



Model-Driven Continuous Deployment for Quality DevOps

*D. A. Tamburri, E. Di Nitto, M. Guerriero,
M. Artač, T. Borovšak*

DICE

Horizon 2020 Research & Innovation Action

Grant Agreement no. 644869

<http://www.dice-h2020.eu>



Funded by the Horizon 2020
Framework Programme of the European Union

Roadmap



- Intro: The Rise of Big Data
- Research Solution: Project DICE
- DICE Meta-models
- M2M and TOSCA in DICE

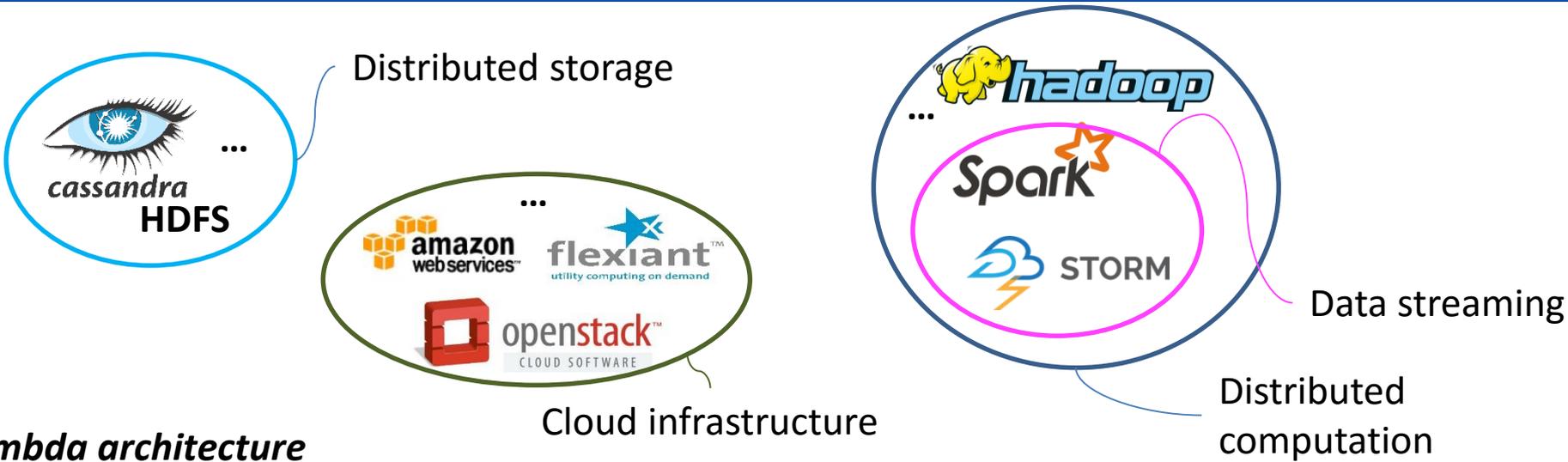
Intro: The Rise of Big Data



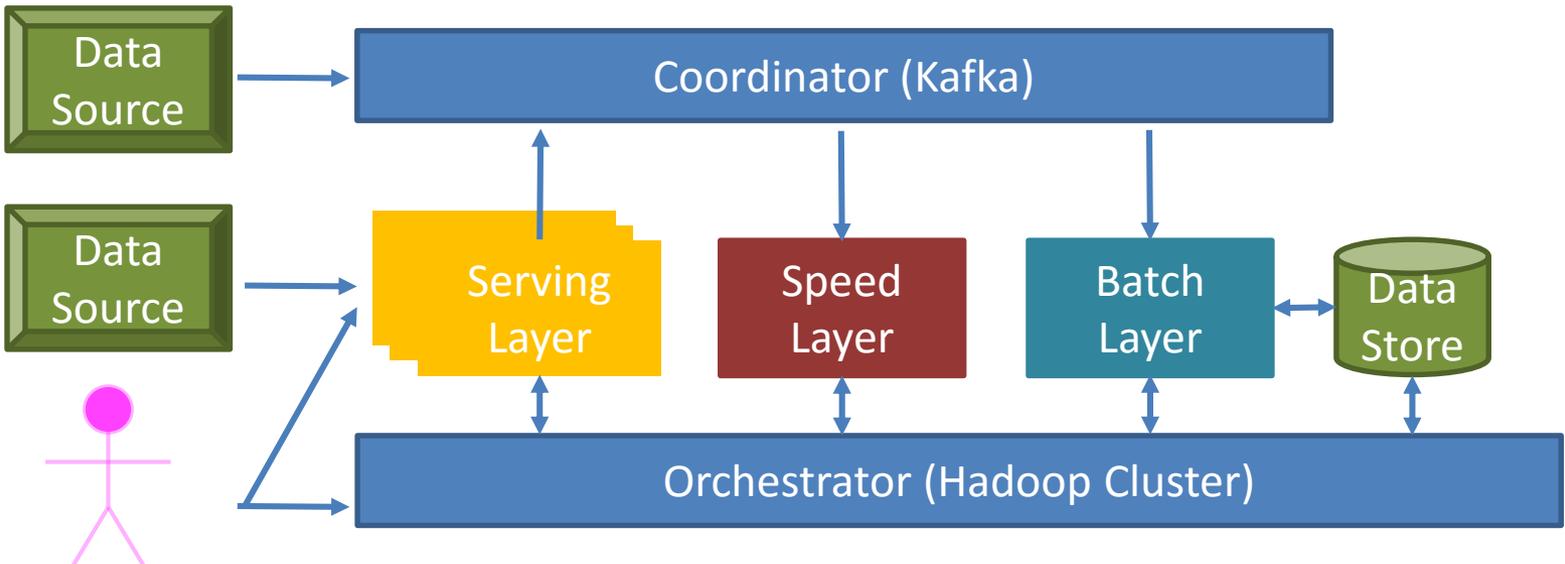
- Software market rapidly shifting to Big data
 - Expected 32% compound annual growth rate in EU through 2016
 - Just 35% of Big data projects are successful [CapGemini'15]



Intro: Building blocks for DIAs today



Lambda architecture





Intro: example challenges!

Legacy Systems and Processes



Learning curves



Initial prototype



Risk of failure



Big Data Analytics Adoption



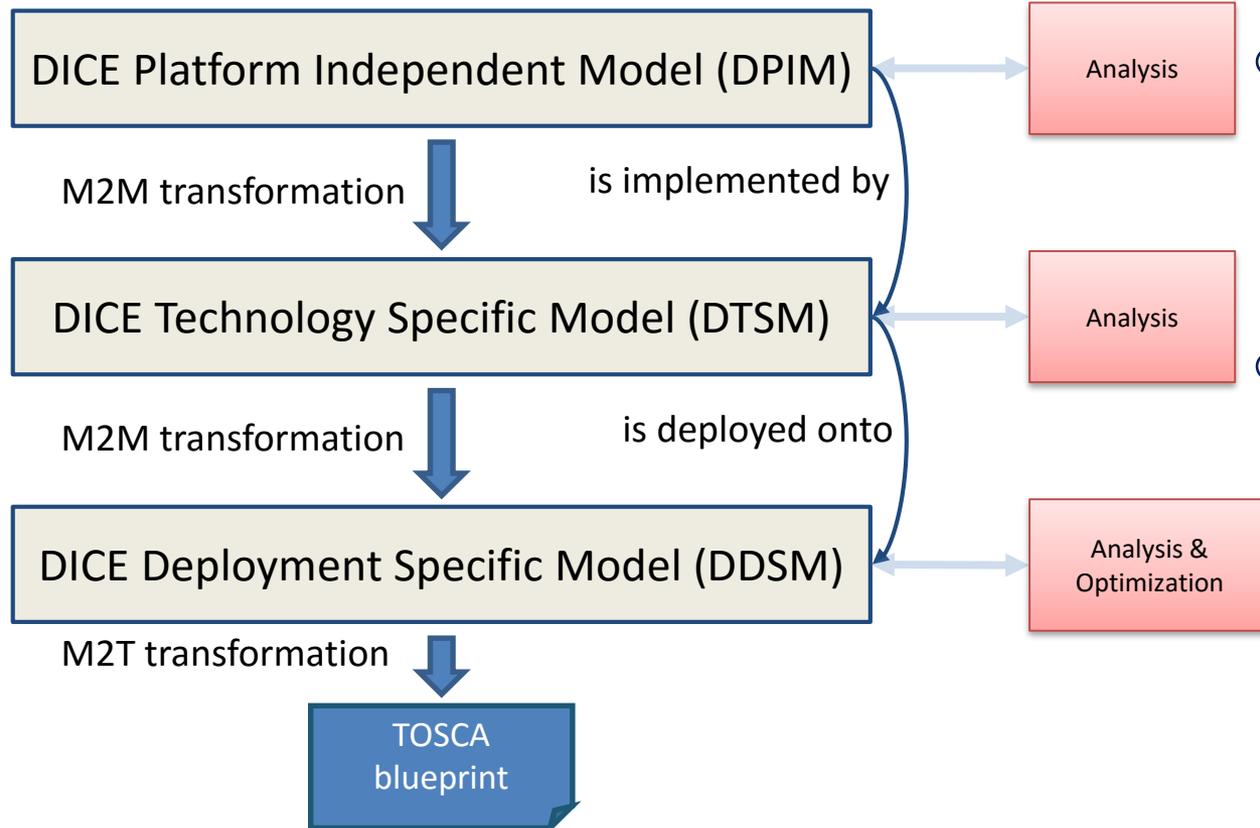
DICE Objectives



- Tackling skill shortage and steep learning curves
 - High-degree of MDE automation via DICE tools
- Shorten time to market for DIAs
 - Push out new products, without sacrificing quality
- Decrease development and testing costs
 - Fast iterative definition of application prototypes
- Reduce number and severity of quality incidents
 - DevOps-fashionable Iterative refinement of application design



DICE incremental modeling and analysis^[6]



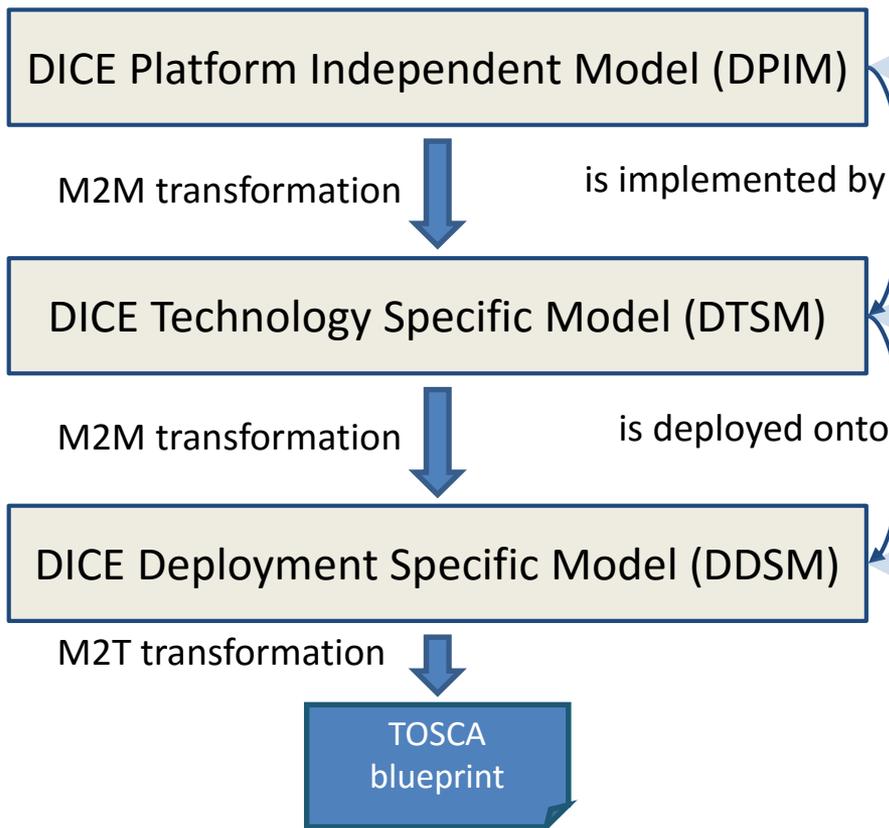
- To provide sound abstractions and UML Profile for DIA

- To provide a sound method for:

- **DICE-based Continuous DIA Architecting**
- **DICE-based Continuous DIA Deployment**



DICE incremental modeling and analysis^[6]



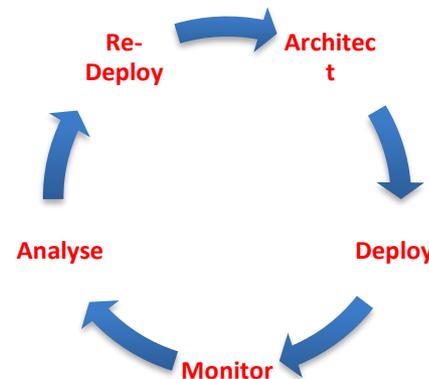
- To provide sound abstractions and UML Profile for DIA



- To provide a sound method for:



- DICE-based Continuous DIA Architecting
- DICE-based Continuous DIA Deployment

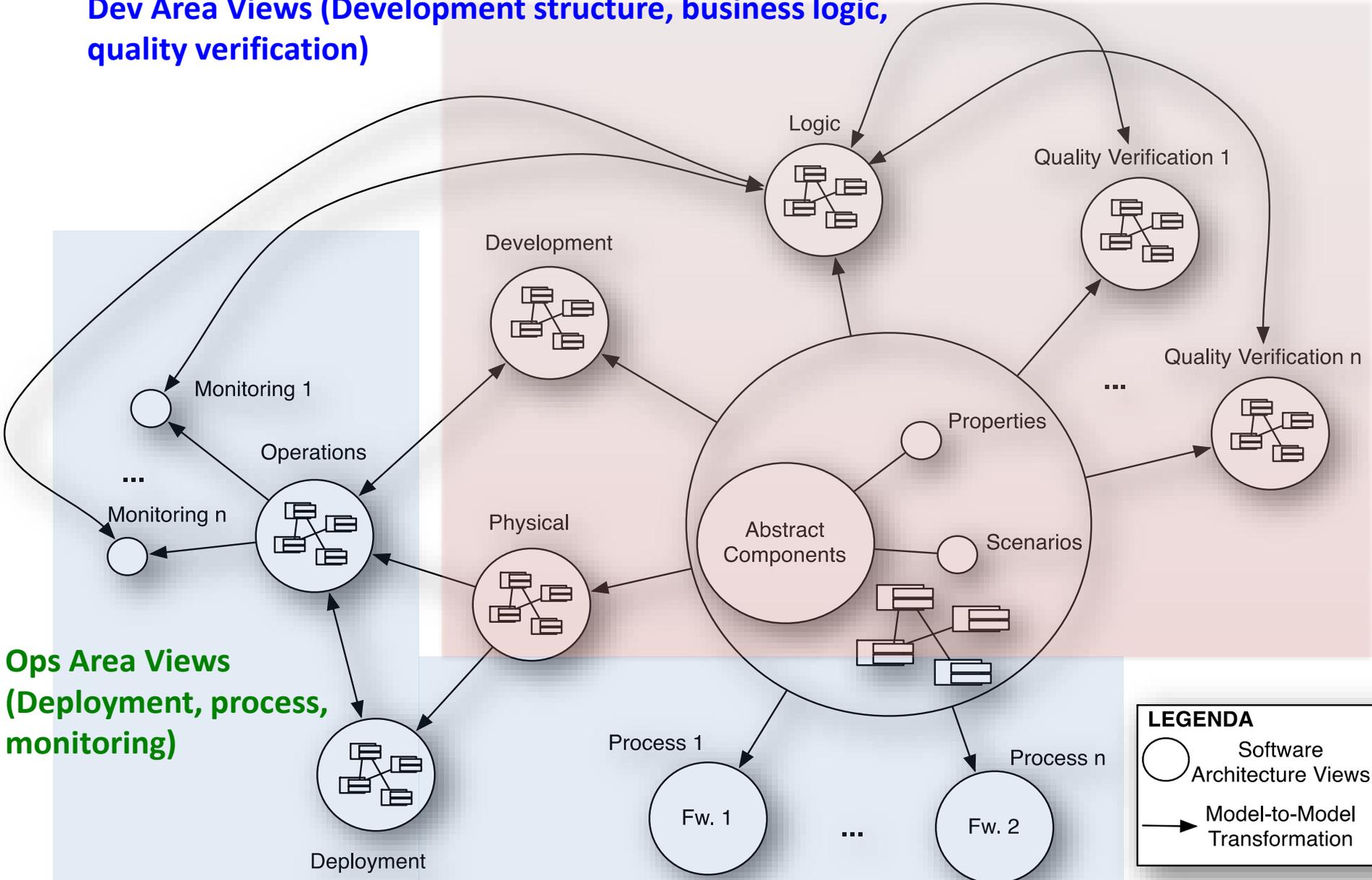


In a DevOps Fashion!

Where does this come from?



Dev Area Views (Development structure, business logic, quality verification)



Ops Area Views (Deployment, process, monitoring)

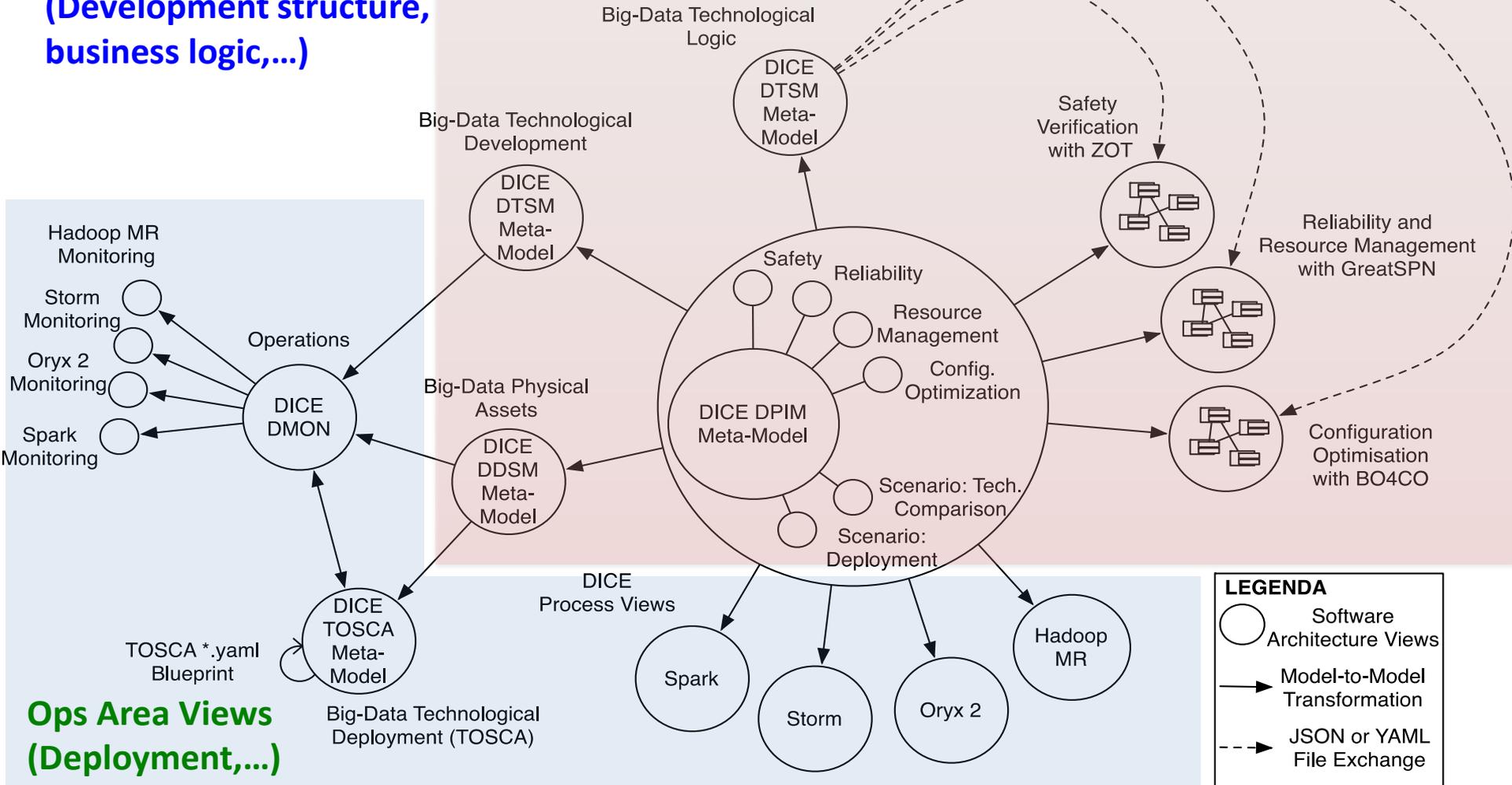
LEGENDA

- Software Architecture Views
- Model-to-Model Transformation

Where does this come from? DICE!



Dev Area Views (Development structure, business logic,...)



Ops Area Views (Deployment,...)

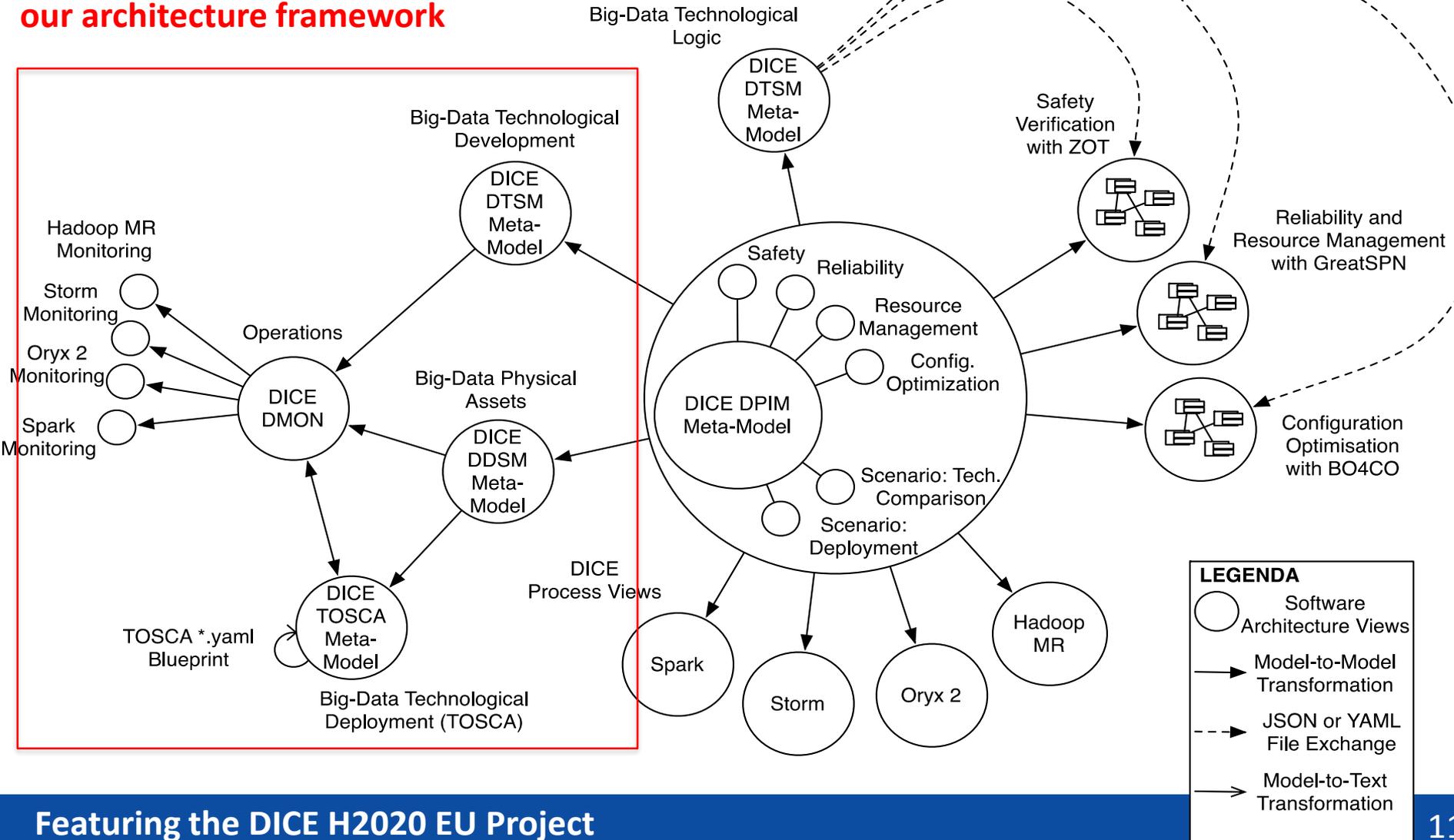
LEGENDA

- Software Architecture Views
- Model-to-Model Transformation
- JSON or YAML File Exchange
- Model-to-Text Transformation

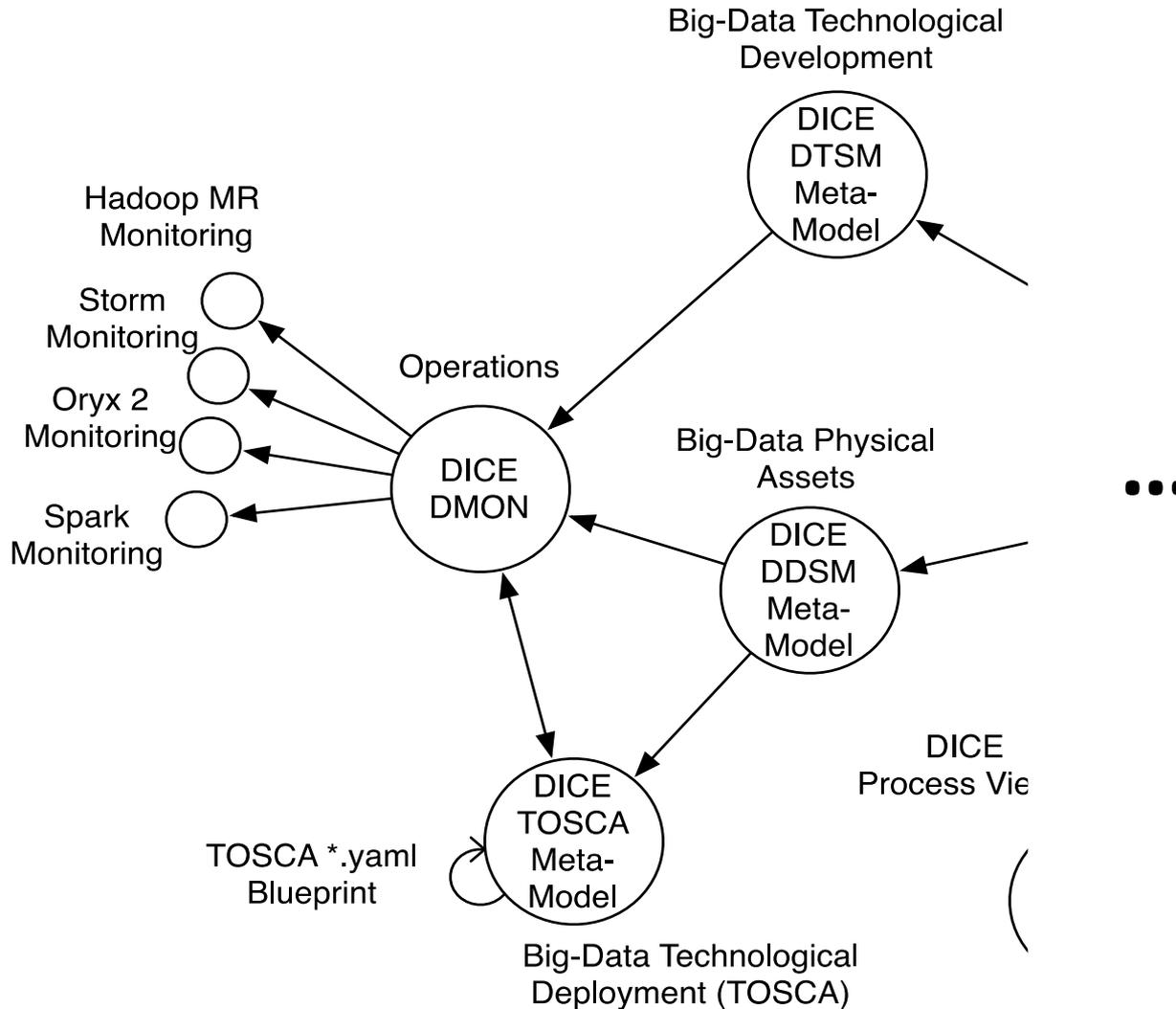
Where does this come from? DICE!



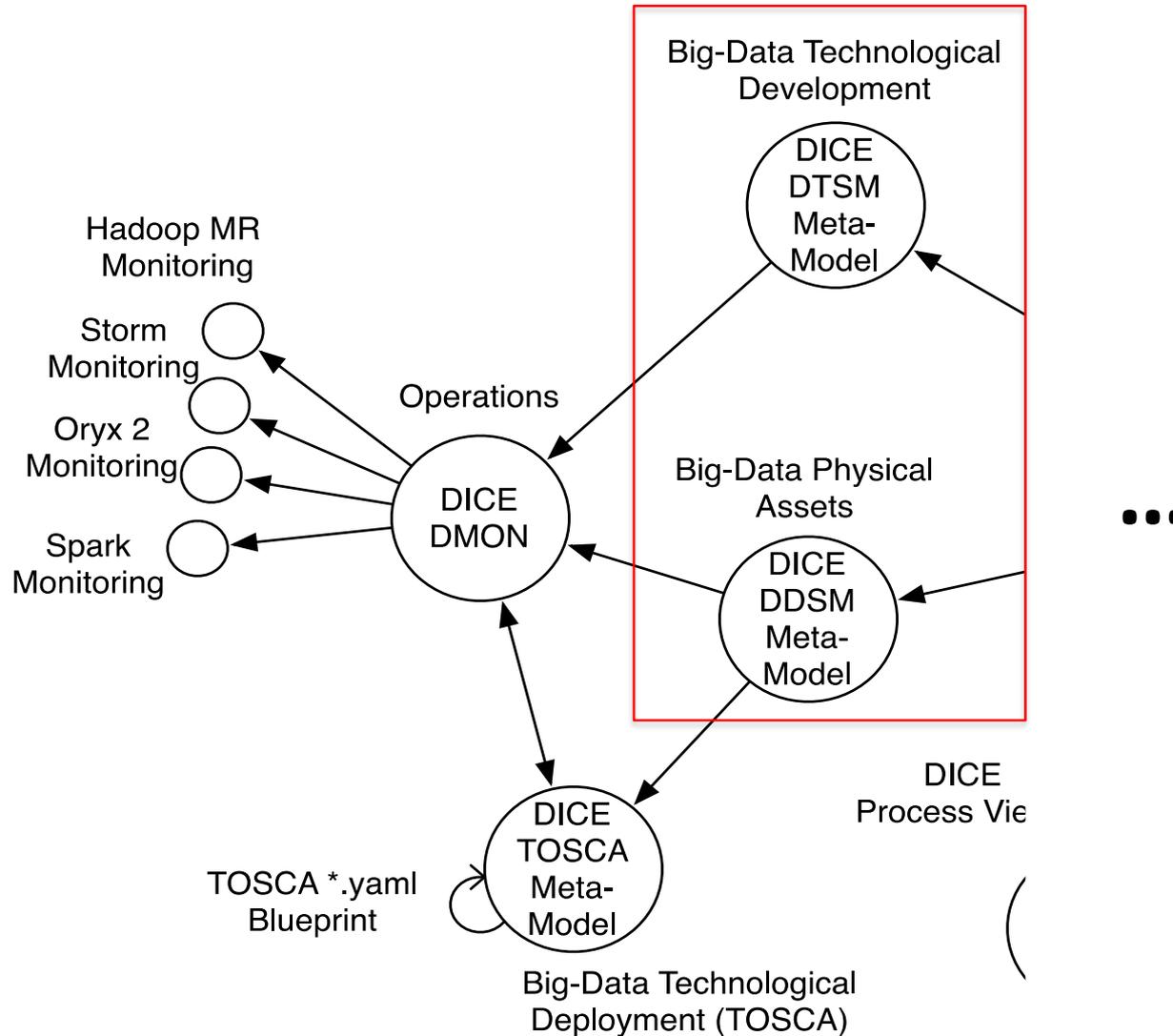
Deployment and Operations area of our architecture framework



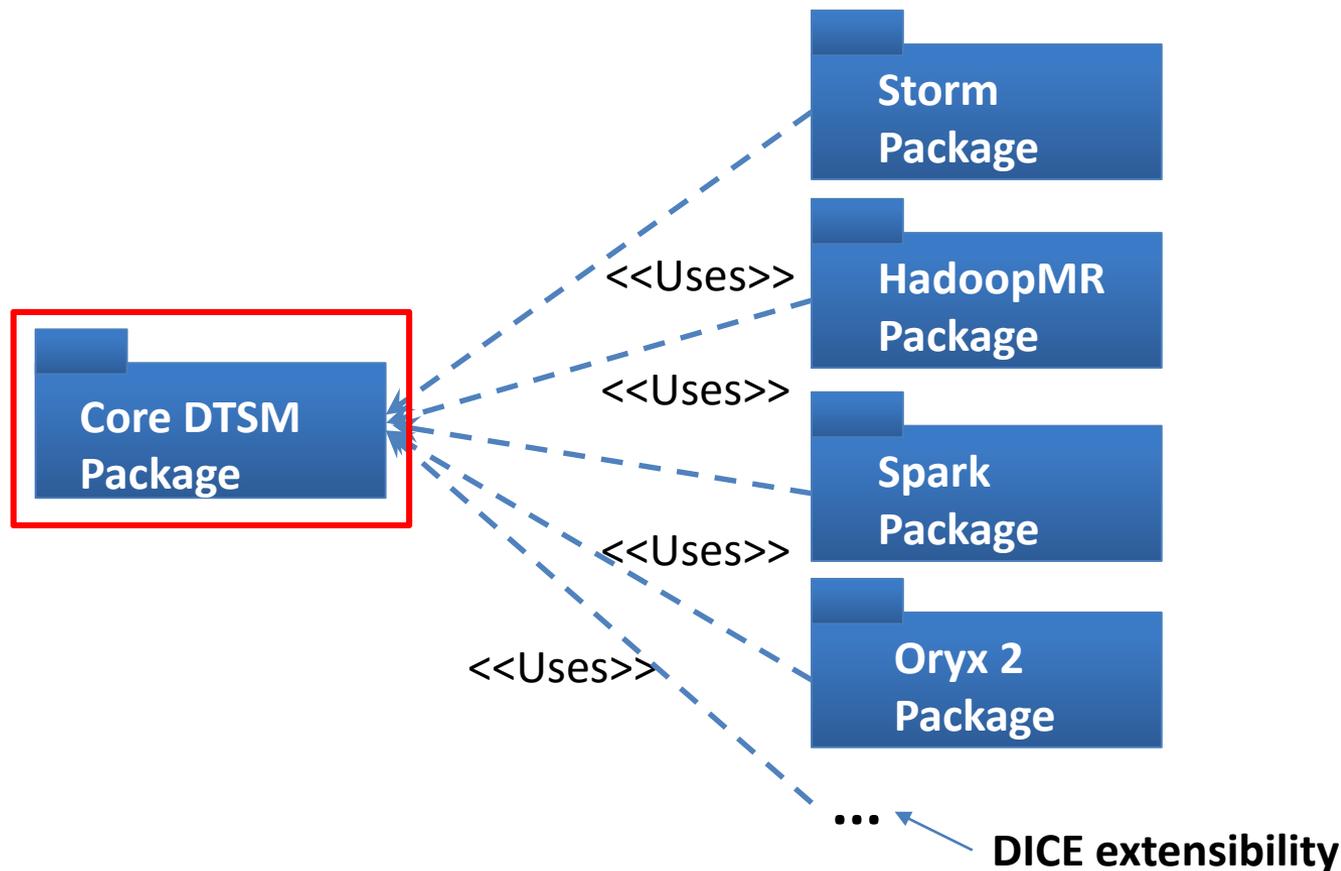
Where does this come from? DICE!



Where does this come from? DICE!



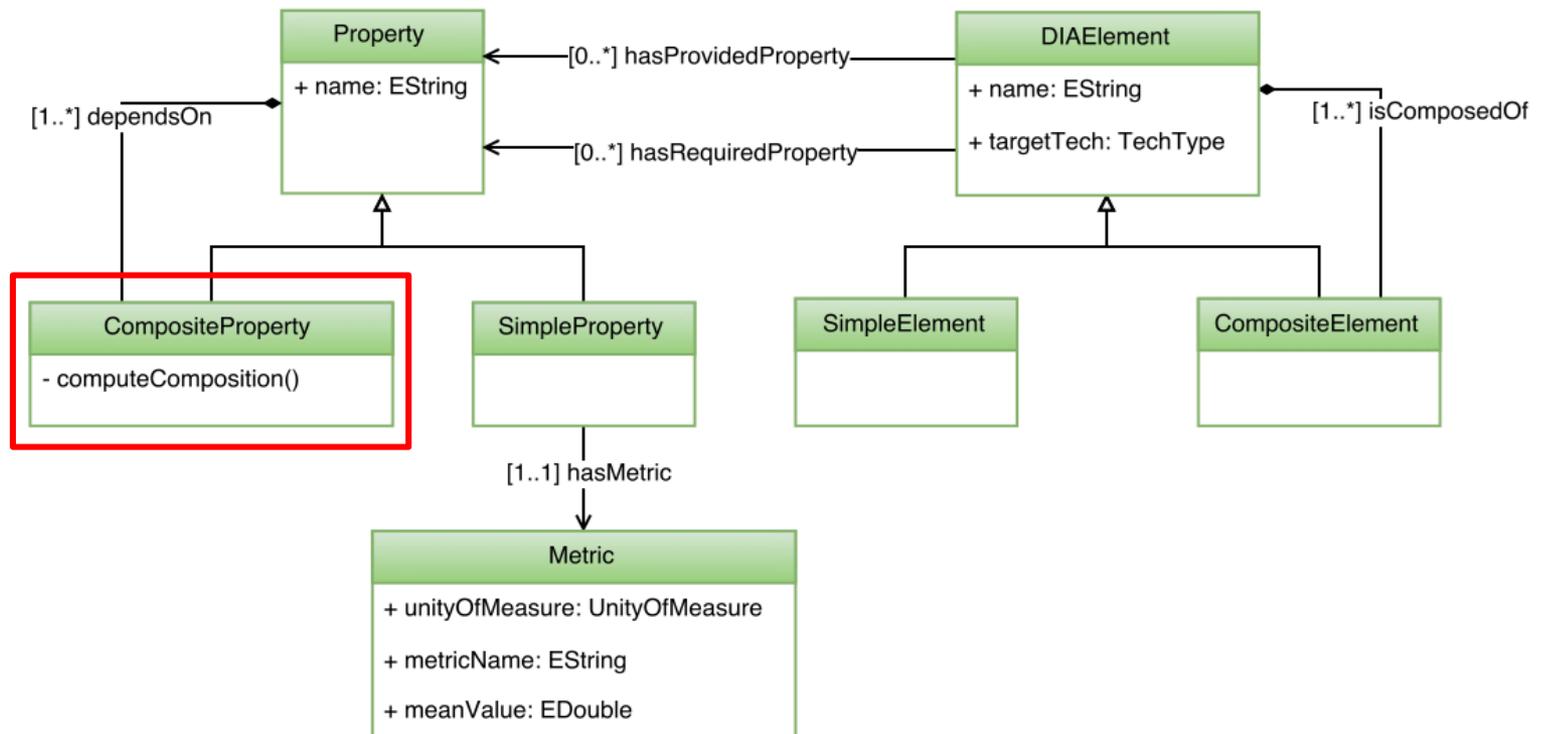
DICE Meta-models - DTSM



DICE Meta-models* - DTSM Core



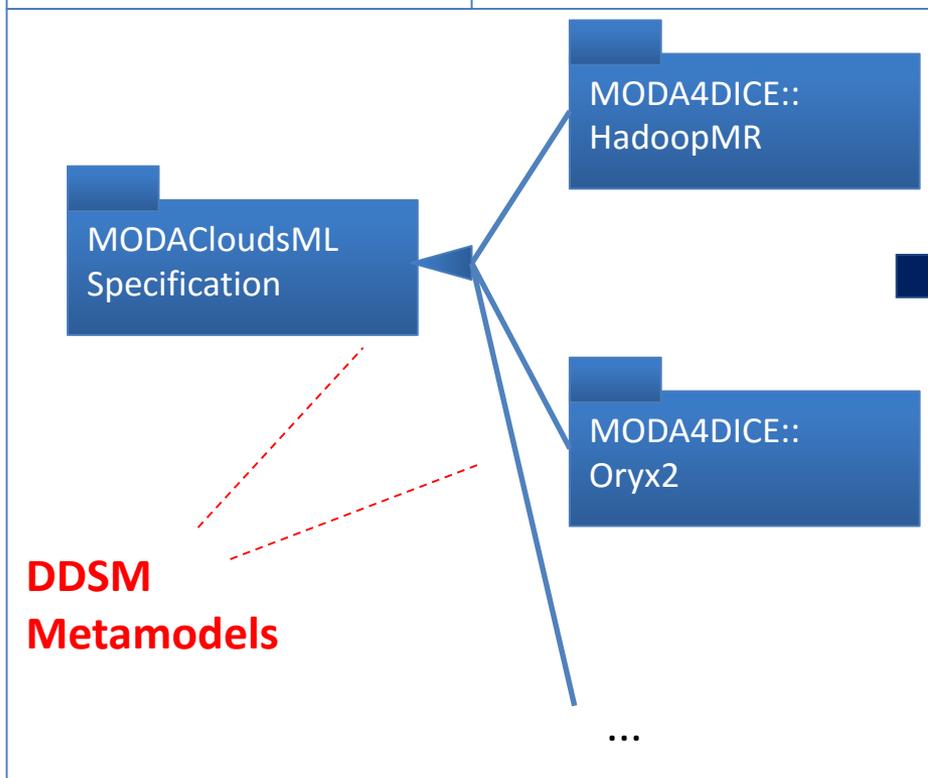
1. Common to all DICE tech-packs;
2. Distinguishing analysable elements;
3. Distinguishing properties;
4. Simplified property definition;



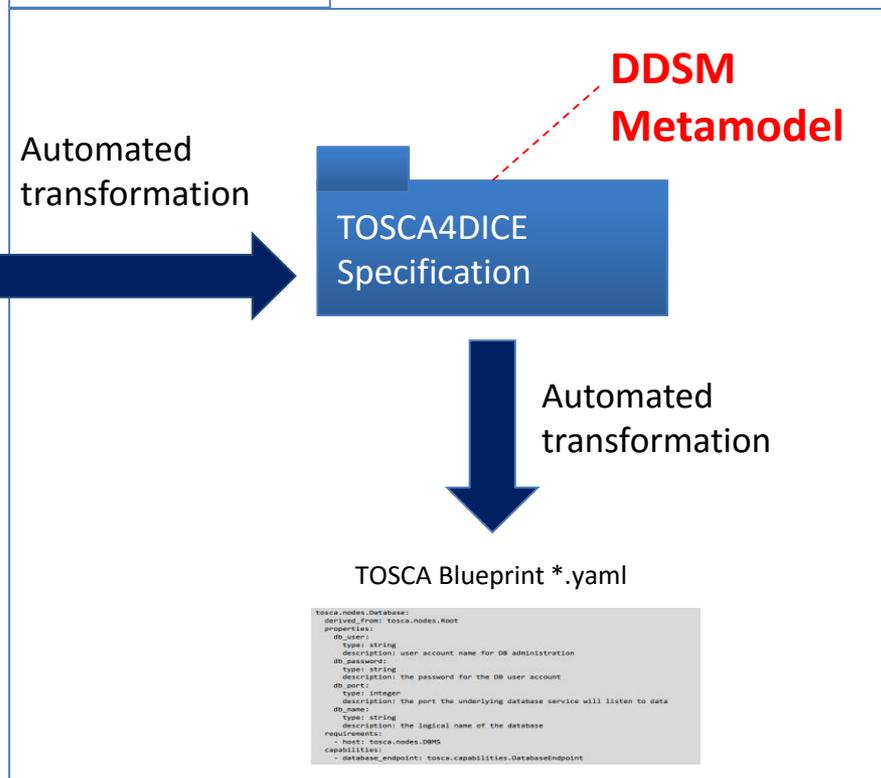
DICE Meta-models – DDSM^[5]



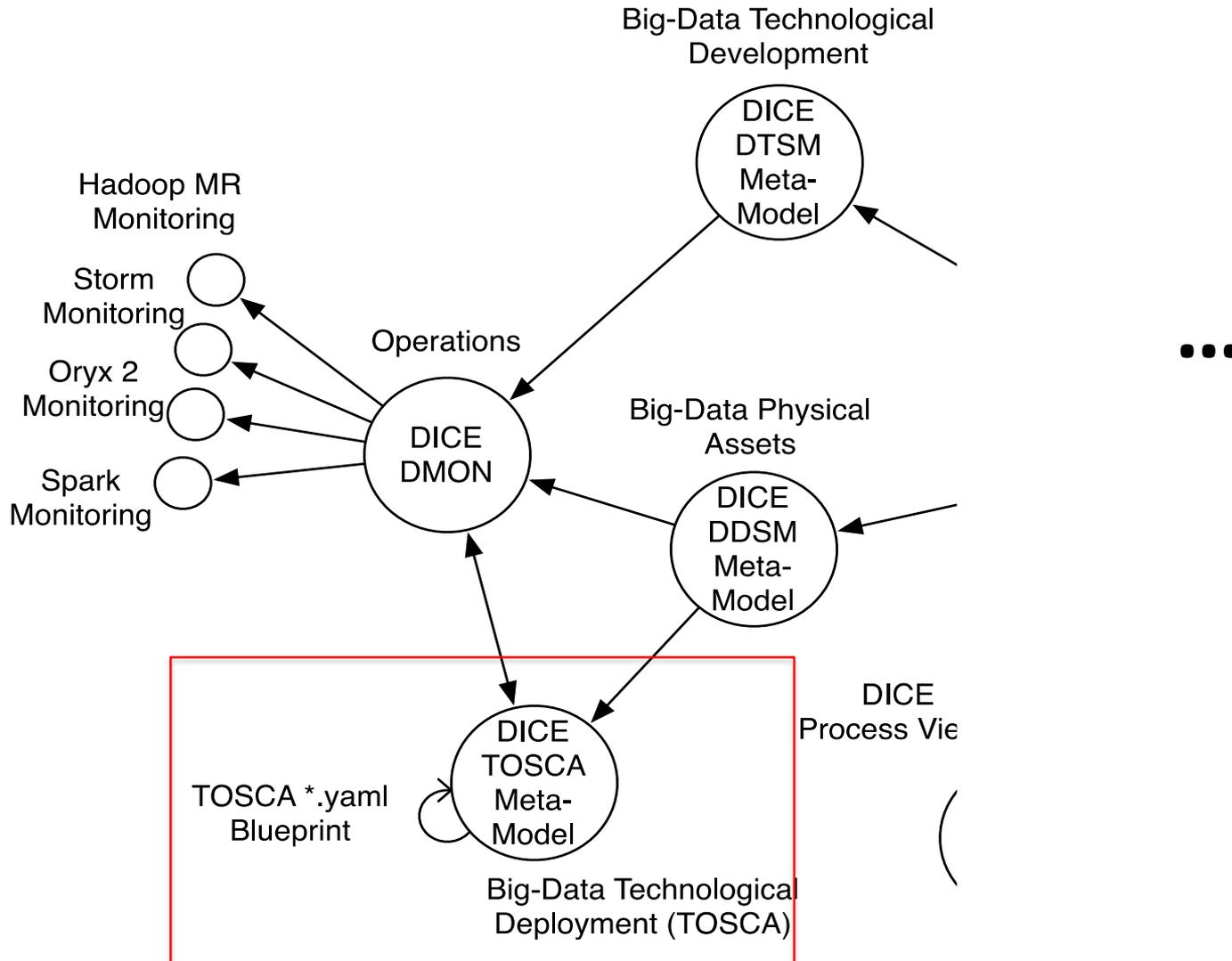
MODACloudsML4DICE



DICER M2T Tool

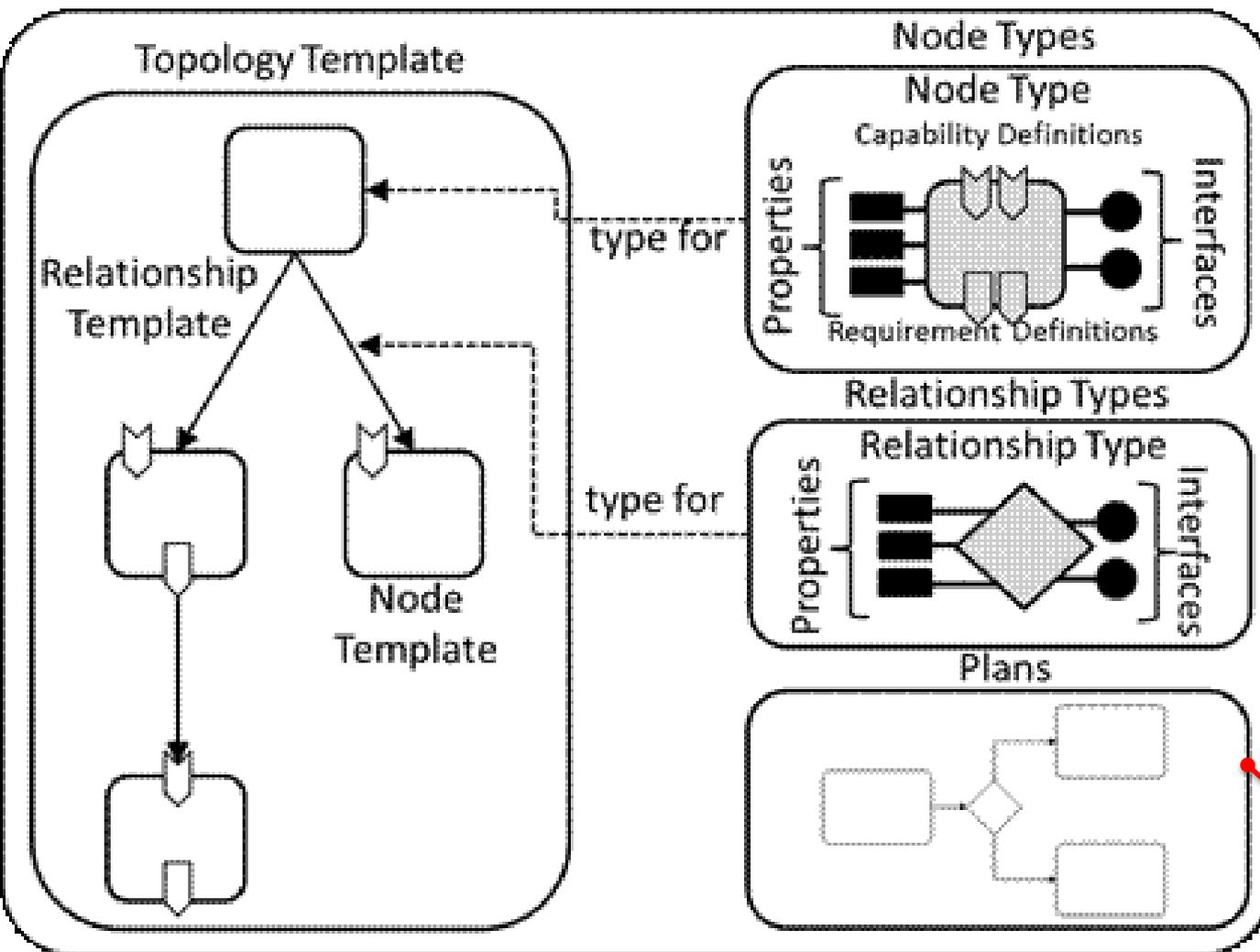


Where does this come from? DICE!





“Topology and Orchestration Specification for Cloud Applications”



1. OASIS Standard;
2. Cloud Infrastructure-as-code language;
1. Type-strength Intent modeling;
2. In DICE? Big-Data TOSCA “profile”;

Service template

DICE Meta-models – DDSM TOSCA

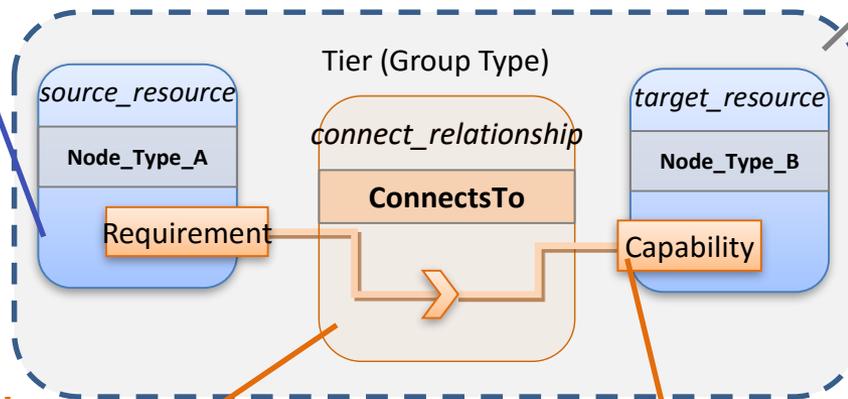


“TOSCA is used to describe the **deployment view** for cloud applications”

- ✓ **Node templates** to describe components in the topology structure
- ✓ **Relationship templates** to describe connections, dependencies, deployment ordering

Nodes - are the resources or components that will be materialized or consumed in the deployment topology

Groups
Create Logical, Management or Policy groups (1 or more nodes)



Relationships
express the dependencies between the nodes (not the traffic flow)

Requirement - Capability Relationships
Relationships can be customized to match specific source requirements to target capabilities

With M2M a TOSCA blueprint happens!

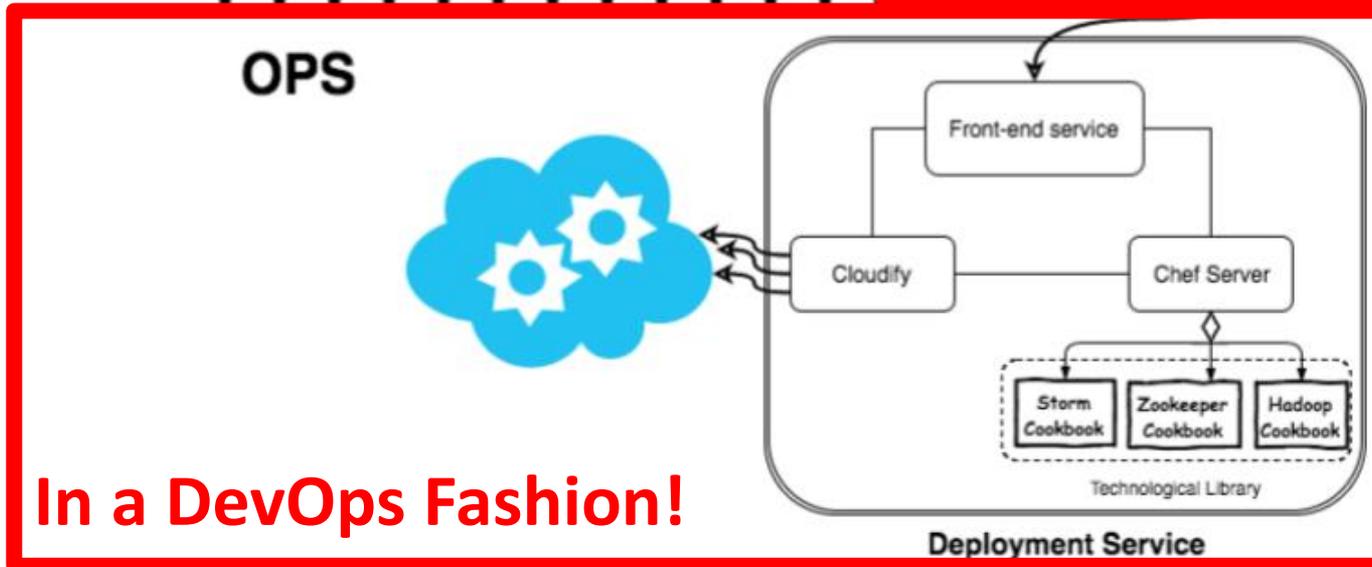
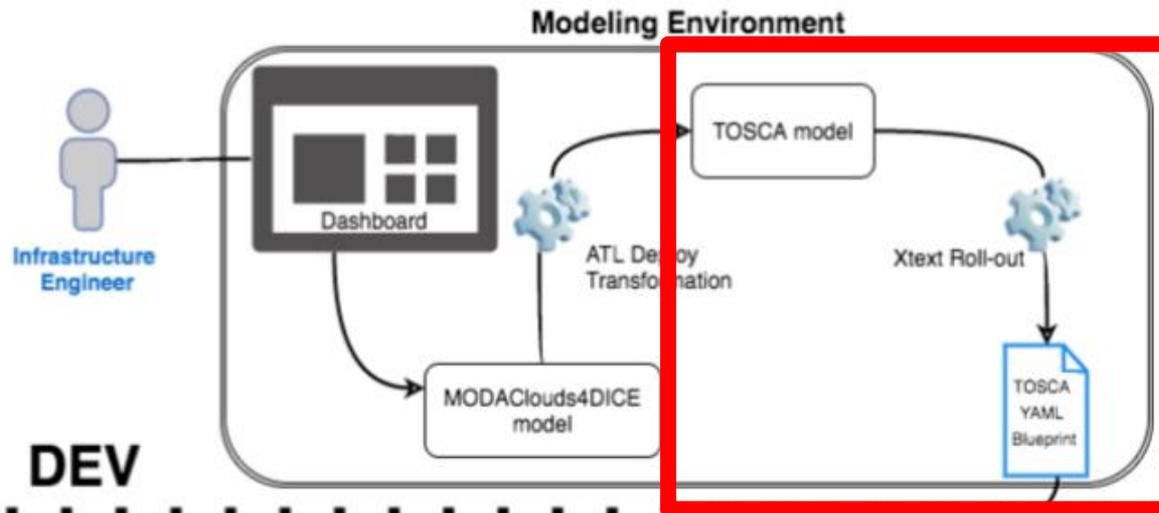


```
.....  
"storm_nimbus_host": {  
  "relationships": [  
    {  
      "type": "cloudify.openstack.server_connected_to_floating_ip",  
      "target": "storm_floating_ip"  
    },  
    {  
      "type": "cloudify.openstack.server_connected_to_security_group",  
      "target": "storm_security_group"  
    }  
  ],  
  "type": "dice.medium_host"  
},
```

```
"zookeeper": {  
  "relationships": [  
    {  
      "type": "cloudify.relationships.contained_in",  
      "target": "zookeeper_host",  
      "source_interfaces": {  
        "cloudify.interfaces.relationship_lifecycle": {  
          "preconfigure": "scripts/connect_zookeeper_servers.sh"  
        }  
      }  
    }  
  ]  
},
```

.....

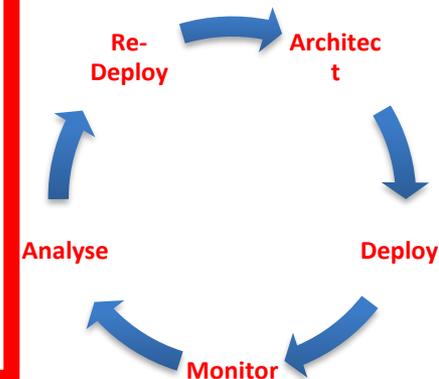
And after that... DevOps!



TOSCA!



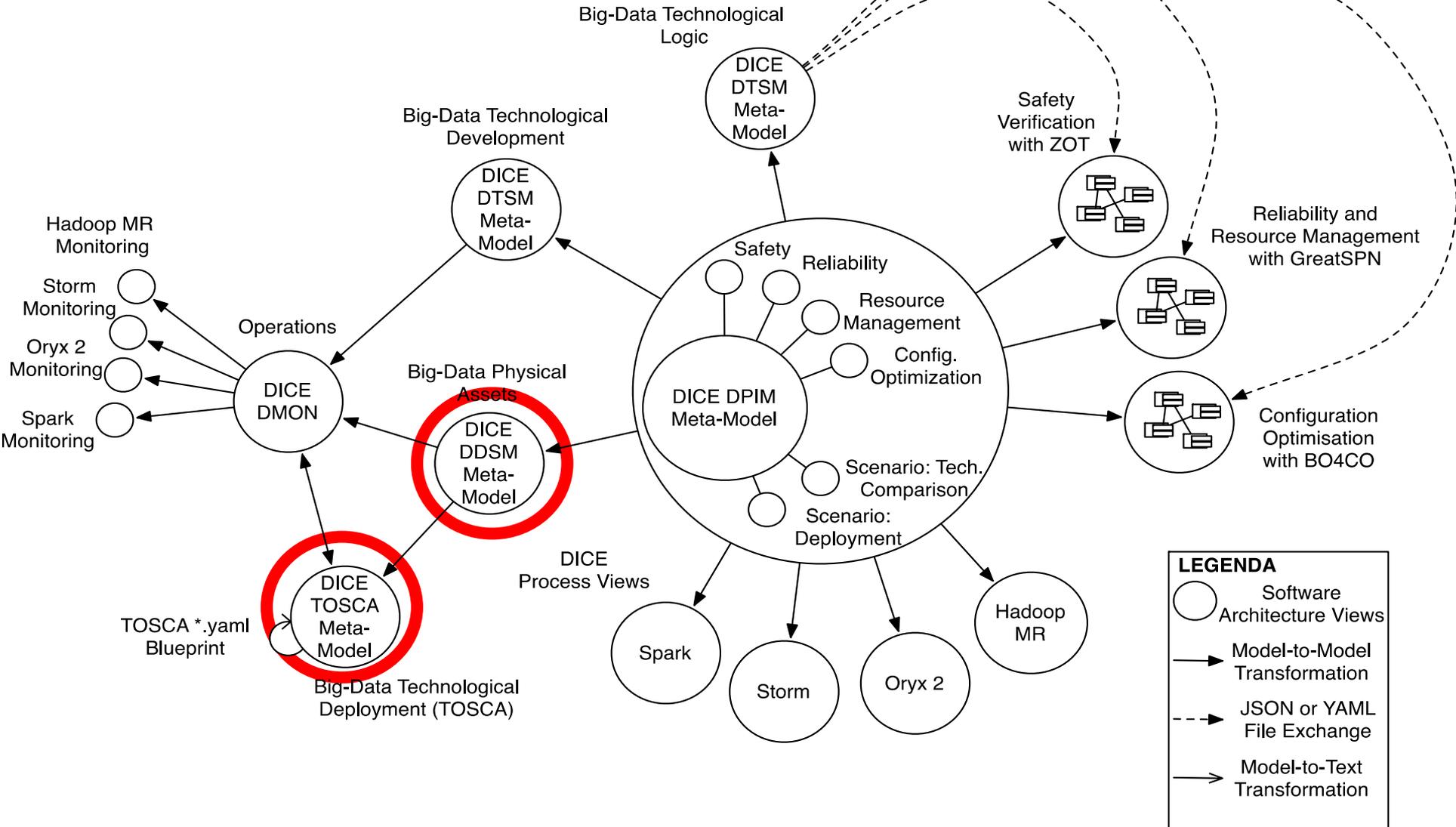
**TOSCA
Deployment!**





Back to basics... DICE Views and Tools!

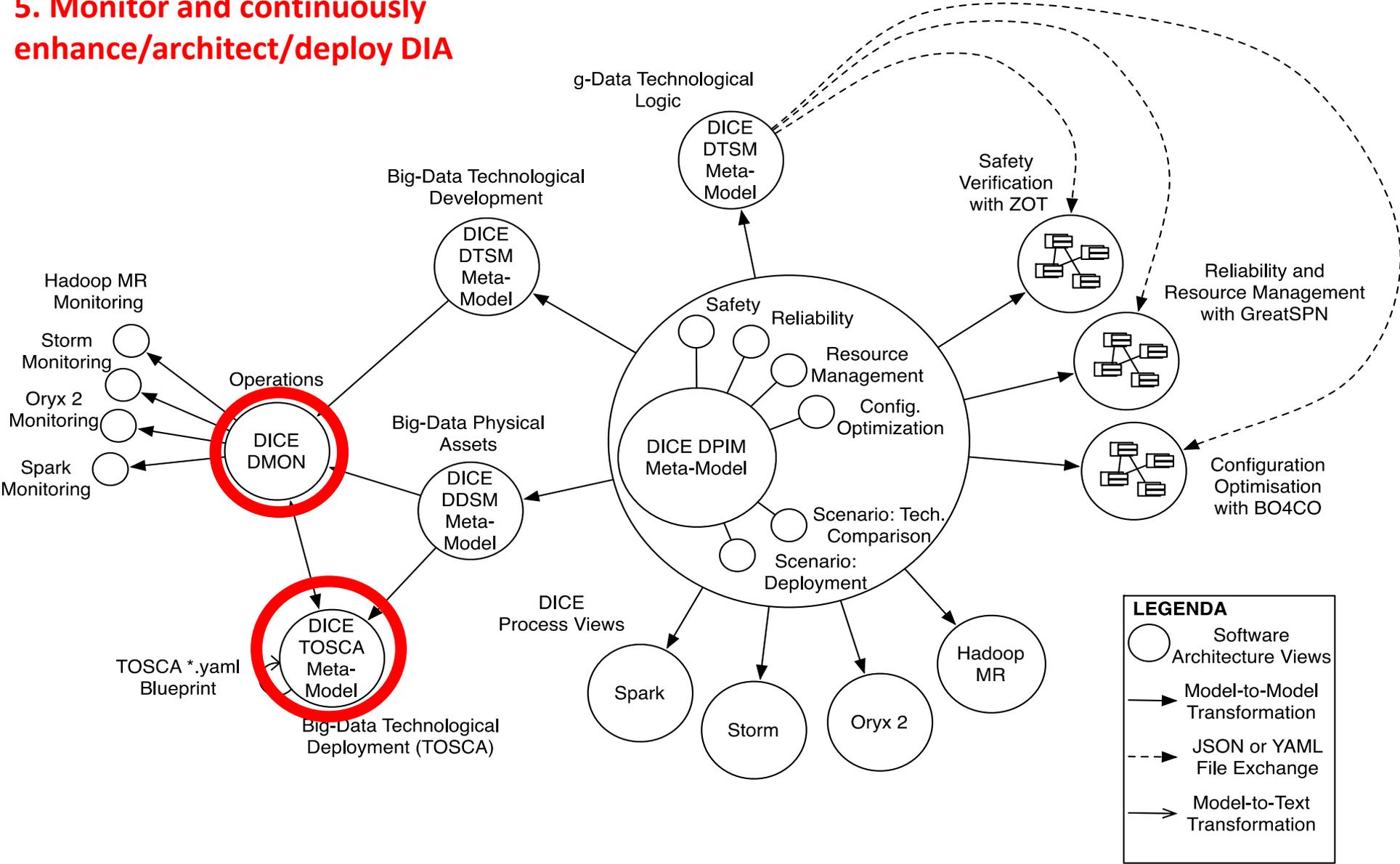
4. Deploy improved-by-verification architecture





Back to basics... DICE Views and Tools!

5. Monitor and continuously enhance/architect/deploy DIA





- **MDE+TOSCA = DevOps Synergy!**
- Big-Data and TOSCA are fit for each other...
 - **but technologies are not mature, yet!**

Bibliography



- [1] A. Rajbhoj, V. Kulkarni, and N. Bellarykar. Early experience with model-driven development of mapreduce based big data application. In Software Engineering Conference (APSEC), 2014 21st Asia-Pacific, volume 1, pages 94–97, Dec 2014.
- [2] S. Santurkar, A. Arora, and K. Chandrasekaran. Stormgen - a domain specific language to create ad-hoc storm topologies. In Computer Science and Information Systems (FedCSIS), 2014 Federated Conference on, pages 1621–1628, Sept 2014.
- [3] Abel Gómez, José Merseguer, Elisabetta Di Nitto, Damian A. Tamburri “Towards a UML Profile for Data Intensive Applications”, Proceedings of 2nd “Quality Aware DevOps” (QUDOS) workshop, to appear
- [4] Elisabetta Di Nitto, Pooyan Jamshidi, Michele Guerriero, Ilias Spais, Damian A. Tamburri “A Software Architecture Framework for Quality-Aware DevOps”, Proceedings of 2nd “Quality Aware DevOps” (QUDOS) workshop, to appear
- [5] Matej Artac̆, Tadej Borovšak, Elisabetta Di Nitto, Michele Guerriero, Damian A. Tamburri, “Model-Driven Continuous Deployment for Quality DevOps”, Proceedings of 2nd “Quality Aware DevOps” (QUDOS) workshop, to appear
- [6] Guerriero, Michele; Tajfar, Saeed; Tamburri, Damian A. & Di Nitto, Elisabetta (2016), “Towards a model-driven design tool for big data architectures.”, in 'BIGDSE@ICSE' , ACM, , pp. 37-43 .