What is an Edge Native Application?

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A comprehensive overview of the open-source IoT and Edge Computing platforms available at the Eclipse Foundation

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Agenda

- Edge VS Cloud
- Edge Native Applications
- Edge Native Runtimes
- EdgeOps
Edge vs Cloud
What is the Cloud?

On-demand availability of resources

- Homogeneous
- Large scale
- Centralized
What is the Edge?

Resources anywhere and everywhere

- Distributed
- Small scale
- Heterogeneous
“Edge computing provides compute, networking and storage capabilities at the border of the network, closer to the source of the data, while maintaining the elasticity and consumption-based pricing model of the Cloud.”
Edge Computing
What it Can Do For You

Latency

Bandwidth

Resiliency

Data Sovereignty

Devices

Cloud
Edge Native Applications
Commonalities With Cloud Native Applications

- Rely on **microservices**
- They expose **APIs**, often in a RESTful way
- Made of **loosely coupled services** to avoid creating affinities and to enhance the resiliency of the application
- They are built by teams leveraging a **DevOps approach**, with a focus on continuous integration and continuous deployment (CI/CD)
Specific Characteristics of Edge Native Apps

- **Long lifespan**: Need to maintain for years, if not decades
- **Heterogenous**: Complete solution requires many players
- **Constraints**: Power, compute, environmental, etc.
- **Connectivity**: Unknowns: stability + reliability concerns
Edge Computing: IT or OT?

Information Technology
- Off-the-shelf
- Replaceable
- Frequent updates

Operational Technology
- Purpose-built
- Controls critical infrastructure
- Infrequent updates
One Continuum
Three Planes

Data
Software components being deployed

Control
Control the applications or the infrastructure
Real-time monitoring

Management
Manage the applications or the infrastructure
Device configuration
Since they often run on constrained hardware, edge native applications are optimized for size and power consumption.

**Optimized for field use**
- Resilient
- Adapted to mobility
- Orchestrated
- Zero Trust security model
- Zero Touch onboarding
Edge Native Applications

- Optimized for field use
- Resilient
- Adapted to mobility
- Orchestrated
- Zero Trust security model
- Zero Touch onboarding

Edge Native applications assume that nodes, services, and even the network may fail at any time.
Edge Native Applications

Optimized for field use
Resilient
**Adapted to mobility**
Orchestrated
Zero Trust security model
Zero Touch onboarding

Edge Native applications not only connect to mobile networks but can also be deployed on nodes onboard vehicles. They are not only location-aware but can leverage location-based routing when needed.
The components of Edge Native applications are often deployed inside containers, but virtual machines, serverless functions, and binaries can also be involved. The lifecycle of all these deployment artifacts must be carefully orchestrated, whether to scale up or down certain services or to stage incremental updates.
The Zero Trust model implies that, by default, no device is trusted. This involves systematic device authentication and authorization and limitations on the scope and timeframe of the access granted. Data must be encrypted in motion and at rest.
Edge Native applications require credentials for authentication, authorization, and even device attestation. The latter involves using certificates or similar means to prove a device’s unique identity and trustworthiness. Zero Touch onboarding means that such credentials can be deployed from a central location as soon as a device connects to the network.
Architecture Considerations

> How predictable should the latency of your system be?
  • Mission-critical systems have real-time requirements

> Can you afford to lose data?
  • How stateful is your application?
  • Are your instances unique?

> How constrained are your edge nodes and infrastructure?
  • There is little to no elasticity at the far edge

> How far should the control plane be from the Edge?
  • How autonomous are your edge devices and servers?
Edge Native Runtimes
All I Need is Kubernetes!

How is Stateful Kubernetes Going for You?
Eclipse IoT Developer Survey 2022

Top Edge Computing Workloads

<table>
<thead>
<tr>
<th>Workload</th>
<th>2022</th>
<th>2021</th>
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</thead>
<tbody>
<tr>
<td>Artificial Intelligence</td>
<td>38%</td>
<td>21%</td>
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<tr>
<td>Control Logic</td>
<td>34%</td>
<td>17%</td>
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<tr>
<td>Data Exchange/ Multiple nodes</td>
<td>22%</td>
<td>14%</td>
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<tr>
<td>Data Analytics</td>
<td>20%</td>
<td>16%</td>
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</tbody>
</table>
Top Edge Computing Artifacts Deployed for IoT Solutions

- **Container Images**: 49% (2022) vs 30% (2021)
- **Virtual Images**: 31% (2022) vs 22% (2021)
- **Native Binary**: 27% (2022) vs 19% (2021)
- **Script Files**: 22% (2022) vs 17% (2021)
Kubernetes at the Edge

Source: G. Baldoni, L. Cominardi, M. Groshev, A. De la Oliva and A. Corsaro, "Managing the far-Edge: are today's centralized solutions a good fit?"
A wider Set of Alternatives

<table>
<thead>
<tr>
<th>Platform</th>
<th>Cloud Managed</th>
<th>Edge Only</th>
<th>K8s integration</th>
<th>Focus</th>
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<tbody>
<tr>
<td>AWS Outposts</td>
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<td>OpenHorizon</td>
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<td>No</td>
<td>Yes</td>
<td>Containers</td>
</tr>
</tbody>
</table>

Adapted from: G. Baldoni, L. Cominardi, M. Groshev, A. De la Oliva and A. Corsaro, "Managing the far-Edge: are today’s centralized solutions a good fit?".
EdgeOps
Download the White Paper

https://hubs.la/H0L379c0
EdgeOps
Adapting DevOps for the Edge

Challenges
- Latency
- Bandwidth
- Resiliency
- Data sovereignty

Characteristics
- Long lifespan
- Heterogeneous
- Constraints
- Connectivity

Deployment
- Workloads
- Artifacts
- Strategies

DevOps Principles
- Short Lifecycle
- Collaboration
- Continuous Integration and Delivery (CI/CD)
- Microservices
- Infrastructure as Code
It Takes a Village to Build the Edge
To Learn More

See my article on opensource.com!

Thank You

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