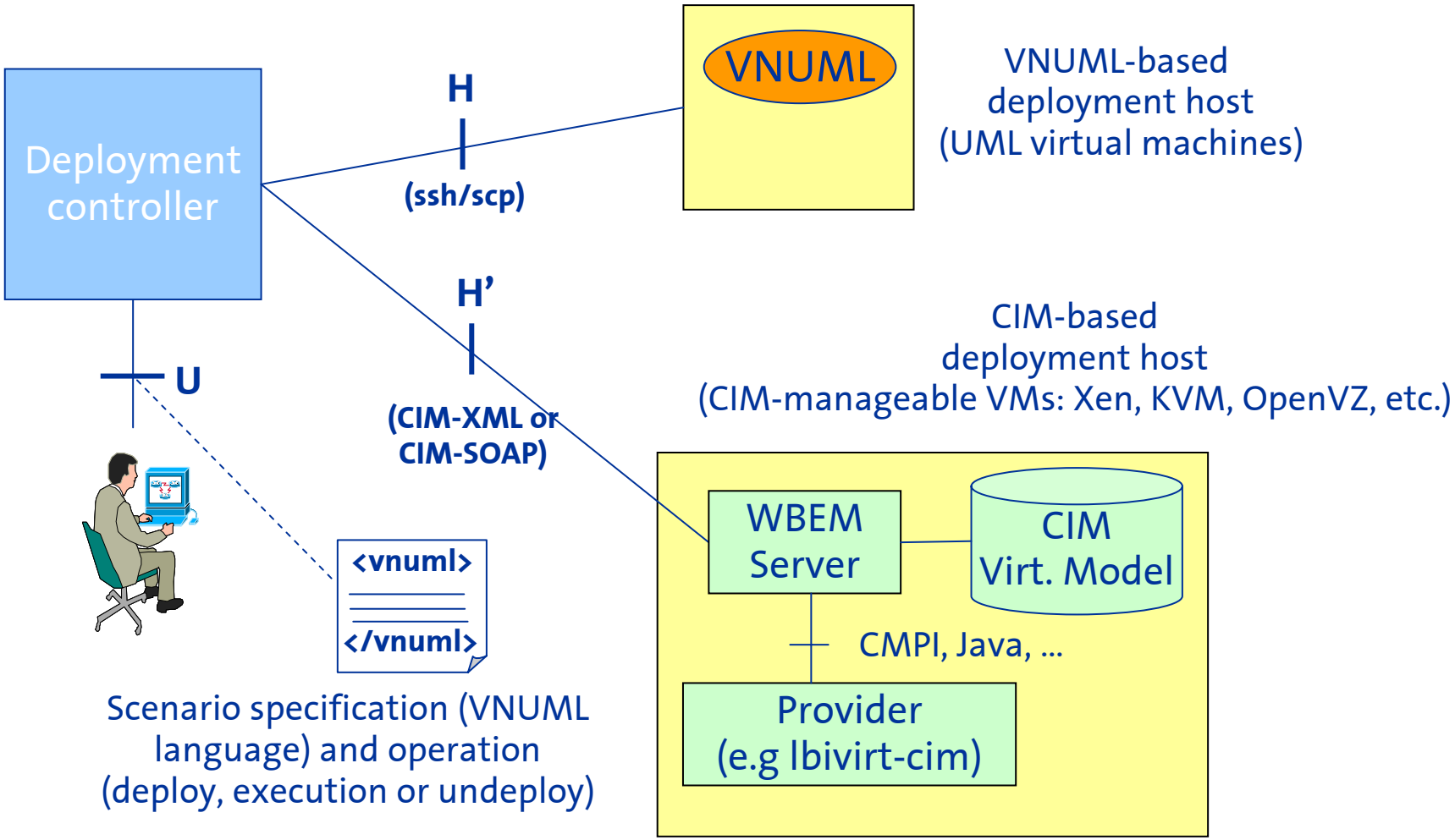
04 DMTF's Standards Alignment

CIM-based virtual machine management



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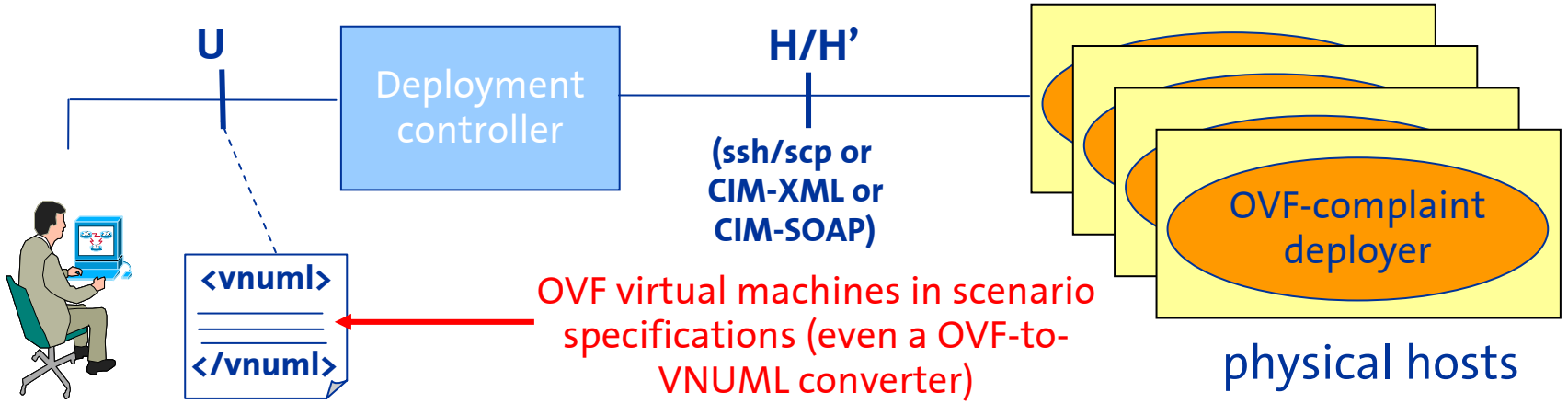
04 DMTF's Standards Alignment

OVF based virtual machines in EDIV scenarios

- Open Virtualization Format (OVF)
  - Recently published DSP0243 1.0.0d (September 2008)
- Why introduce OVF in EDIV?
  - To use virtual appliances highly optimized for specific purposes in EDIV scenarios (e.g., firewalls, dynamic routing stacks, etc.)
  - To smooth the migration from development/pre-production environments to production
- How to do it?



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05 Summary

- Main conclusions
  - EDIV architecture solves the problem of scenario-based virtualization management in distributed multi-host environment (as checked by ours experiments)
    - Scalability
    - Dramatic reduction (50-60% saving) in deployment time
  - Simple and open API to develop new partition algorithms
  - Transparency to VNUML users (the specification language is the same)
- Work in progress
  - Wide-area deployment environment (instead of a local cluster)
    - This is being working out in PASITO (a distributed experimentation platform within RedIris, the Spanish National Research and Education Network)
- Future working lines
  - Alignment with DMTF's standards
  - Virtual machine filesystem management

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EDIV tool and documentation is freely available at http://www.dit.upm.es/vnuml

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