Towards Robust Trust in Software Defined Networks

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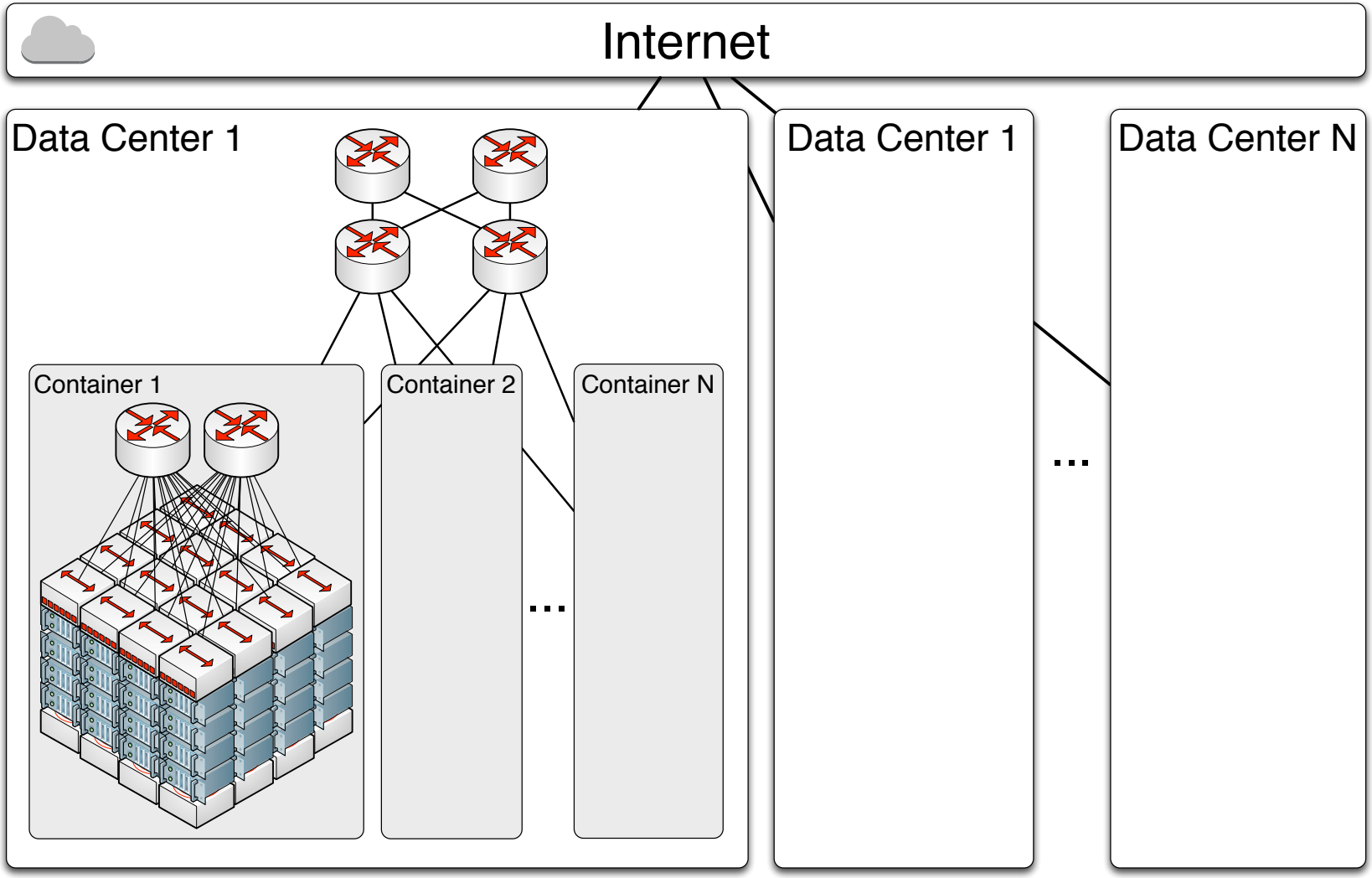
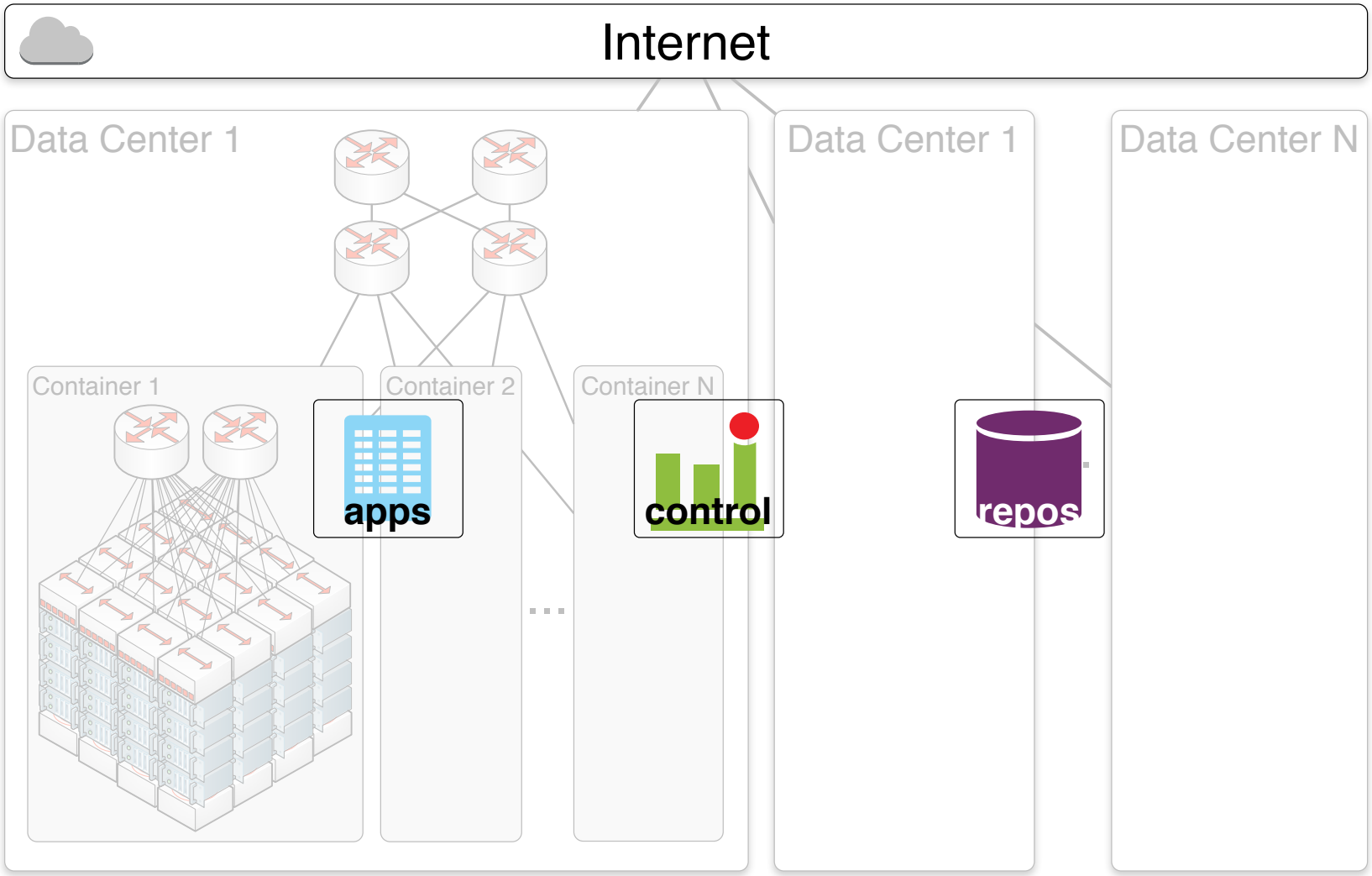
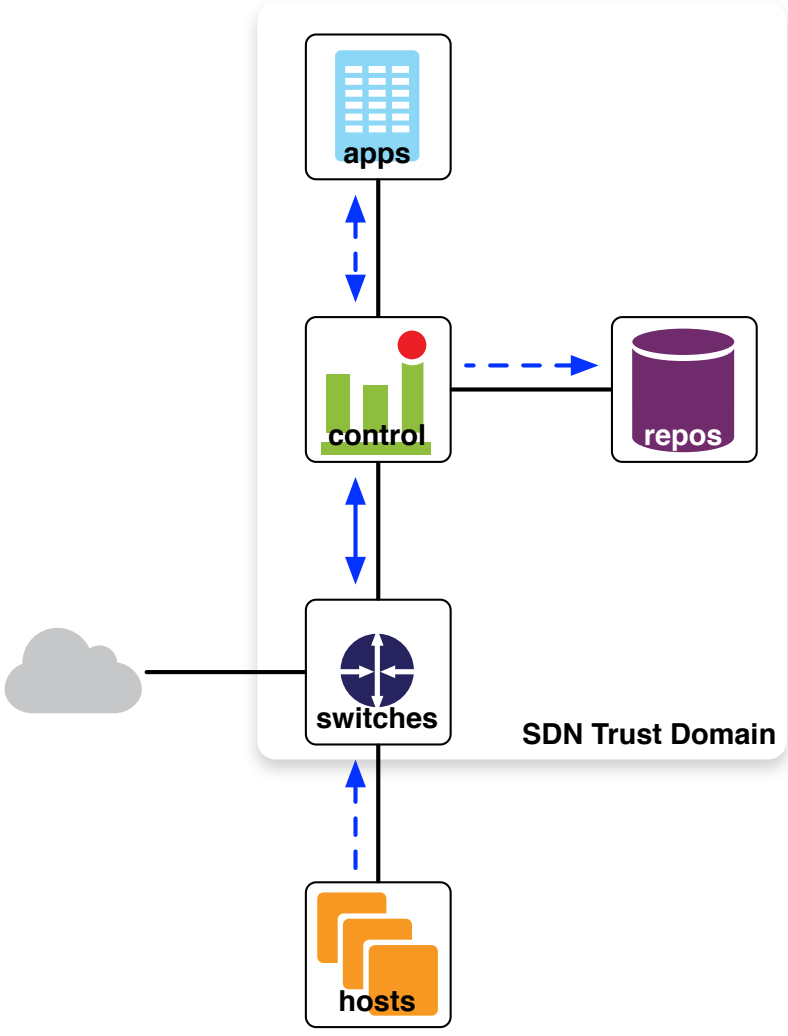
Networks in the Bad Old Days



The Brave New World!



Brave New Implications

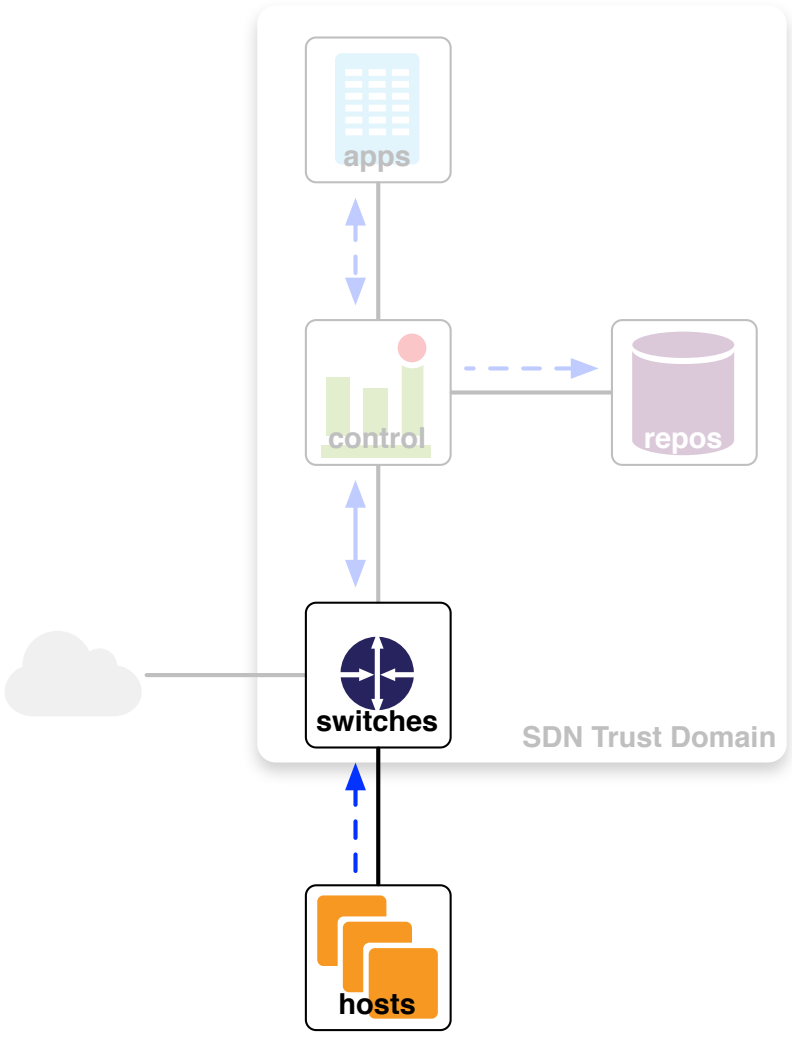


Unintended Results of SDN

Moving to centralized management has profound implications.

- Trust loci provides greater spoofing opportunities
- Smaller number of involved systems refines target space
- Trust concentration leads to larger attack surface
- Single compromise can have outsized effects

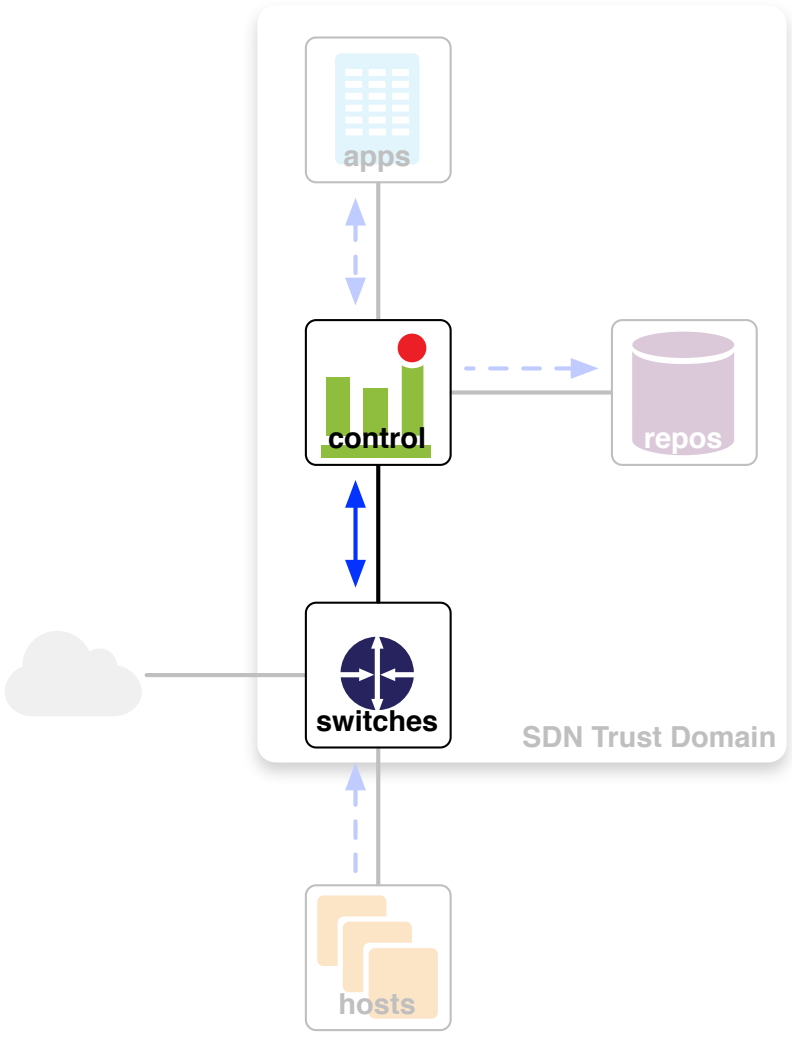
host $\Longleftrightarrow$ switch



(In the following slides, red is very important, orange less so, and green even less).

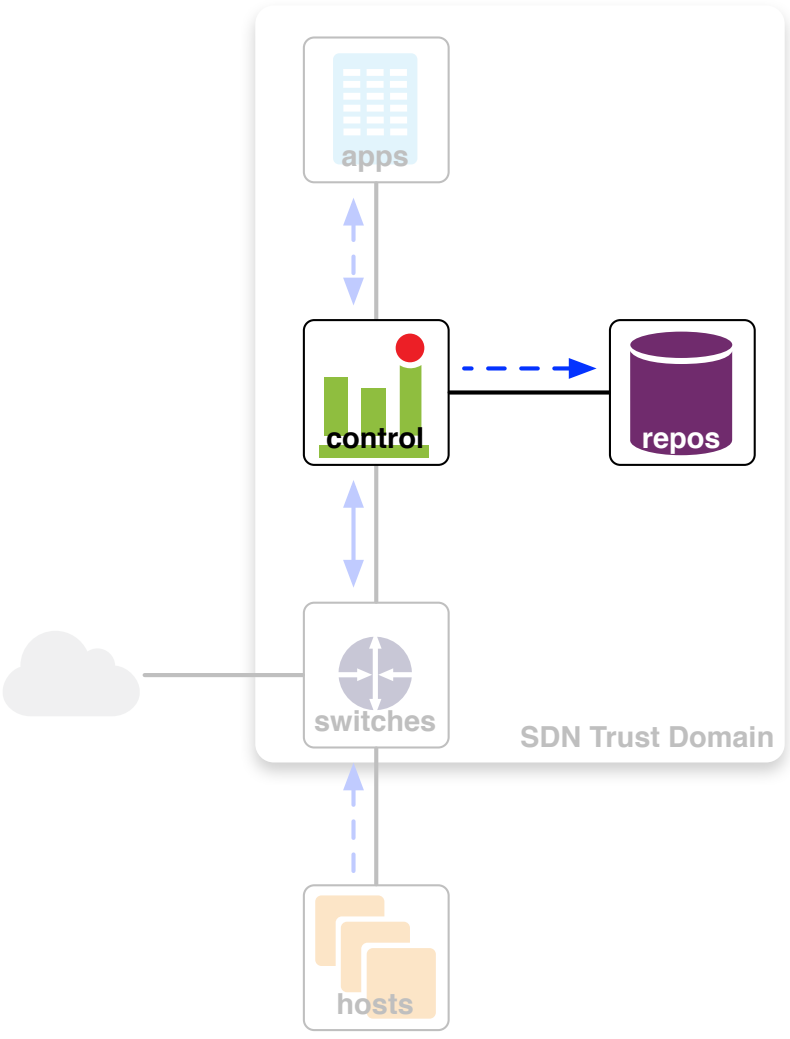
- Confidentiality not critical
- Integrity vital
- Availability expected
- Non-repudiation nice under certain circumstances
- Authentication likewise handy at times

switch $\Longleftrightarrow$ controller



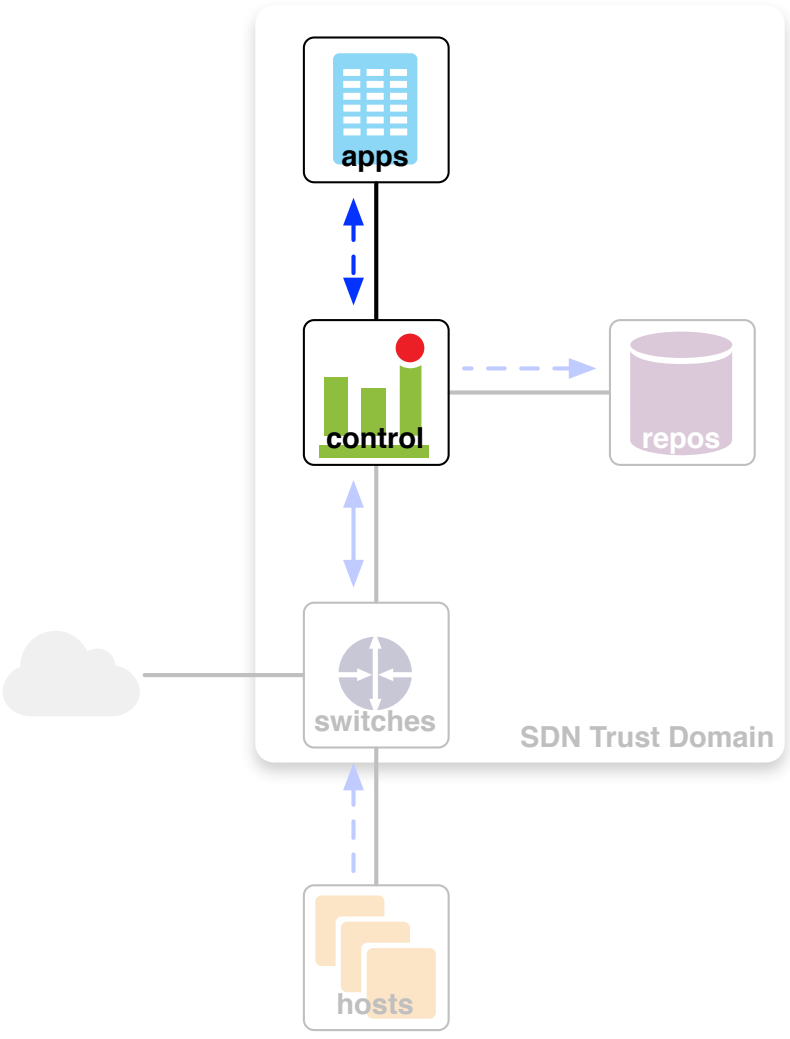
- Confidentiality only important in some edge cases
- Integrity again vital
- Availability paramount
- Non-repudiation perhaps more important
- Authentication of controllers important

controller $\Longleftrightarrow$ repository



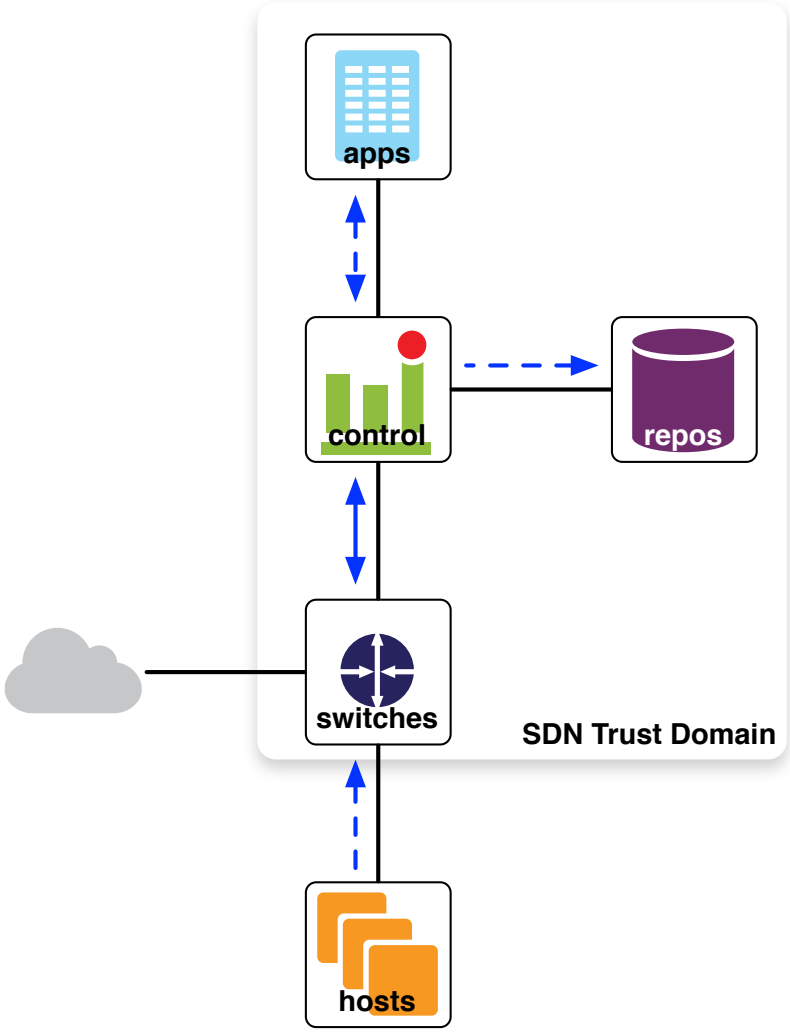
- Confidentiality not always vital
- Integrity imporant, as usual
- Availability not vital
- Non-repudiation a big less important for core control plane functions
- Authentication of repositories important

controller $\Longleftrightarrow$ application



- Confidentiality based on application
- Integrity important, as usual
- Availability not vital
- Non-repudiation needs again based on application
- Authentication of certain applications important

Attribute Commonality



So overall, how important are our typical cyber-security attributes?

- Confidentiality
- Integrity
- Availability
- Non-repudiation
- Authentication

Differentiating Attributes of SDN

Compared to other more agent-centric systems, SDN control systems have some advantages:

- Limited control-plane volatility
  - MANETs and agent-based systems are much more chaotic with respect to functional distribution (many devices wear multiple commmunication hats) and suffer from frequent attach / detach issues
- Centralized High-Availability
  - Any high-availability requirements are constrained to specific functional areas (e.g. controllers)
- Clearly Defined Roles
  - SDN entities have clear roles; systems in MANETs or agent-based systems frequently do not
- Predicable Expected Behavior
  - Clear roles should lead to more predicable behavior and correspondingly easier behavioral outlier detection

Questions? Comments?