

TOMORROW'S INNOVATION TODAY

Bayesian network-based framework for
large Agile project risk analysis

09 July 2019

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Big Compute (AIML)

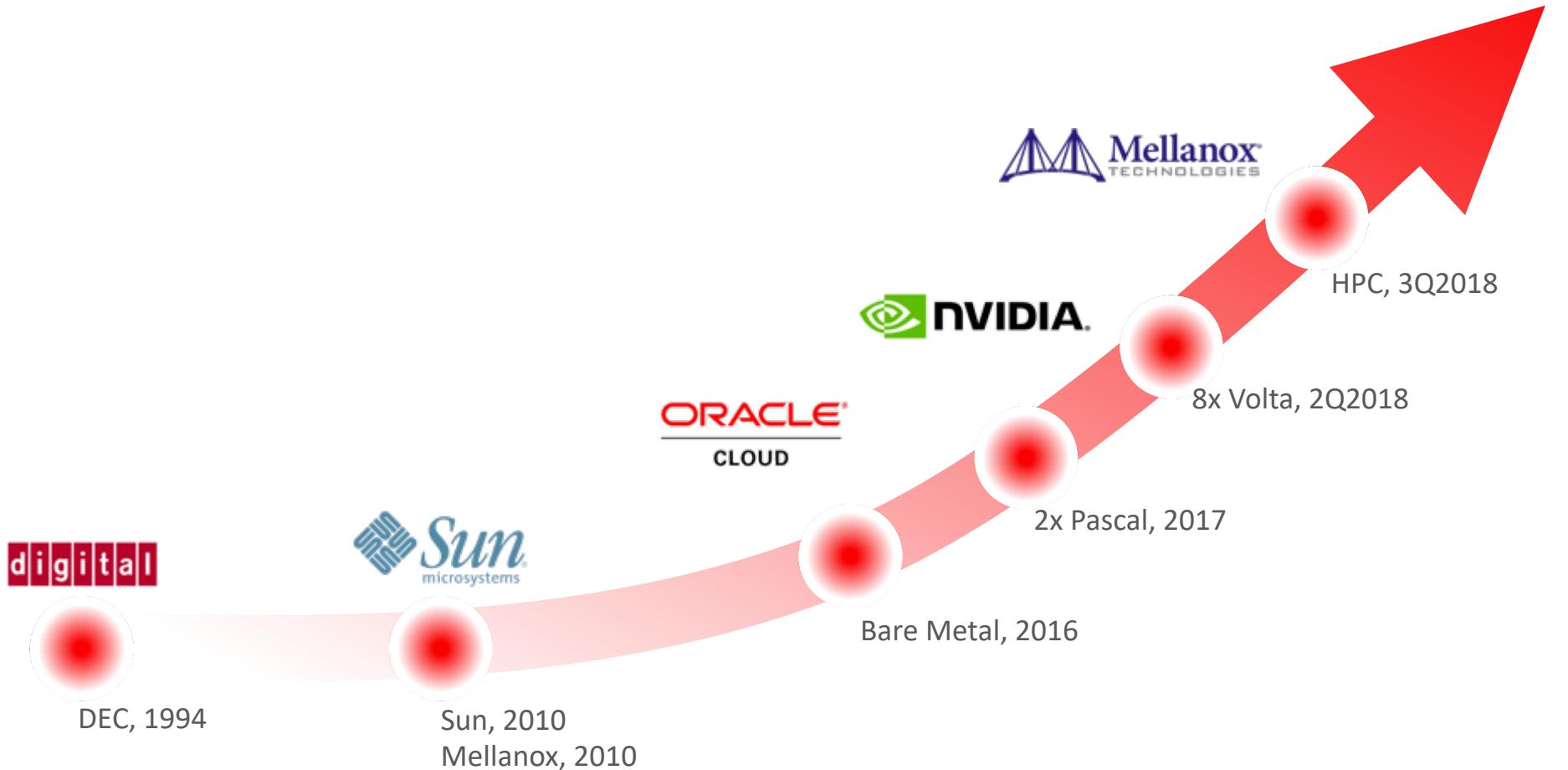
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Oracle HPC History



2nd Generation Cloud

Off-Box IO Virtualisation

Flat, Non-Blocking Network:
Eliminates “noisy neighbors”
Sub 100µsec latency

Bare Metal Instances

ORACLE®

True Enterprise Cloud

Built for the Enterprise:
Migrate applications “*as they are*”
Performance better than on-prem
Integrated control and visibility
True Enterprise SLA

Complete cloud infrastructure services

COMPUTE

Bare metal/VM, CPUs/GPUs



Up to 64 CPU cores, 8 GPUs, 768 GB RAM, 51 TB local NVMe SSD, 5M IOPS, AMD and Intel processors

STORAGE

NVMe, Block, File, Object, Archive



Predictable IOPS Block Storage for up to 98% less, storage for whole lifecycle

AUTONOMOUS DATABASE

Transactions, Data Warehouse



Fast provisioning. Automatic tuning, patching, securing. 99.995% availability.

SECURITY

IAM, Audit, KMS, CASB



Integrated security services to protect data and to control and monitor access

CONTAINERS

Containers and Kubernetes



Fully managed, certified Kubernetes service with Docker containers

NETWORKING

VCN, LBaaS, FastConnect, VPN



Isolated networks with reserved IPs, security lists, firewalls, lowest cost private connectivity

DATABASE

Bare metal, VMs, Exadata



Millions of TPS; Full RAC and Active Data Guard support

EDGE

DNS, WAF, DDoS, Email



Global DNS, application protection, bot management, DDoS protection, email delivery

Migration

Migrate VMs



Move VM environments, retaining existing networking, to the cloud

OCI AT CUSTOMER

IaaS, PaaS, Exadata on-premises



Subscription-priced cloud infrastructure, PaaS, and database managed by Oracle

DATA MOVEMENT

Storage appliance, Data Transfer



Software NAS gateway, data ingest service with full chain of custody (HDD or appliance)

GOVERNANCE

IAM, Tagging, Cost Management



Logical separation and tagging of resources for simplified management

OCI differentiators: Embrace Open Source & Multi cloud

Leadership role in Open Source communities



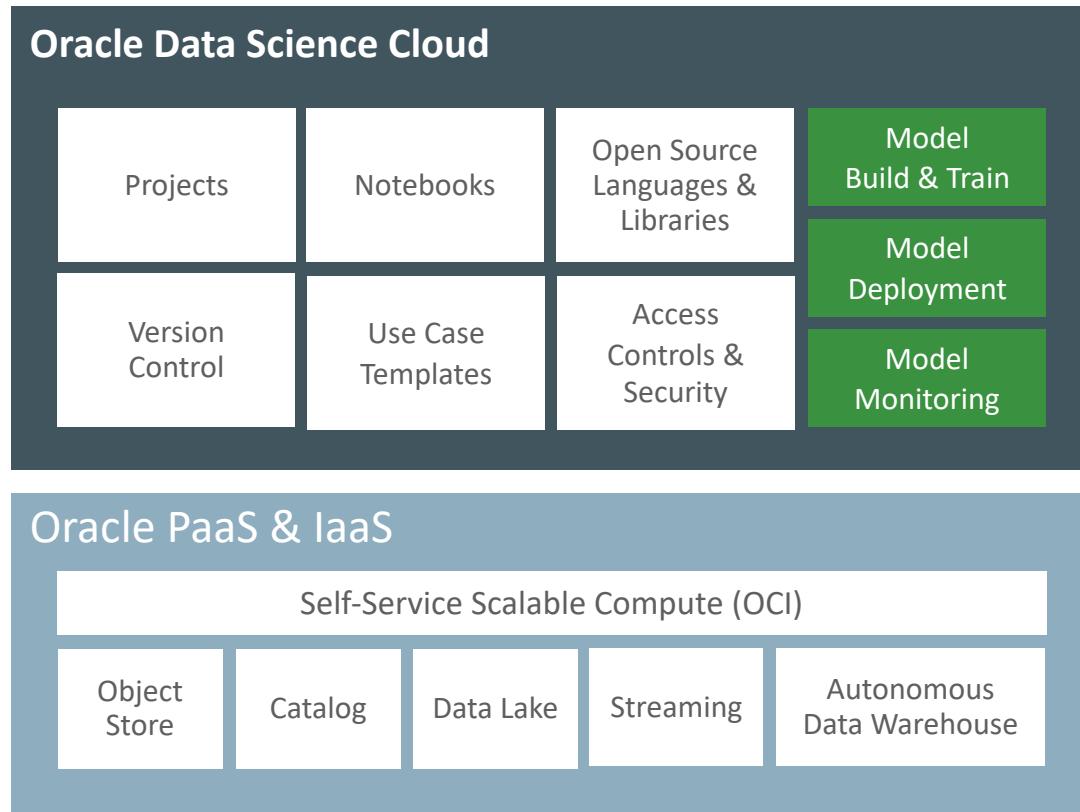
Bringing Open Source software to OCI platform



Contributing back to Open Source software



Oracle Data Science Cloud Key Components & Benefits



Core Benefits:

Collaborative

- Project driven UI enables teams to easily work together on end-to-end modeling workflows with self-service access to data and resources

Integrated

- Support for latest open source tools, version control, and tight integration with OCI and Oracle Big Data Platform

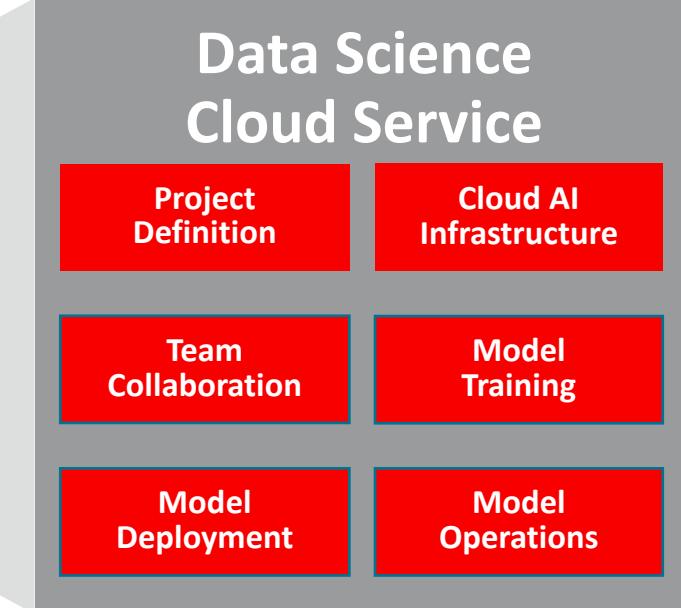
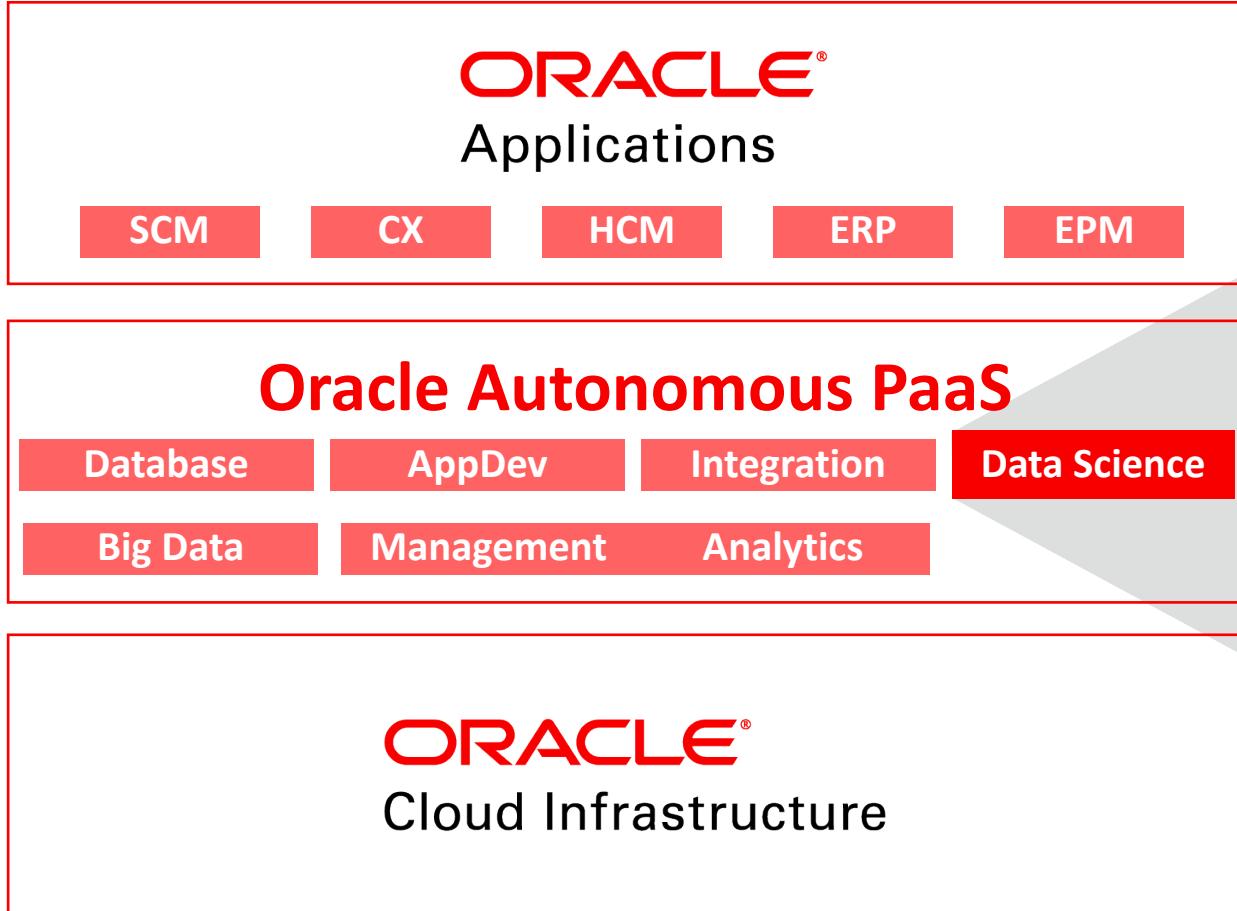
Enterprise-Grade

- A fully managed platform built to meet the needs of the modern enterprise

Oracle Data Science Cloud Enables an End-to-End Machine Learning Platform

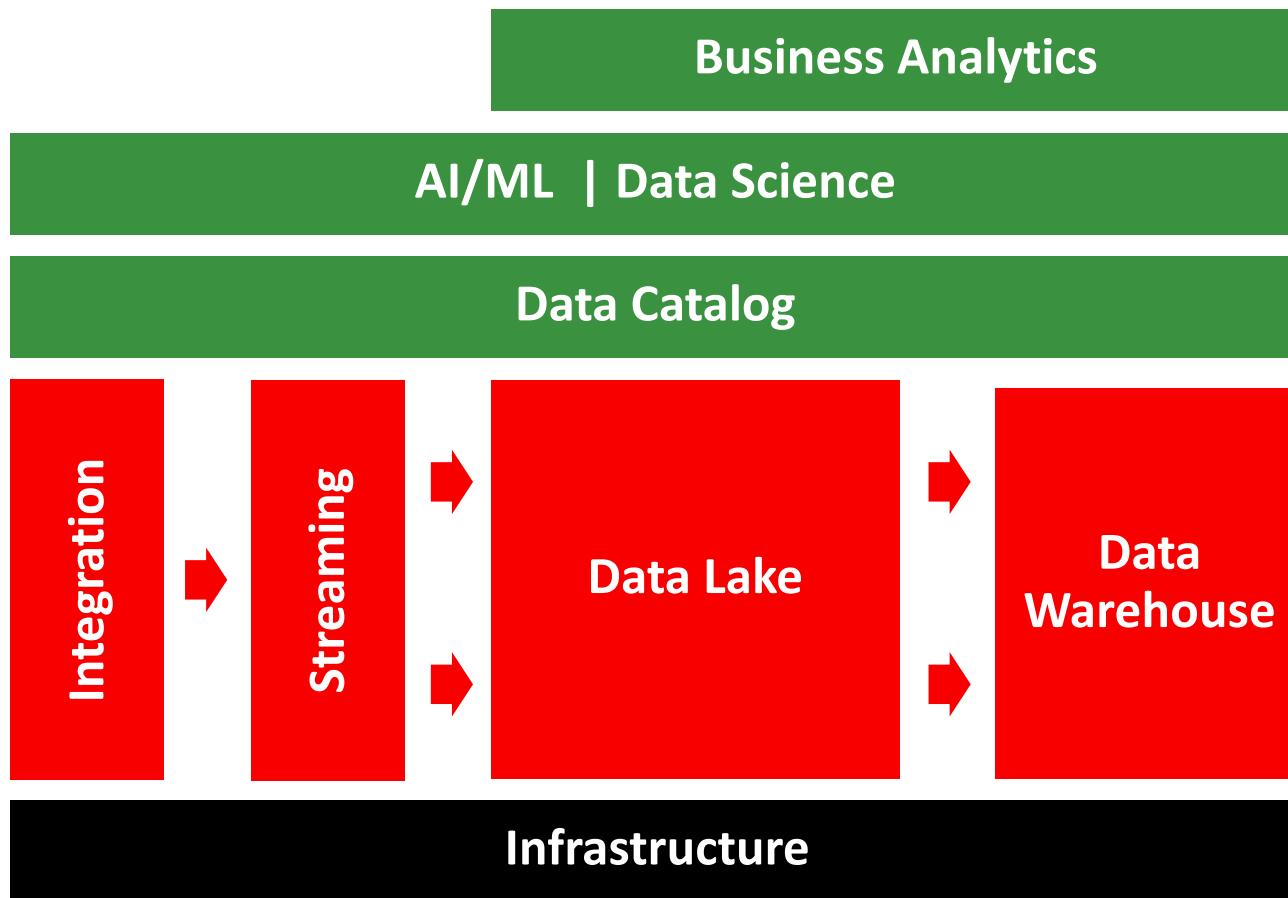


DATASCIENCE.COM



Summary: Oracle Autonomous Big Data Platform Strategy

Modern, Open and Intelligent



- Modern, Cloud Native
 - Self Healing, Self Patching, Self Securing, Elastic, Hybrid
- Open
 - Built on Open Source - Spark, Kafka, Docker, Kubernetes, Python ...
- Intelligent
 - Accelerating Business Analytics and Data Science

Agenda

Learning Objectives

Introduction

Literature review

Bayesian Networks Modeling

A prototype of risk assessment model

Conclusions

Slides Courtesy: Dr. Subhro Mitra and Neelov Kar

Learning Objectives

- Understand framework to identify risk and calculate risk probability
- Bayesian network approach

Slides Courtesy: Dr. Subhro Mitra and Neelov Kar

Introduction

- Project managers are responsible for successful delivery of their projects
 - Maximize the probability and impact of positive events on projects
 - Minimize the probability and impact of negative events on projects
- All projects have uncertainty
- Project Risk Management seeks to explore uncertainty: anticipate and deal with it

“An uncertain event or condition that, if it occurs, has a positive or negative effect on one or more a project’s objectives such as scope, schedule, cost and quality.”

Slides Courtesy: Dr. Subhro Mitra and Neelov Kar

Trends and Emerging Practices

- **Non-event Risks**
 - Variability Risk
 - Ambiguity Risk
- **Project Resilience (Emerging Risk)**
 - Unknowable-unknowns
 - Right level of budget and schedule contingency
 - Flexible project processes
 - Frequent review of early warnings
- **Integrated Risk Management**
 - Organizational context

Slides Courtesy: Dr. Subhro Mitra and Neelov Kar

Risk Categories

- **PESTLE – Political, Economic, Social, Technology, Legal, Environment**
- **TECOP– Technology, Environment, Commercial, Operational, Political**
- **VUCA – Volatility, Uncertainty, Complexity, Ambiguity**

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Project Risks

- **Scope**
 - Missing requirements
 - New technology/ technology failure
 - Lack of Information
 - Politics and culture
- **Schedule**
 - Dependencies, Critical Path
 - Time estimates and project size
 - Delays with sign-offs and approvals
 - Third-party involvement
- **Resources**
 - Estimated labor cost
 - Team motivation
 - Resource availability and efficiency
 - Hidden Costs

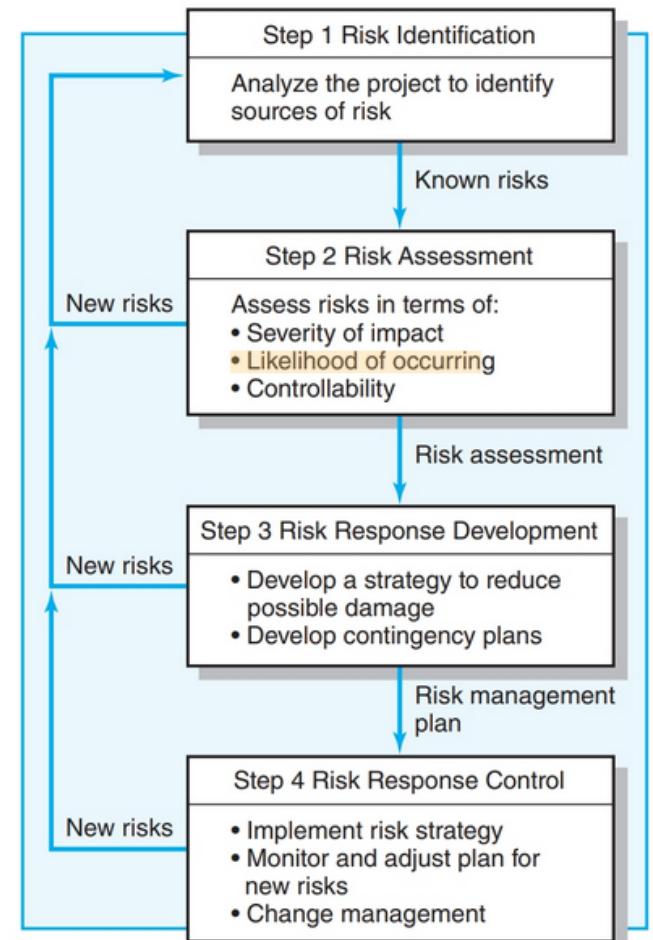
Slides Courtesy: Dr. Subhro Mitra and Neelov Kar

Risk Management Planning

- Create a plan for handling risk management for a particular project
- Adapt policies and procedures for risk to the needs of a particular project
- Tailor risk management activities to the needs of the project to make sure level, type, and visibility of what is done is equal with:
 - The nature of the project
 - The experience of the project team
 - The perceived level of project risk
 - The importance of the project to the organization

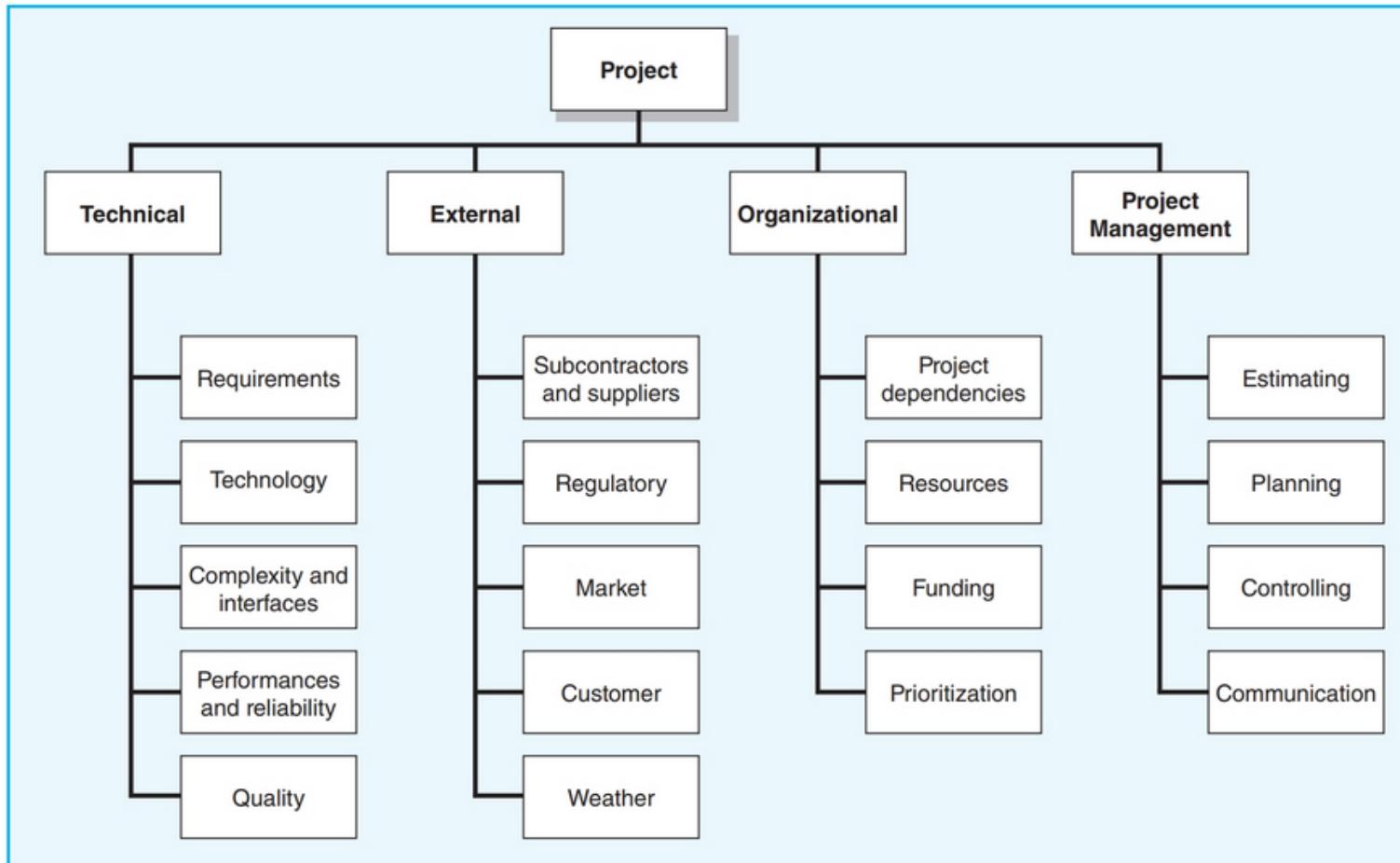
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The Risk Management Process



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The Risk Breakdown Structure (RBS)



Slides Courtesy: Dr. Subhro Mitra and Neelov Kar

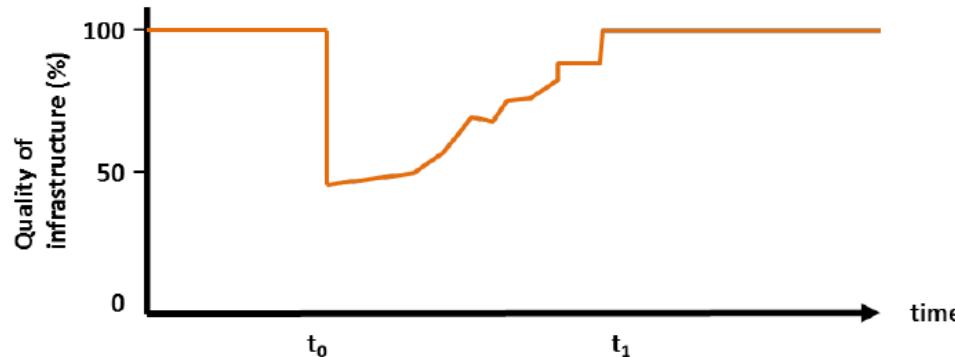
Risk Assessment Form

Risk Event	Likelihood	Impact	Detection Difficulty	When
Interface problems	4	4	4	Conversion
System freezing	2	5	5	Start-up
User backlash	4	3	3	Postinstallation
Hardware malfunctioning	1	5	5	Installation

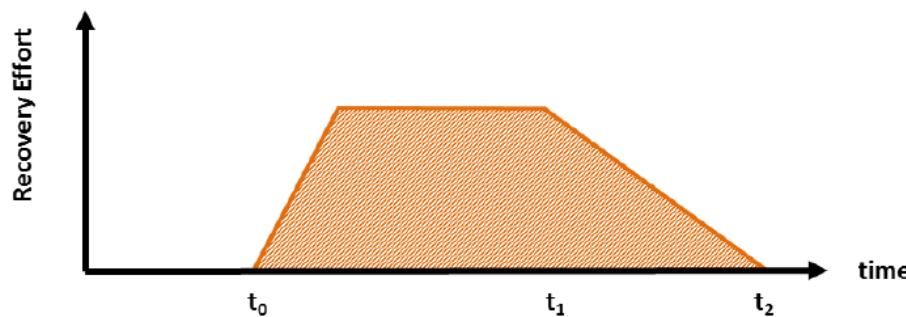
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What is resilience?

Conceptually the measure of resilience over time from a single event (at t_0) and the restoration of '100%' level of service (at t_1).



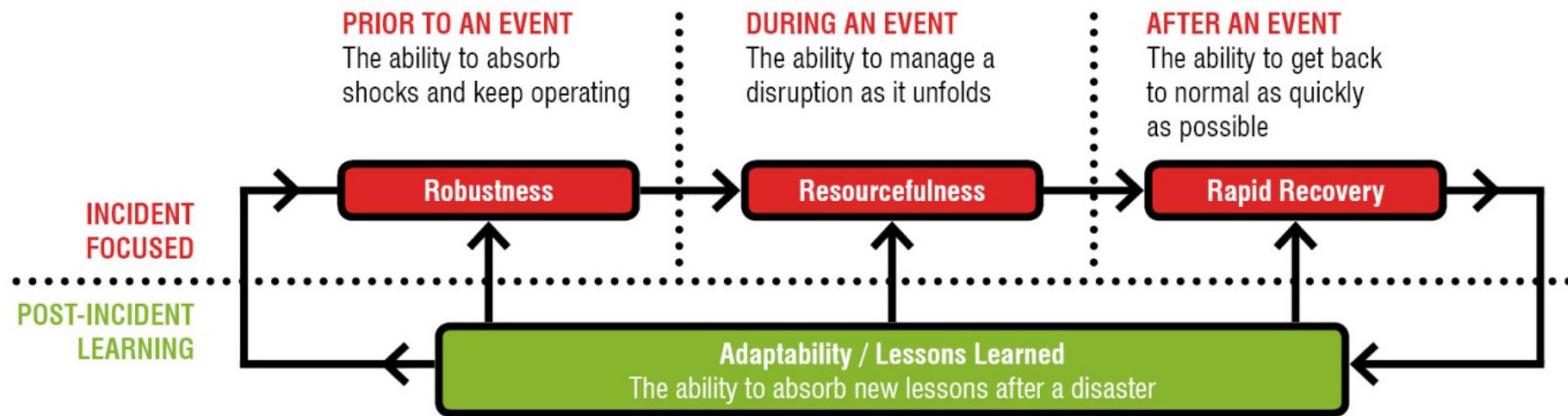
Conceptual measure 1 of resilience



Conceptual measure 2 of resilience (recovery effort)

Slides Courtesy: Dr. Subhro Mitra and Neelov Kar

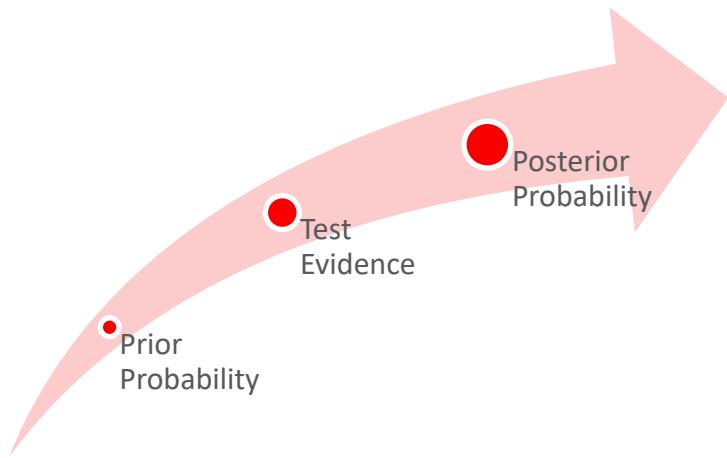
Resilience principles in sequence



Slides Courtesy: Dr. Subhro Mitra and Neelov Kar

Bayesian Approach:

use Bayes' rule to compute a new density for θ given data



$$p(\theta | data) = \frac{p(\theta) p(data | \theta)}{\int p(\theta) p(data | \theta) d\theta}$$

$$\propto p(\theta) p(data | \theta)$$

Slides Courtesy: Dr. Subhro Mitra and Neelov Kar

Bayesian Networks

A Bayesian network specifies a joint distribution in a structured form

Represent dependence/independence via a directed graph

- Nodes = random variables
- Edges = direct dependence

Structure of the graph \Leftrightarrow Conditional independence relations

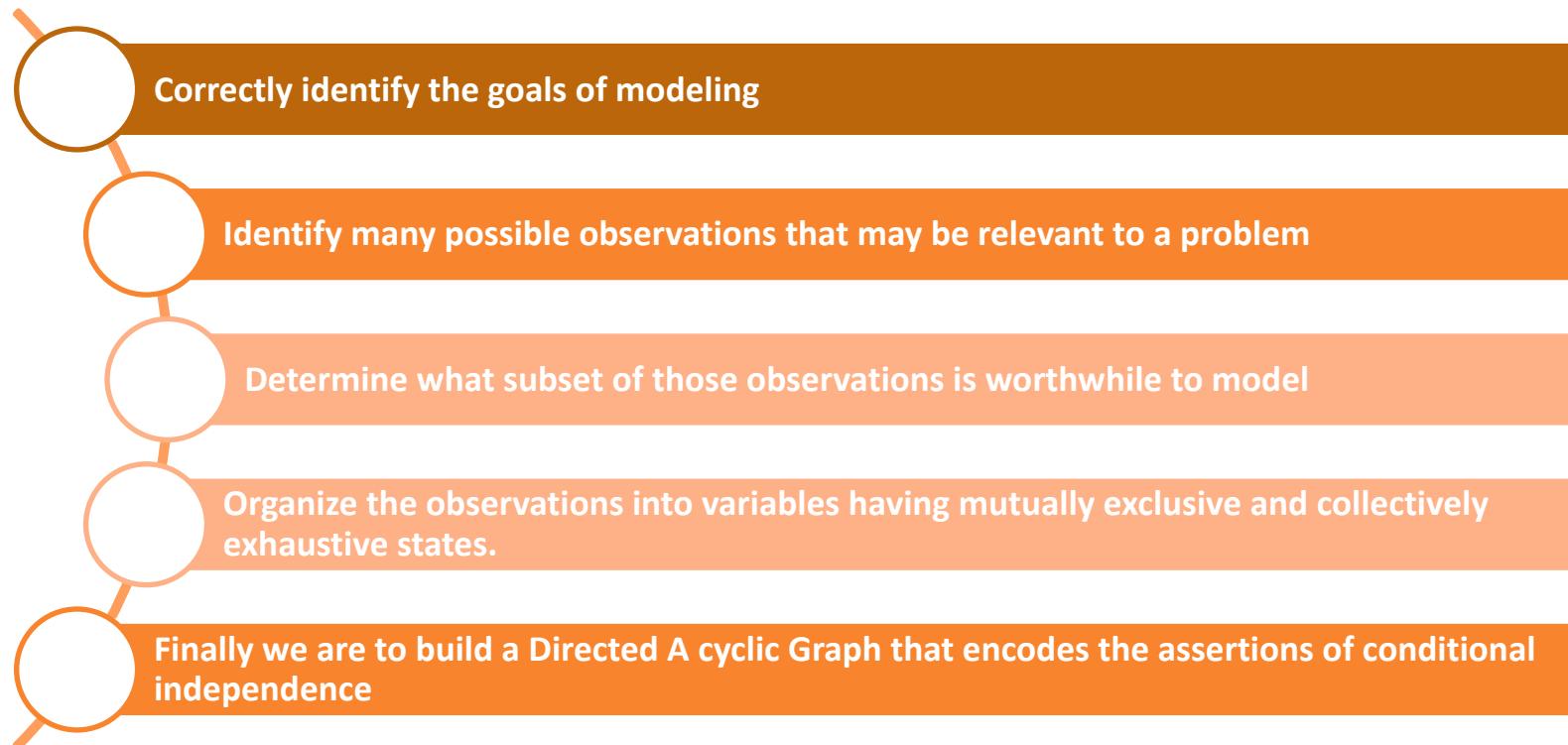
Requires that graph is acyclic (no directed cycles)

Two components to a Bayesian network

- The graph structure (conditional independence assumptions)
- The numerical probabilities (for each variable given its parents)

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Tasks



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Bayesian Belief Network

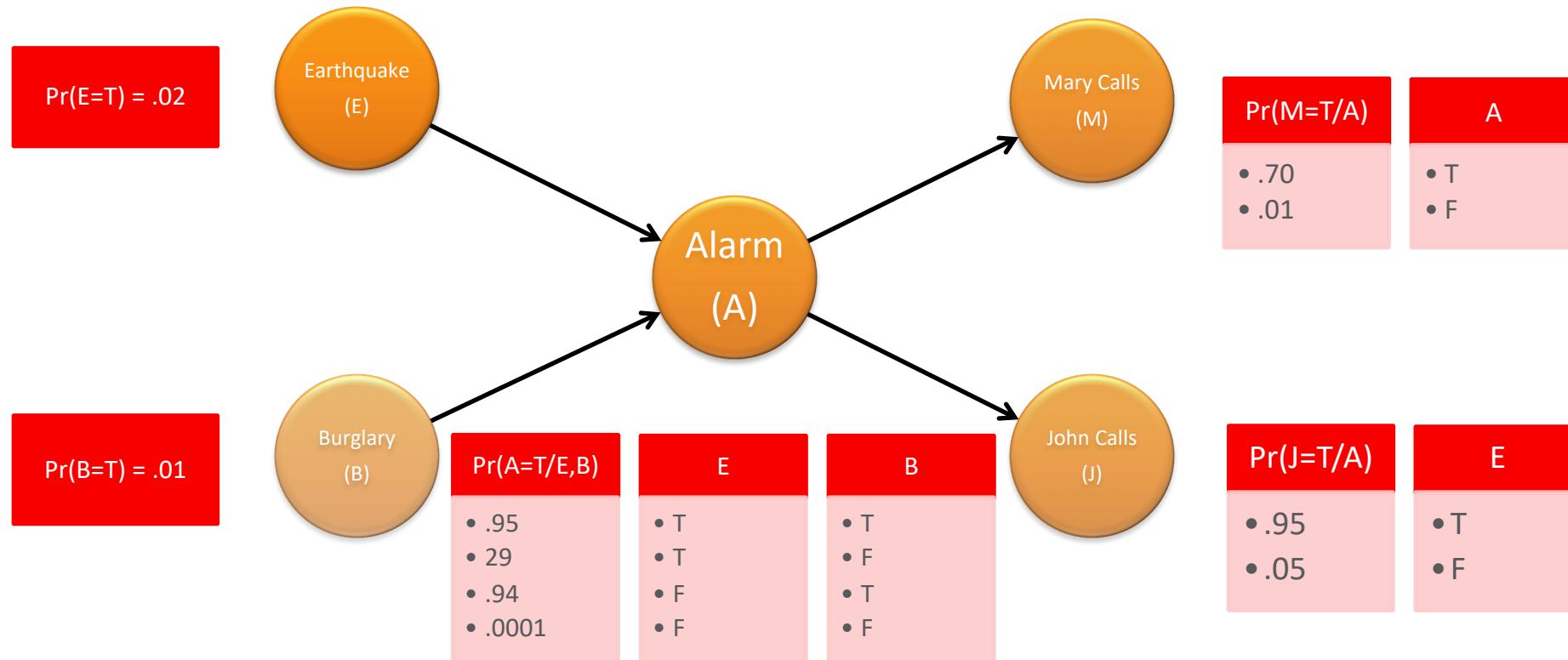
I'm at work, neighbor John calls to say my alarm is ringing, but neighbor Mary doesn't call. Sometimes it's set off by minor earthquakes. Is there a burglar?

Variables: *Burglar*, *Earthquake*, *Alarm*, *JohnCalls*, *MaryCalls*
Network topology reflects "causal" knowledge:

- ▶ A burglar can set the alarm off
- ▶ An earthquake can set the alarm off
- ▶ The alarm can cause Mary to call
- ▶ The alarm can cause John to call

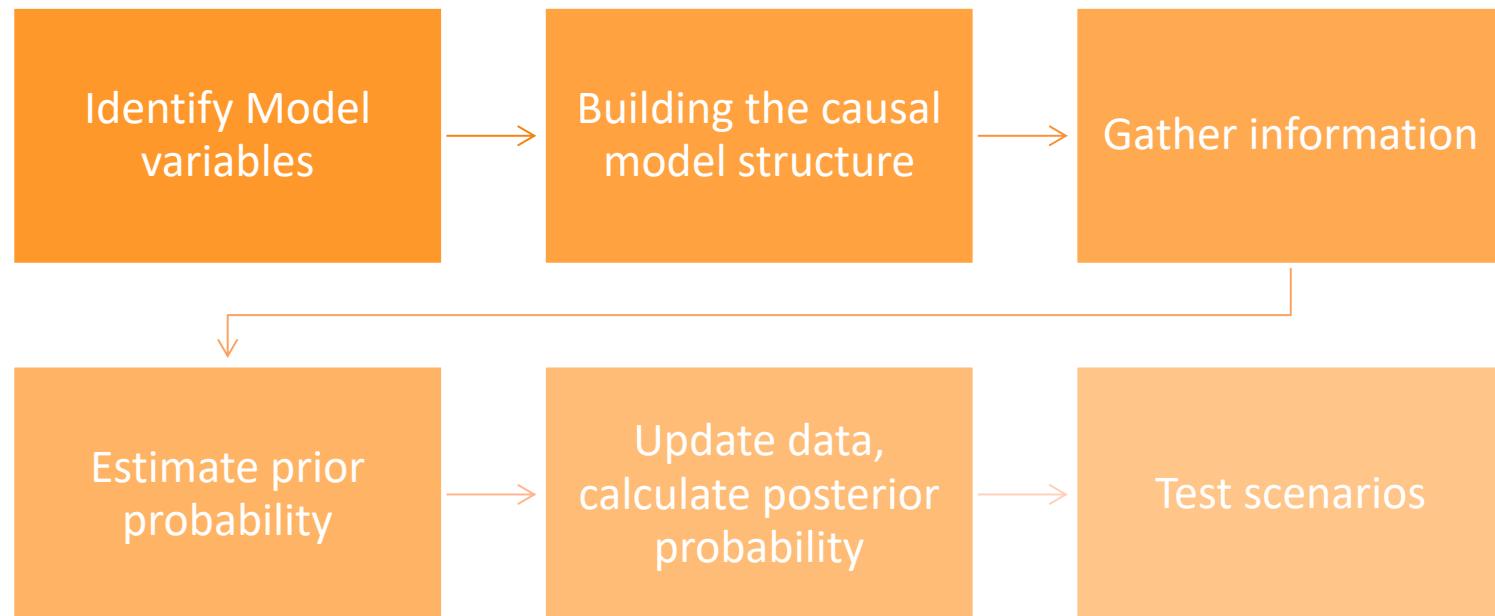
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BAYESIAN NETWORKS



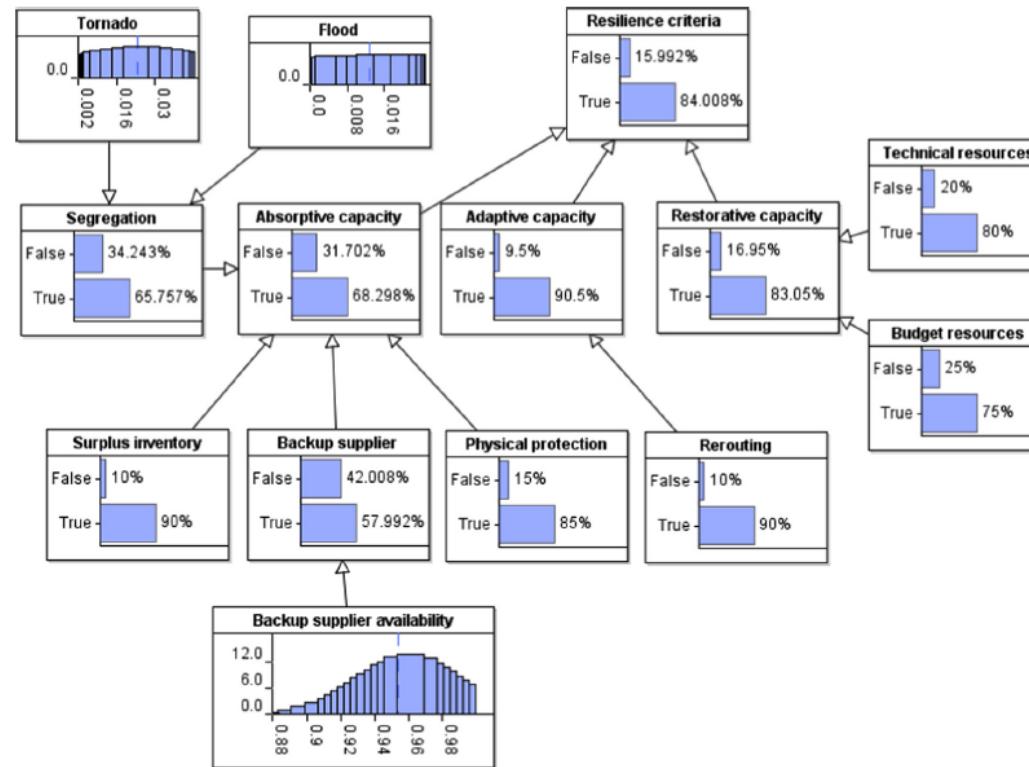
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Proposed BN for supplier risk estimation

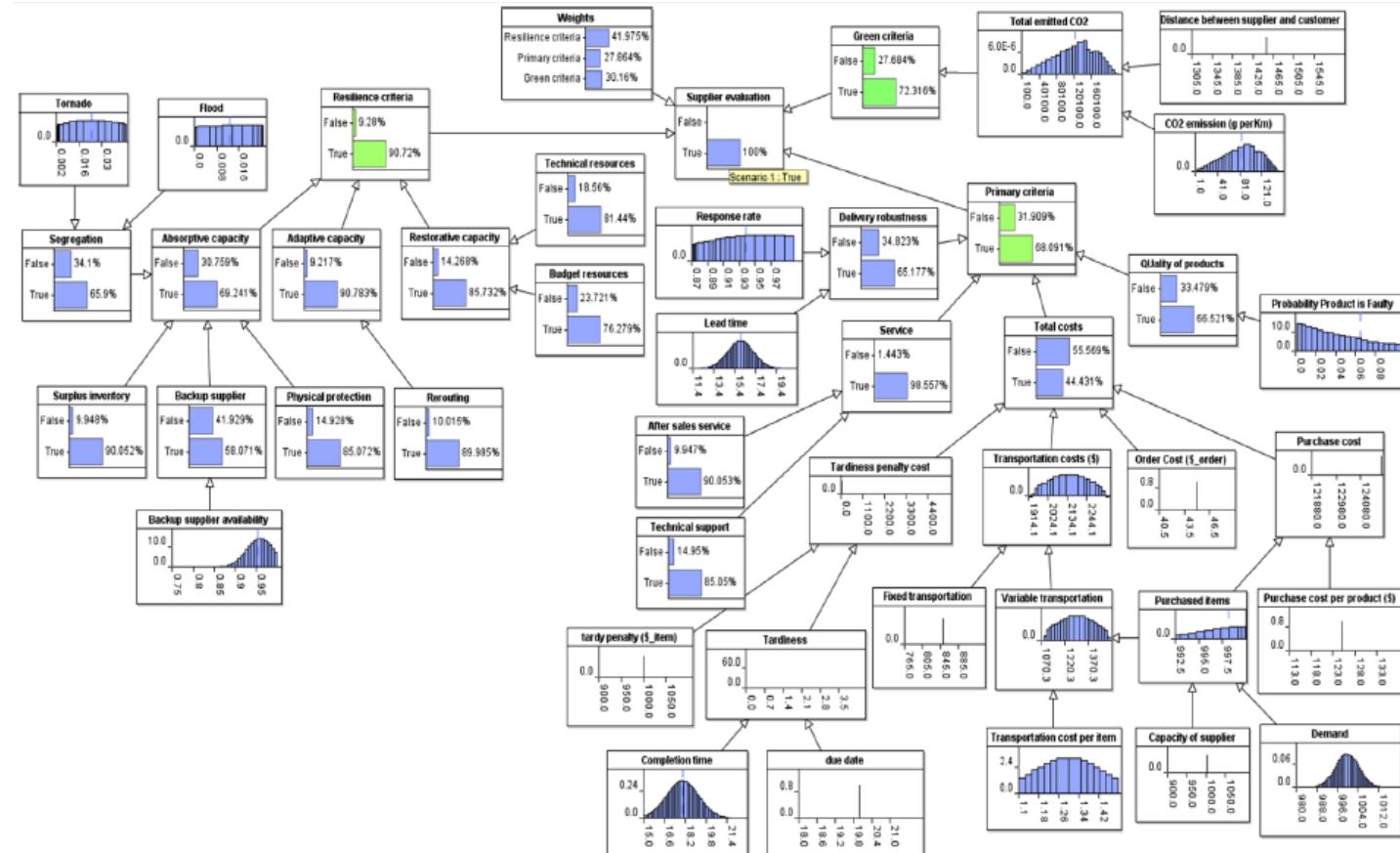


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BN model for Suppliers resilience criteria

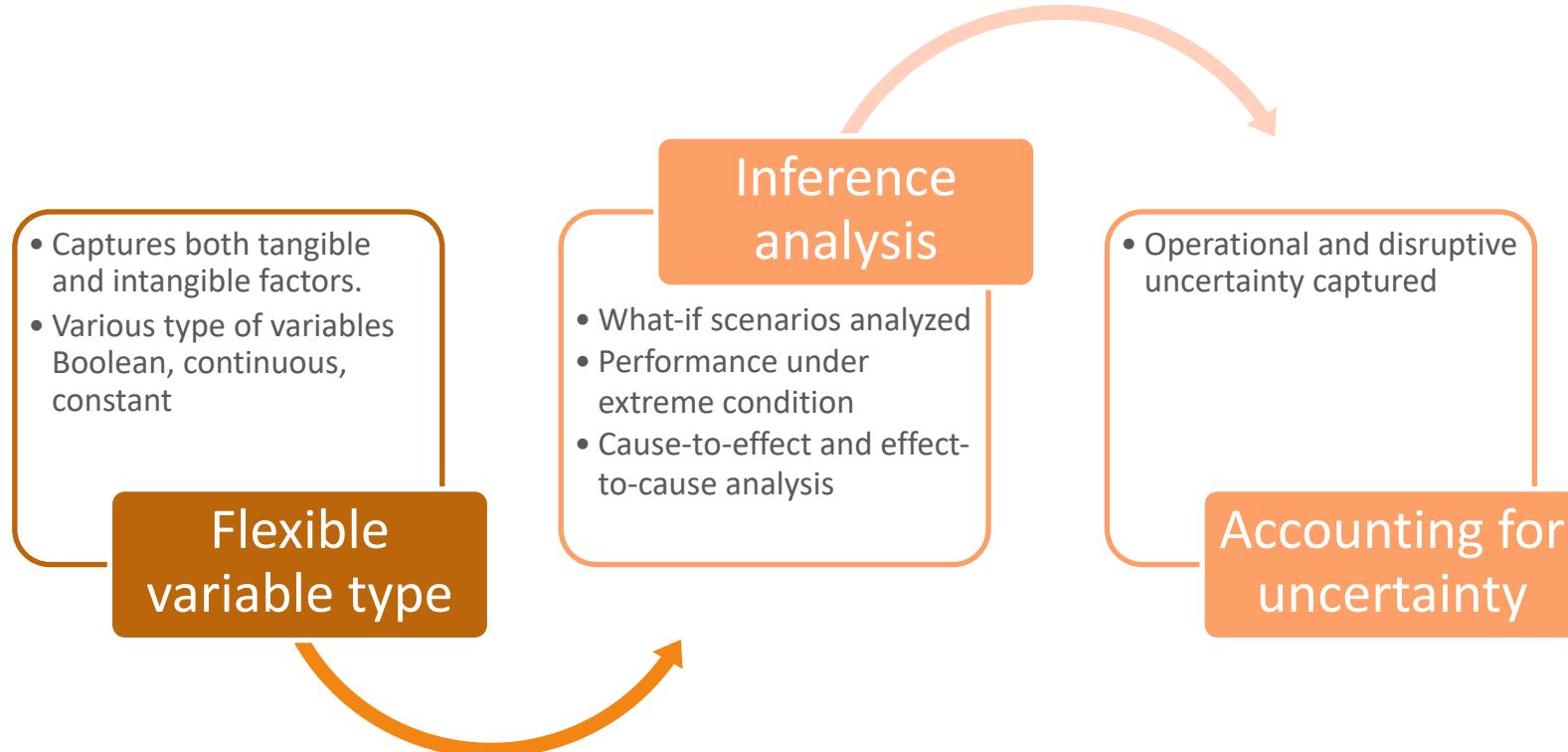


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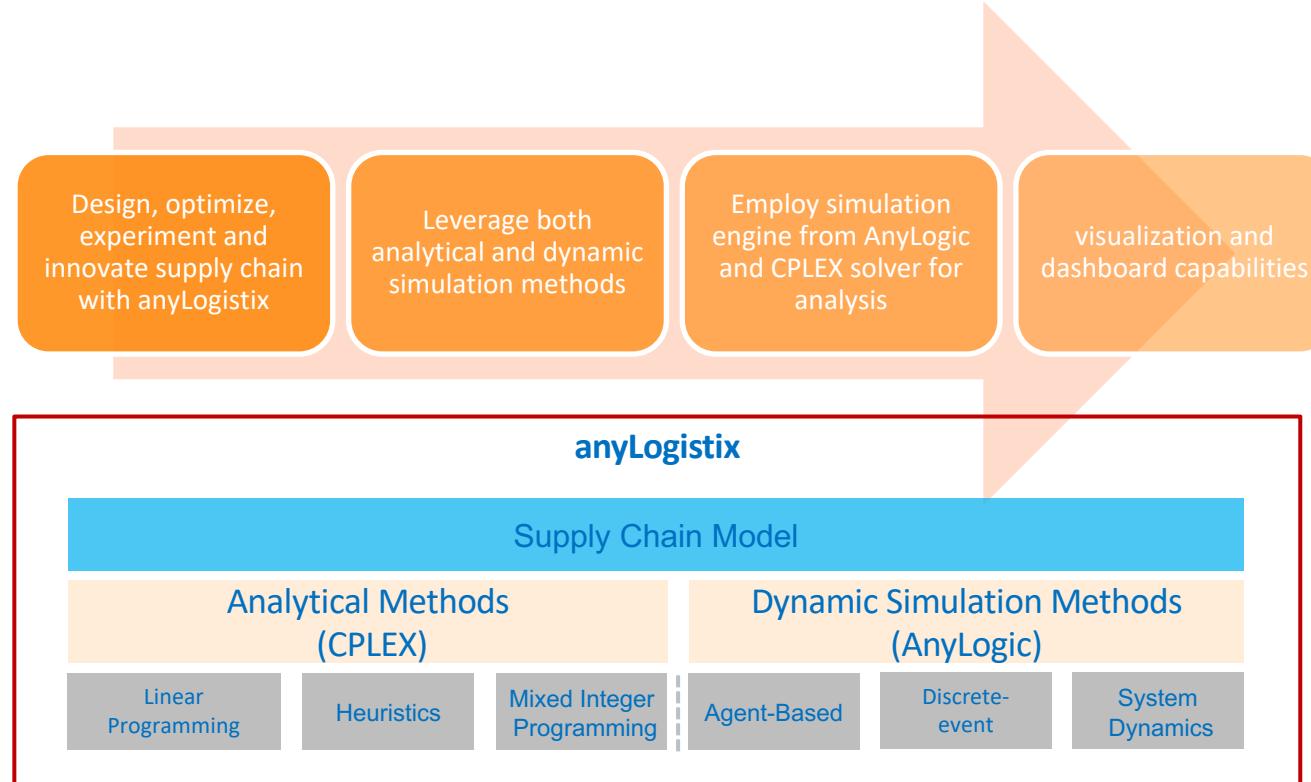
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Benefits of BN formulation



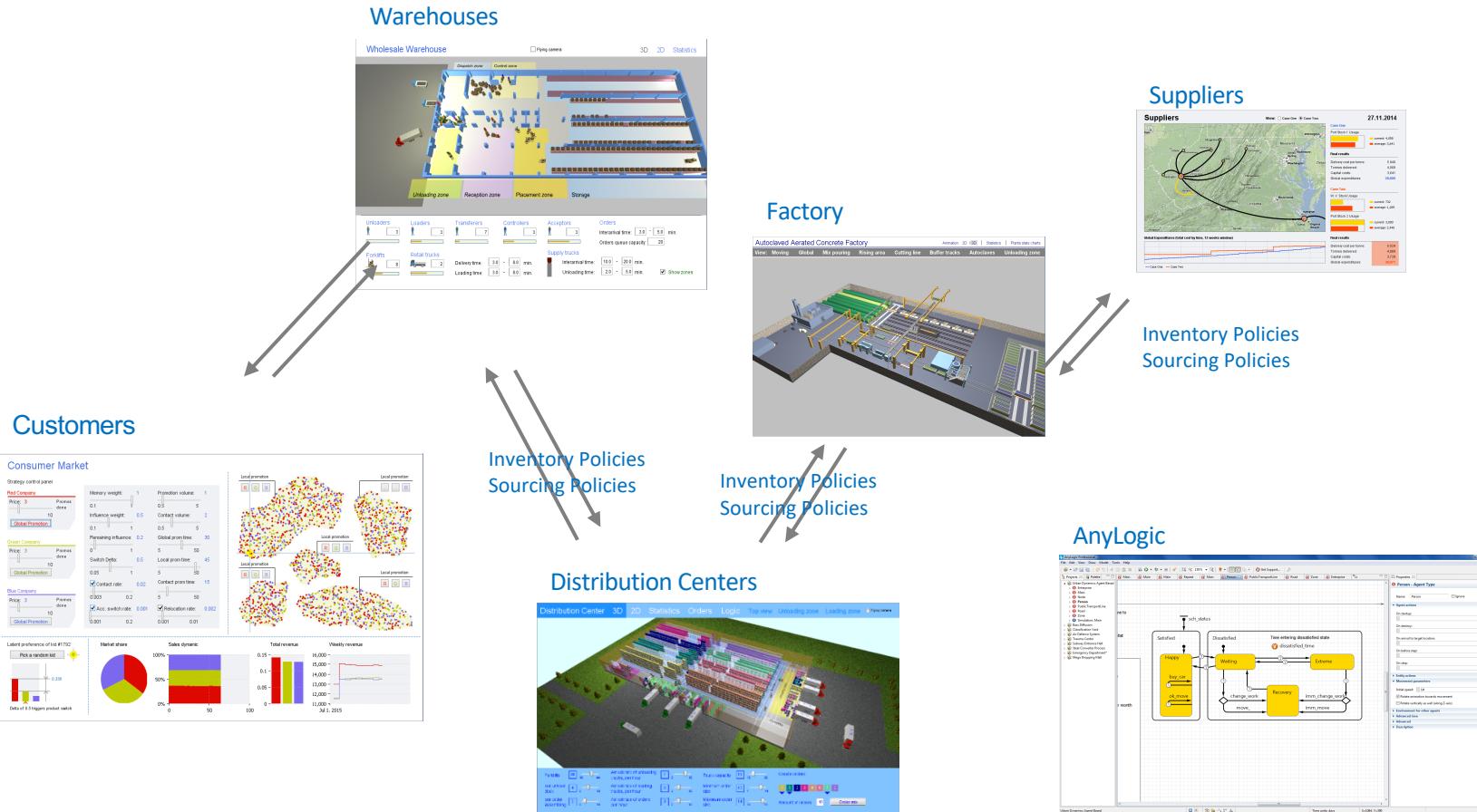
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anyLogistix – Supply Chain Analytics Tool



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anyLogistix Simulation Modeling Capabilities



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