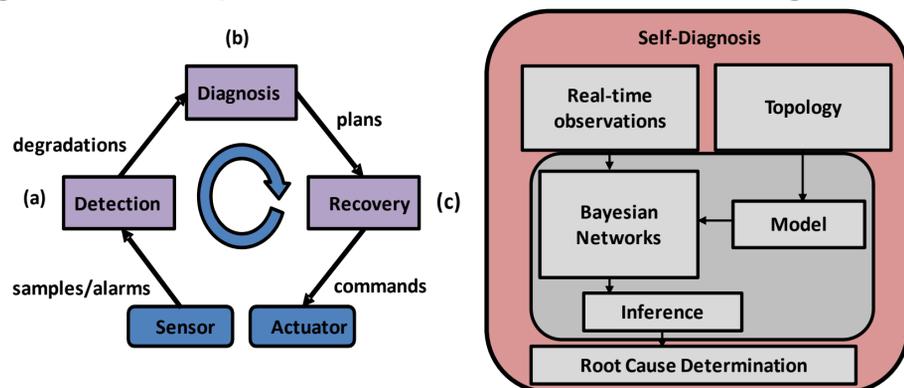


# Self-Healing Mechanisms for SDN

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## What is Self-Healing?

- Autonomic mechanism that recovers the network from abnormal states (i.e. degraded or broken states)
- Implemented as a control loop composed of detection, diagnosis and recovery blocks
- Algorithms: Bayesian Networks for network diagnosis



## What is SDN?

- SDN (Software-Defined Networking) is a network architecture that:
  - separates the control plane from the data plane/forwarding plane
  - centralizes the intelligence in the control plane
  - allows a programmable control of the network through APIs

## Why does SDN need Self-Healing?

The centralization of the intelligence on SDN jeopardizes the controller, that needs self-healing capabilities to ensure Autonomic Fault Management. Despite this, Fault Management on SDN is not sufficiently investigated and most healing solutions are based on OpenFlow-based mechanisms, leaving out the detection and diagnosis parts. Self-healing will bring SDN automation to Fault Management processes.

## General Framework

- We propose to enrich SDN architectures with a generic self-healing module
- Self-Healing brings resiliency to SDN in:
  - any service/application on the application plane (1)
  - any service on the control plane (2)
  - the controller: software or hardware causes (2)
  - the controller links towards the data plane (2)
  - elements of the data plane (3)

## Results

We test a video streaming service over an centralized in-band SDN architecture, where we embed a Self-healing module in the control plane to perform the aforementioned three blocks (a), (b) and (c):

- Detection of alarms from the network. Three levels of alarms:
  - Service-related alarms: problems on the application plane
  - Transport-related alarms: problems on the control plane protocols
  - Physical-related alarms: physical failures on equipment
- Calculation of the root cause based on Bayesian Networks
  - Model-based algorithm to model uncertainty and complex dependencies of network equipment
  - Extraction of the dependencies from the network topology
- Suggestions of actions according to the diagnosed root cause

