AUTOSAR ADAPTIVE DEPLOYMENT WITH OCI CONTAINERS FOR EMBEDDED USING VXWORKS

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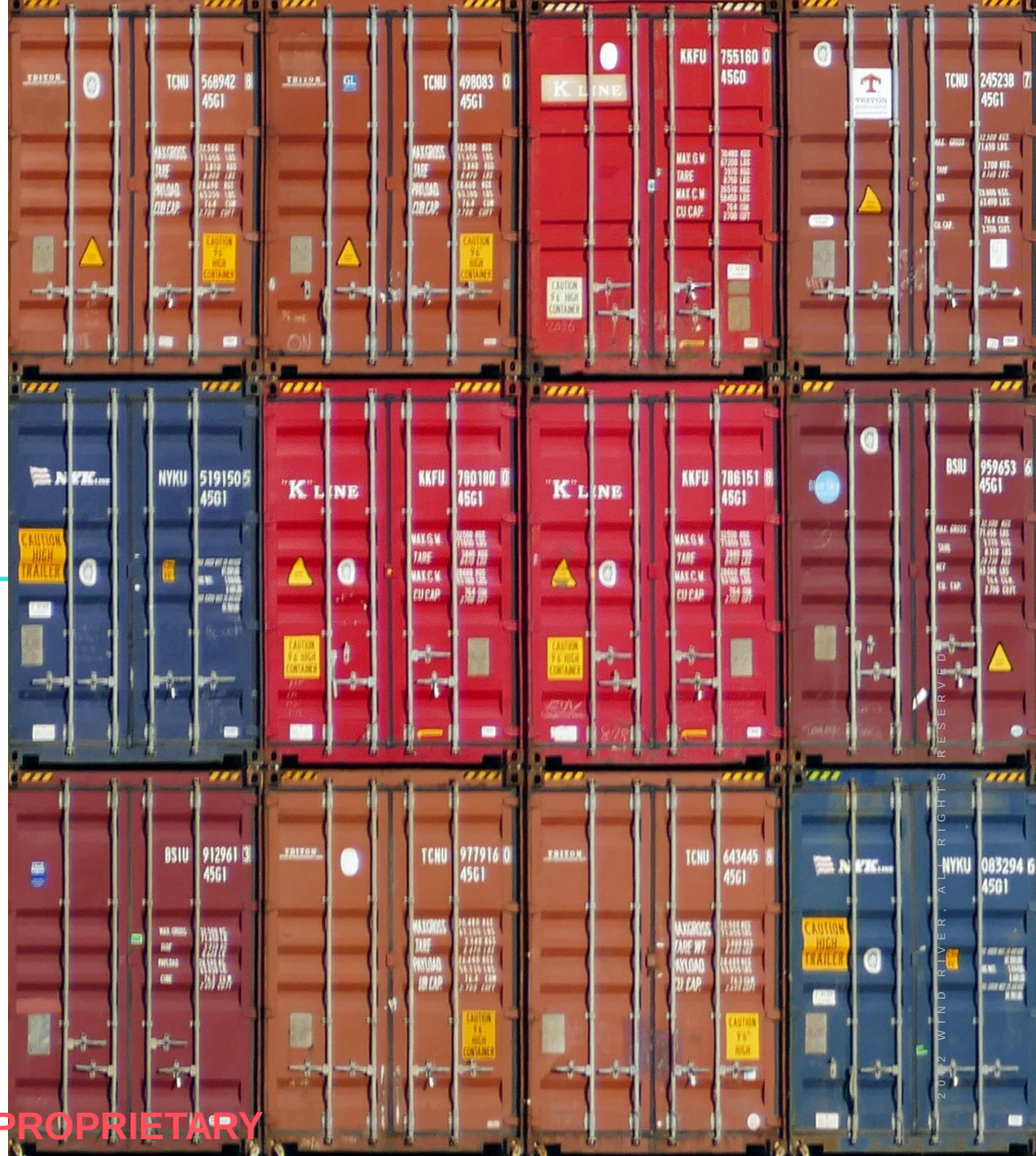
Agenda

1 Container technology

2 Container in Embedded with VxWorks

3 Application to AutoSAR Adaptive

WHAT IS A CONTAINER?



A WAY TO ENABLE SOFTWARE TO RUN RELIABLY WHEN MOVED

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CONTAINER TECHNOLOGY IS A METHOD OF PACKAGING AN APPLICATION SO IT CAN BE RUN WITH ISOLATED DEPENDENCIES

* https://www.section.io/engineering-education/history-of-container-technology/

STANDARD OPEN TECHNOLOGY

A BRIEF HISTORY OF CONTAINER TECHNOLOGY

WE ARE PAST THE PEAK OF INFLATED EXPECTATIONS

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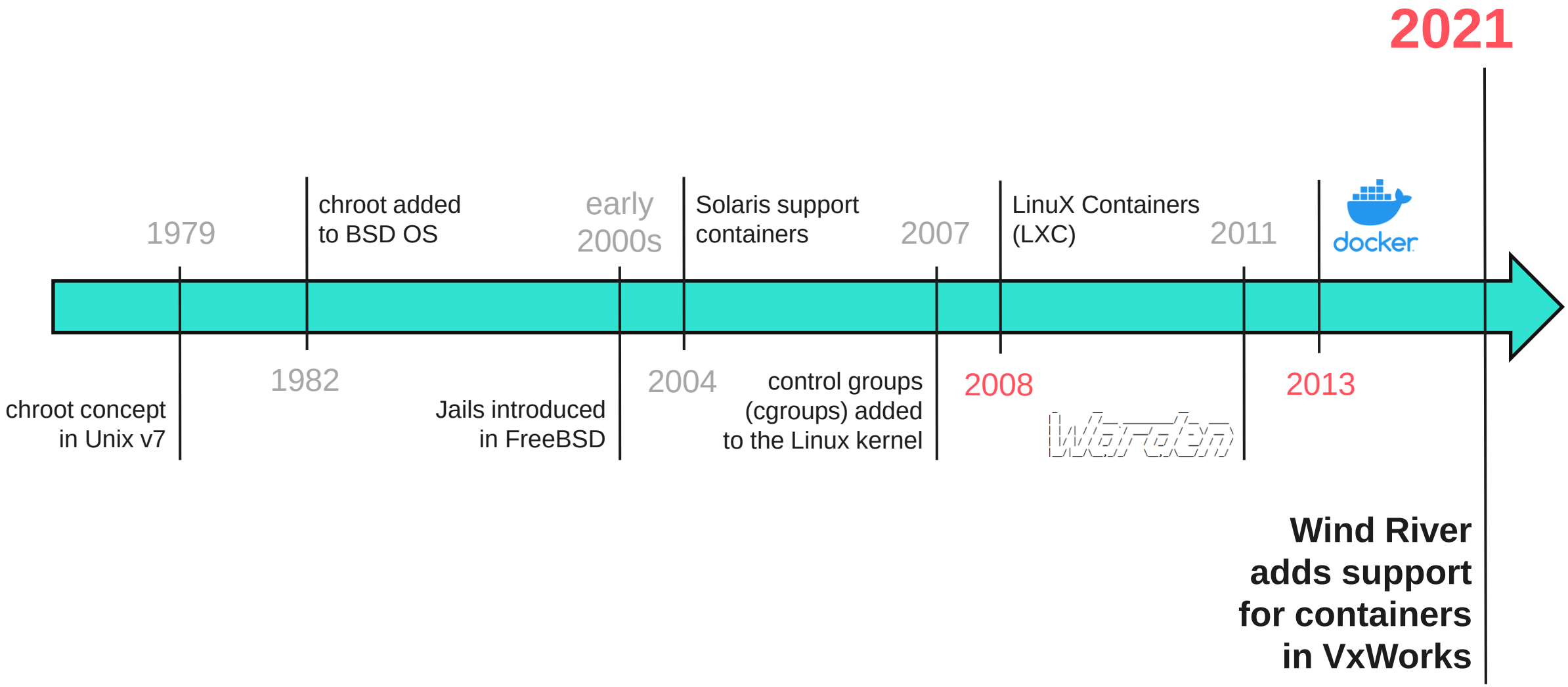


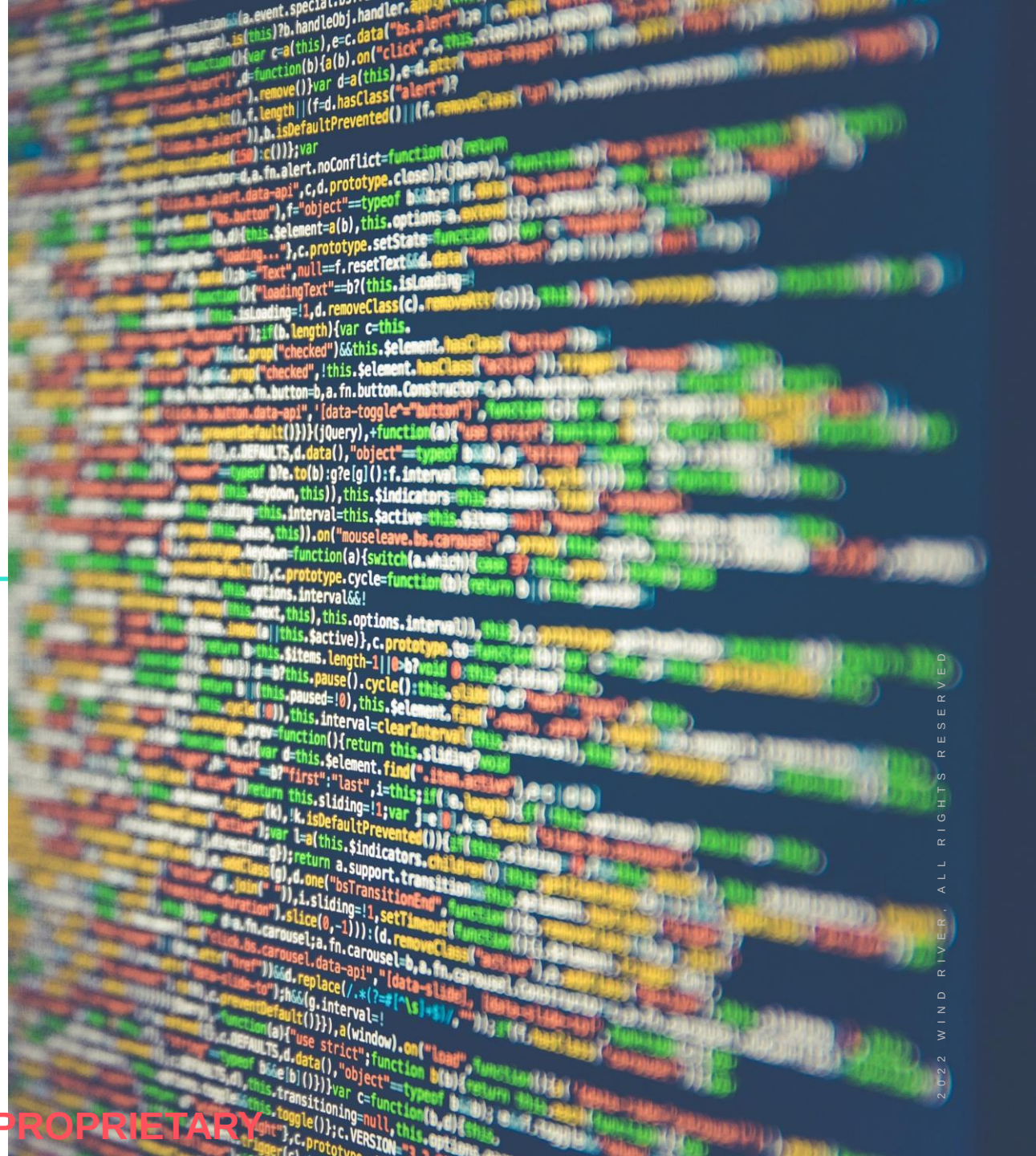
PERCENTAGE OF GLOBAL ORGANIZATIONS RUNNING CONTAINERIZED APPLICATIONS IN PRODUCTION BY 2025 *

85%

* https://www.gartner.com/doc/reprints?id=1-24237Z3C&ct=200831&st=sb/

SIMPLIFIED MANAGEMENT

EASILY MANAGE DEPLOYED SOFTWARE



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LIFECYCLE IN EMBEDDED

- Fixed function/monolithic approach
- Traditionally disconnected (or with limited connectivity)
- Very long deployment life
  - 8 to 10 years for an industrial robot *
  - 20 to 36 years for the average aircraft **
- Risk aversion
- Deployment models changed over the years with limited commonalities
  - Technology or systems limitations, etc.

* motioncontrolsrobotics.com – Robot life cycle faq
** Key Findings on Airplane Economic Life, Boeing

LIFECYCLE AT AWS –

AWS ENGINNERS DEPLOY CODE EVERY

11.7s

* invent 2019

CONTAINER IN EMBEDDED WITH VXWORKS

Wind River provides OCI Container support for

- Safe Real Time OS VxWorks

VxWorks

- Yocto based Wind River Linux

Wind River Linux

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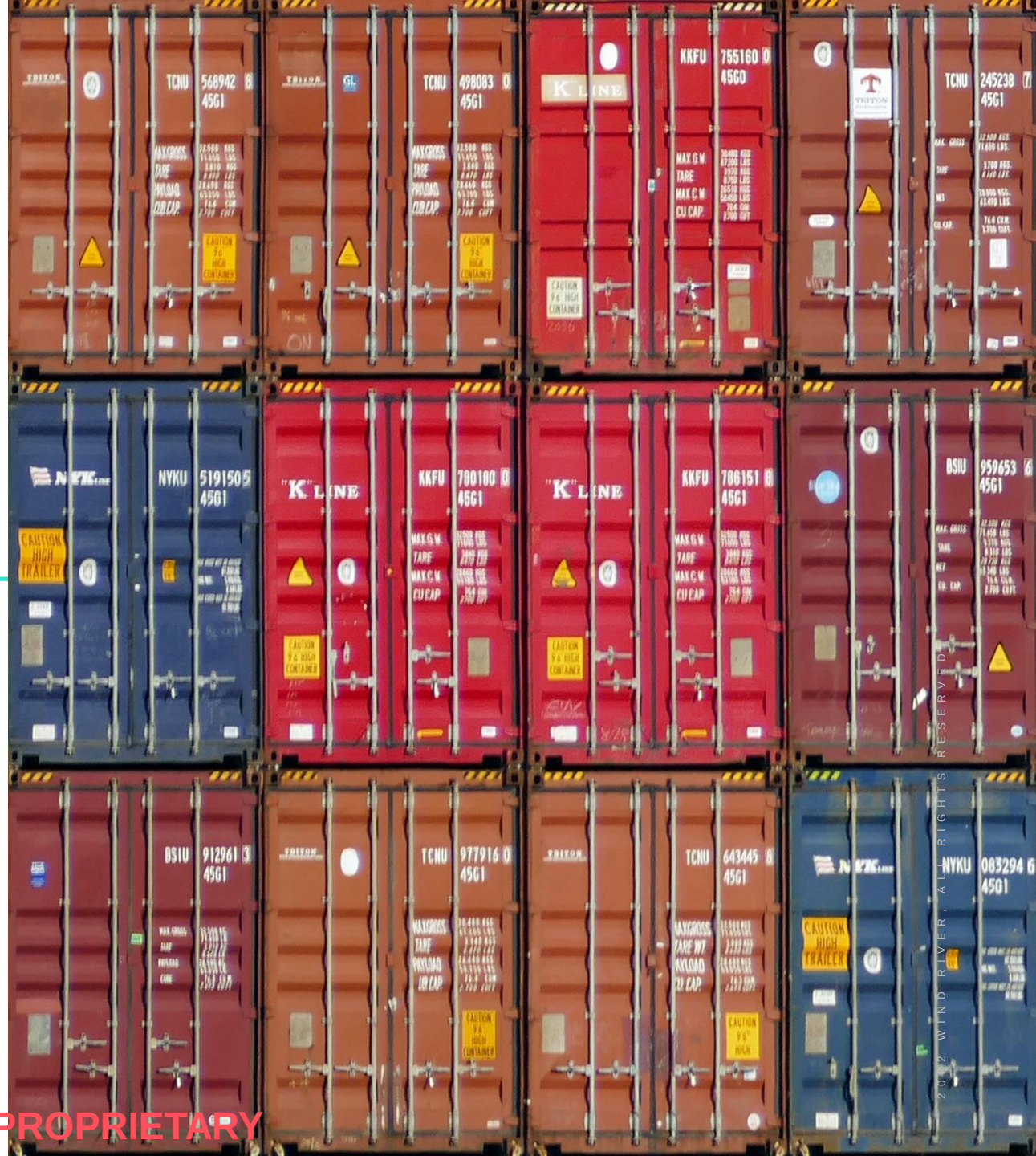
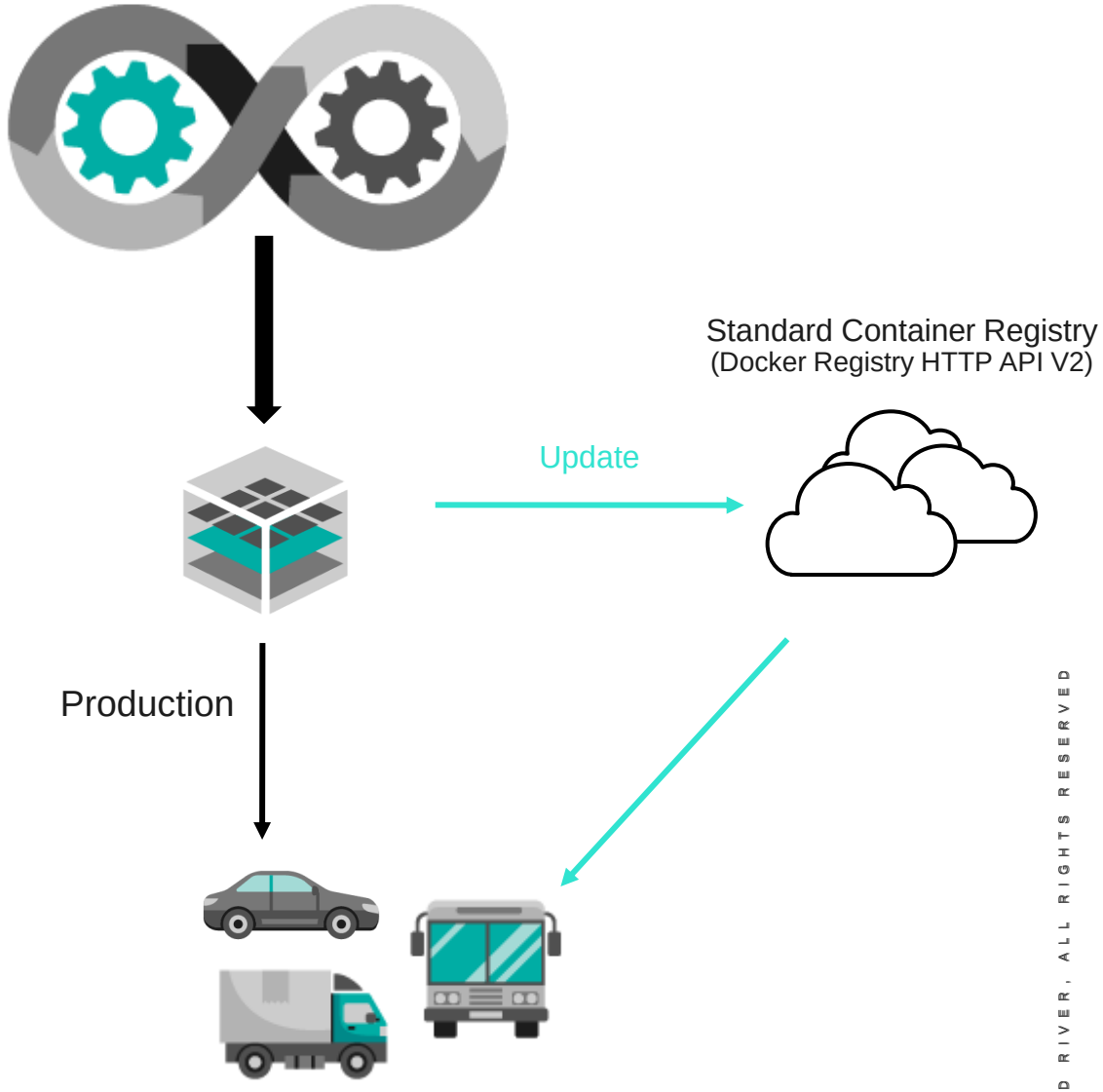
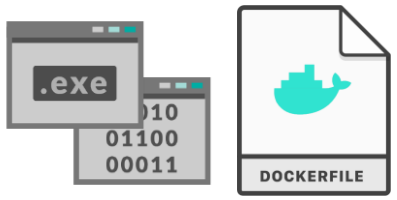


WHAT ABOUT VXWORKS?

- Compliant with OCI specifications
- Runtime
  - Image parsing/validation
  - Instantiation of the container
  - Execution of the application
- Manager
  - Logic for pulling containers from registry
  - Command line tools for development/testing



WHAT ABOUT VXWORKS?




```
FROM scratch
WORKDIR /usr
WORKDIR /vxbin
COPY helloworld.vxe /vxbin
ENTRYPOINT ["helloworld.vxe"]
LABEL com.windriver.vxworks.rtp.rtpStackSize 0x400000
LABEL com.windriver.vxworks.rtp.rtpPriority 50
LABEL com.windriver.vxworks.rtp.rtpOptions 0x80
LABEL com.windriver.vxworks.rtp.rtpTaskOptions 0x01000000
VOLUME "/ram0/usr:/usr"
VOLUME "/shm:/shm:--:iodev"
VOLUME "/romfs:/romfs:--:iodev"
USER 1001:1000
STOPSIGNAL SIGTERM
```

HOW DO CONTAINERS HELP?

- Easy to “tear down” and restart
- Can bundle multi-systems applications (e.g. VxWorks Arch1/Arch2 or VxWorks + Linux)
- Micro services/micro function architecture
  - Can upgrade parts of the system only (useful for security bugs)
  - Consider a progressive approach
- Large ecosystem of tools

WHY LEVERAGE THE IT INFRASTRUCTURE?

- No need to re-invent the wheel
  - Use what is there for the IT operations of you or your clients
- Easy to integrate
  - Many components are open and community driven (e.g. K8s)
  - Talent exists to help transition
- Quicker to deliver
- Reduces amount of development and testing

CONTAINER TECHNOLOGY IS A METHOD OF PACKAGING AN APPLICATION SO IT CAN BE RUN WITH ISOLATED DEPENDENCIES

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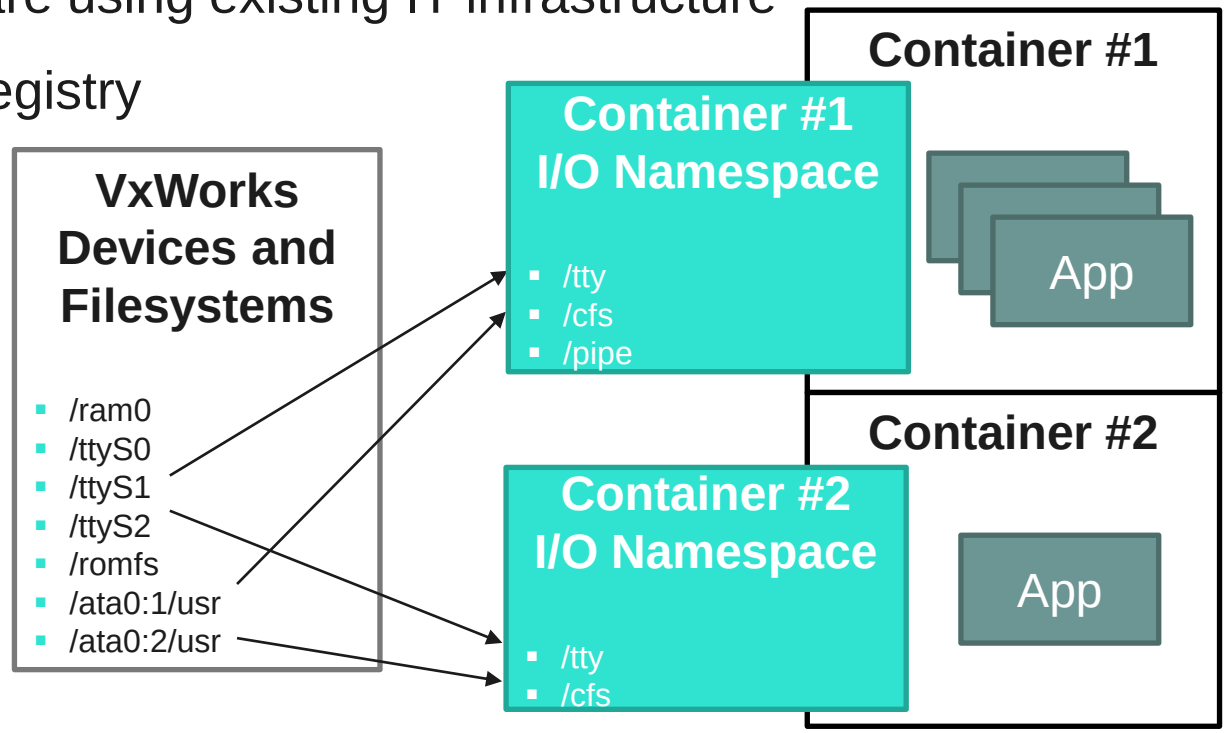
BUILD ONCE AND RUN ANYWHERE

- Lightweight engine
  - In VxWorks, due to careful design of the engine, little to no runtime performance impact for the application
    - Startup time could be impacted if container image remains packed
  - Small footprint
- Easier to update various layers of the application
- Reduces impact when OS gets updated

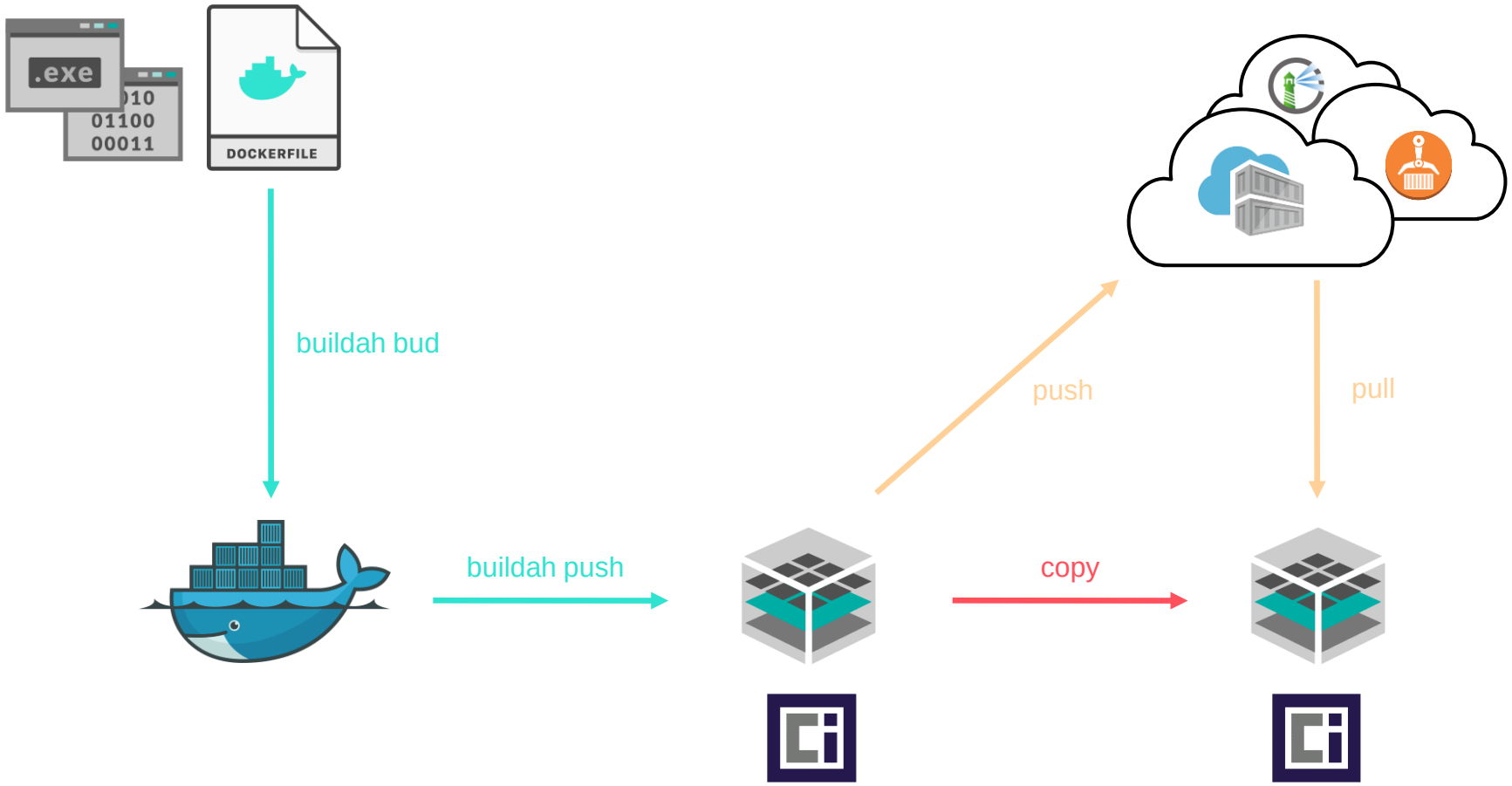
ISOLATION

- Standard packaging for applications across architectures and operating systems
  - No Wind River proprietary tools
  - Use standard Dockerfile
- Quick update of deployed software using existing IT infrastructure
- Authentication of the container registry
- Device isolation
- Overlay filesystem



COMMON PROCESSES

COMMON TOOLS



CONTAINER AND AUTOSAR ADAPTIVE

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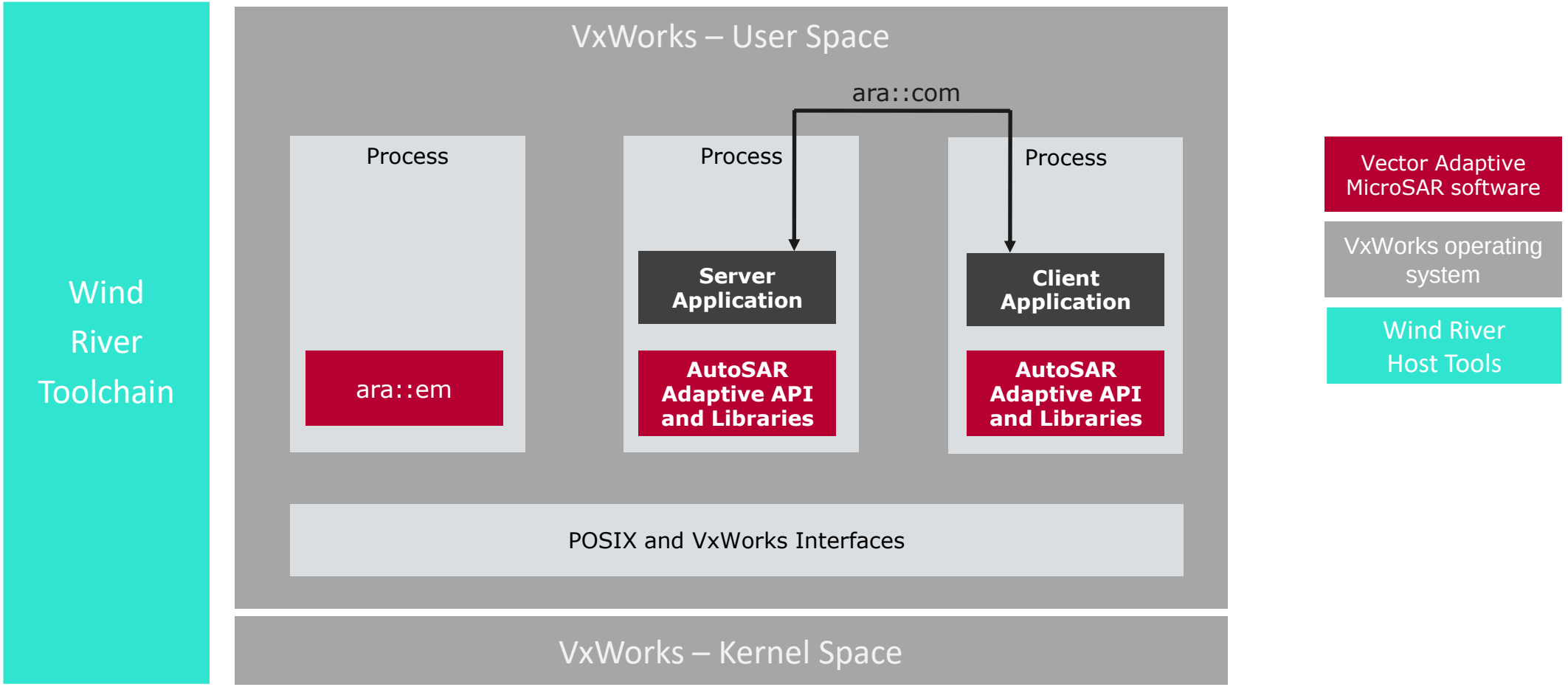
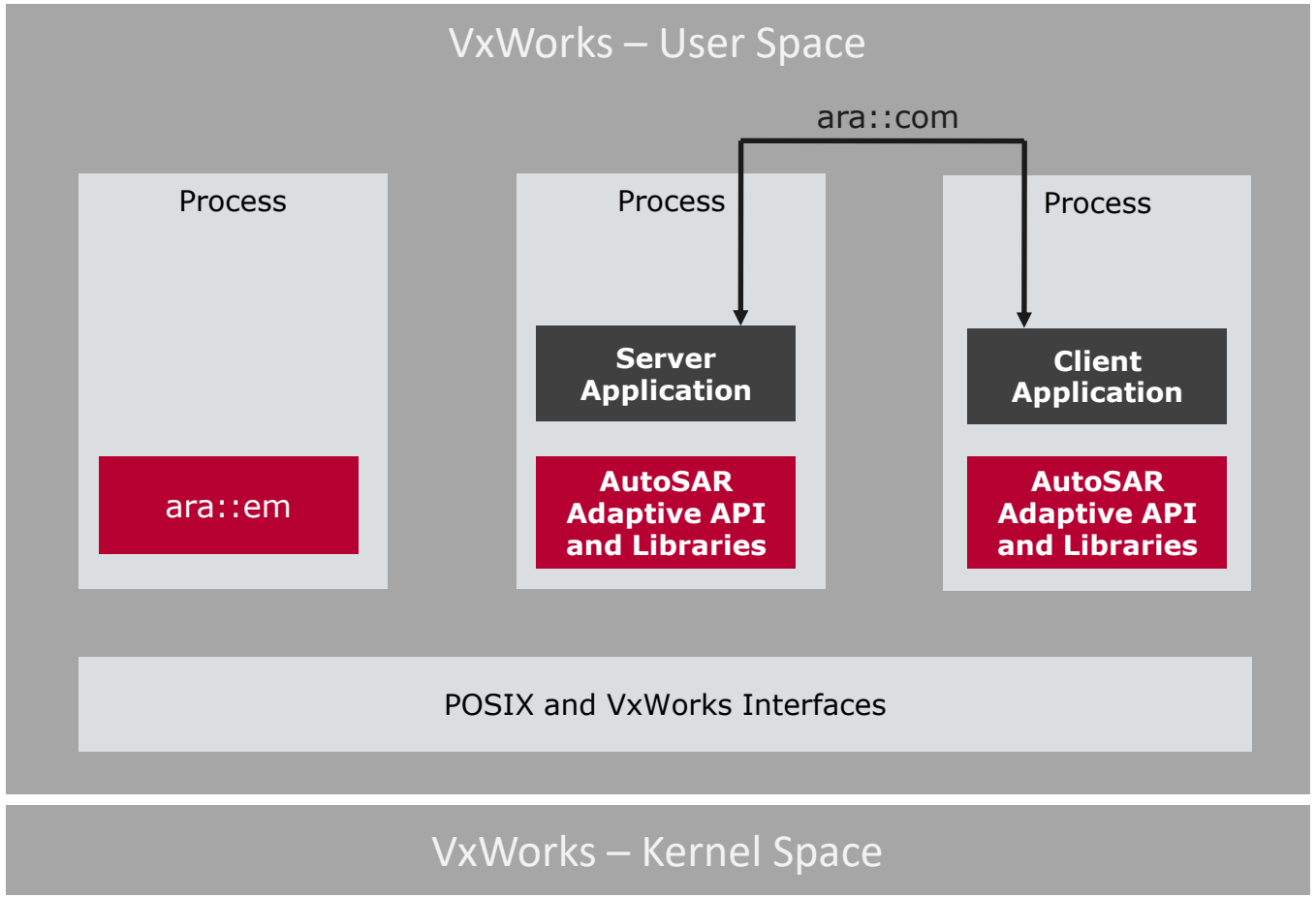
ADAPTIVE MICROSAR AS VXWORKS PROCESSES PARTNER SOLUTION: VECTOR - WIND RIVER



ADAPTIVE MICROSAR AS VXWORKS PROCESSES CLOUD NATIVE DEVELOPMENT

Wind River Toolchain In Studio



Virtual Lab – Digital Twin in Studio

Vector Adaptive MicroSAR software

VxWorks operating system

Wind River Studio

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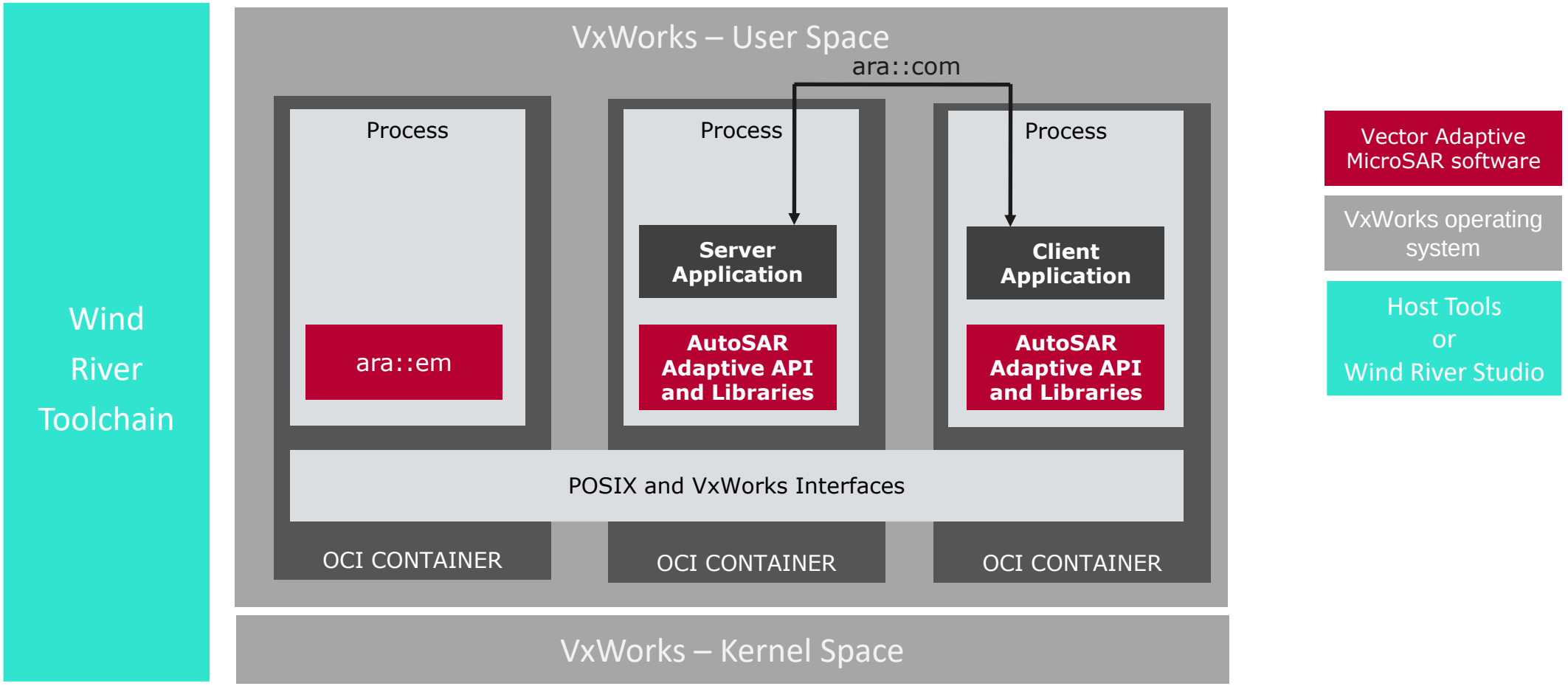
AUTOSAR ADAPTIVE APPLICATION DEPLOYED AS CONTAINER USING VXWORKS CONTAINER RUNTIME



CONSIDERATIONS

- ara::em needs to updated to spawn containers instead of processes
  - Identify container to be used for set of applications
  - Start/Stop container instead of processes
- File based sharing needs to be known and mapped properly
  - SOME/IP settings
- Adaptive SW Update needs to be made ready for container
- Container creation is packaging exercise post Adaptive application build
- JSON file for ARA::EM and Dockerfile contain overlapping information

Q&A

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WHAT'S NEXT