Fog and Security

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Key Questions

1. What are fog-specific security challenges?
2. How can we address them?
3. What new opportunities are there?

What Would Change in the Fog?

Fog Node/System

1. Vastly diverse capabilities
2. Many have constrained resources
3. Widely varying lifespans, with HWs that cannot be upgraded or replaced easily
4. Often not managed by experts

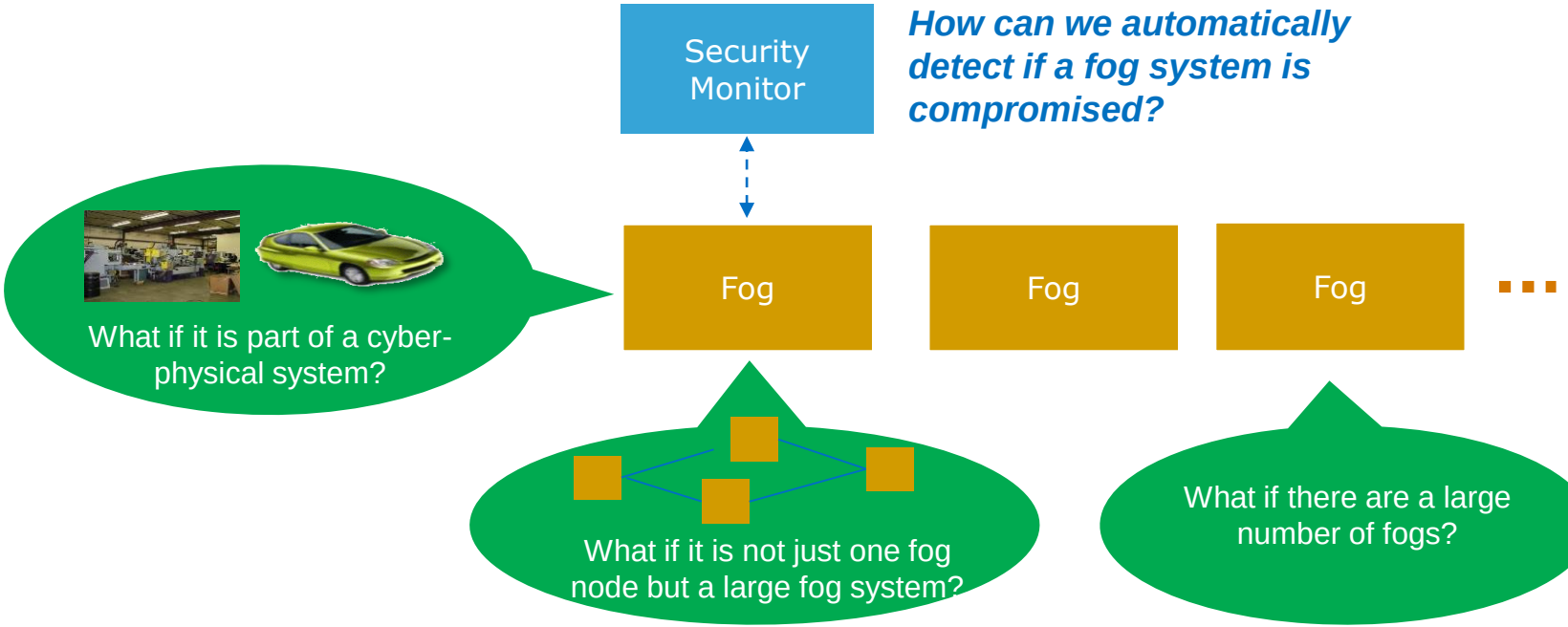
Environments and Operations

1. Geographically distributed and often remote
2. More vulnerable environments
3. Often integrated with OT systems, hence inheriting OT requirements
   - Little tolerance for downtime
4. Security of fog can rely heavily on security of its environment
5. Rapid deployments
6. Pervasive ad-hoc and transient interactions

Fog-Specific Security Challenges

1. Resource-constrained fog nodes, and “things”, need external help (services) to achieve adequate security
2. “Firewalled Castles” inadequate in many scenarios
3. “Shutdown-Cleanup-Restart” incident response no longer adequate. Need
   - ❑ Proactive, adaptive, risk-proportional responses
   - ❑ Remote online threat mitigation
4. Trustworthy ways to monitor large distributed fog systems
5. New ways to keep security up to date (or survive when security is not up to date)
6. “Behavior security” increasingly important – behave “securely” even when environment is compromised
7. Trust management for ad-hoc and transient interactions
8. New requirements for solutions:
   - ❑ Highly elastic
   - ❑ Significantly more automated
   - ❑ Cause negligible inconvenience to users

Fog Security Monitoring

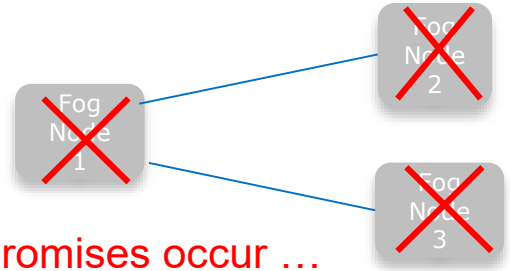


Trustworthy and Scalable

What compromises can or cannot be detected? how? under what conditions?

New Ways to Handle Security Compromises

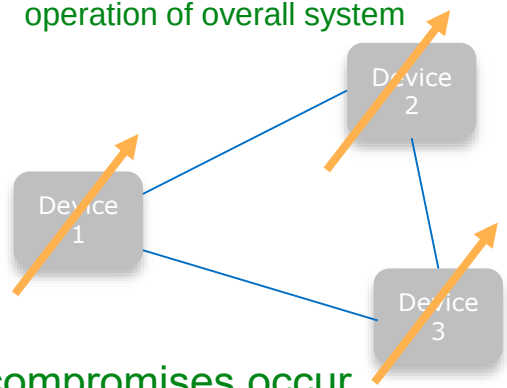
Other nodes
could also be brought down
as a result,
intentionally or unintentionally



If compromises occur …

- Max. response is applied, regardless of severity of the compromises
- Compromised devices/systems are shut down for inspection and restoration

Other Nodes take collaborative
actions to enable safe
operation of overall system

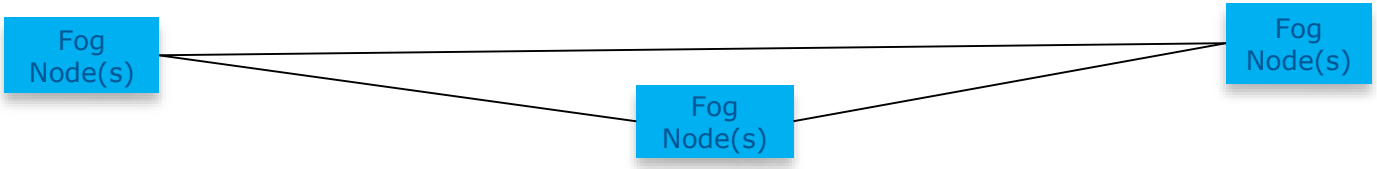


If compromises occur …

- Evaluate risks
- Track compromises
- Allow compromised files to run if …
- Take protective actions
- Learn to enhance future protection
- …

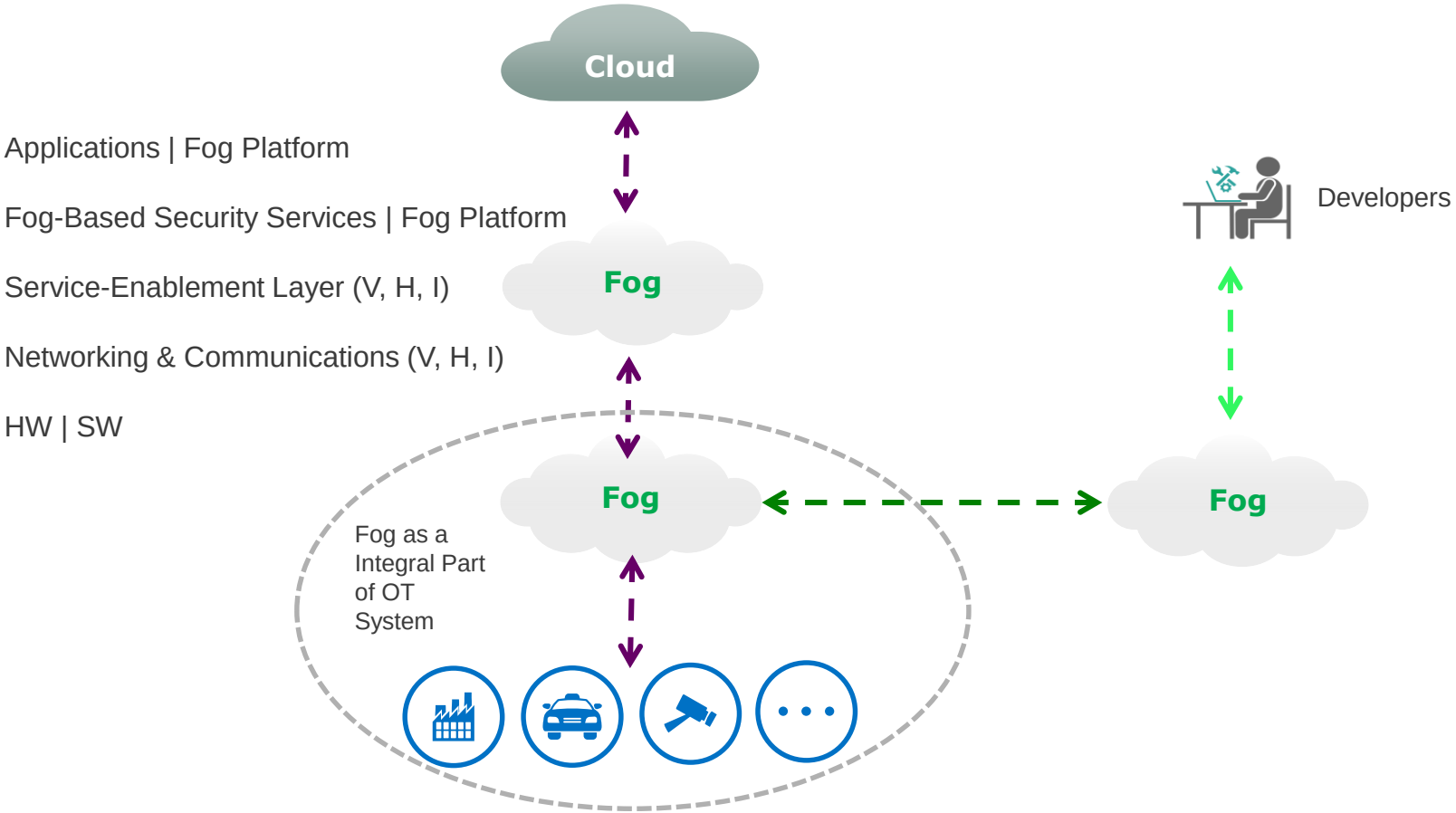
in real time

Fog-Based Security Services



- **Manage** security credentials for endpoints
- **Update** endpoint security capabilities
- **Authenticate** endpoints
- **Protect** endpoints (offloading security processing to fog)
- **Establish** trusted transient relations
- **Monitor/report** security-related status and activities

A System Approach



Thank You!