АВРОРА
СВОЯ СИСТЕМА

Lab 3 Booting the Kernel

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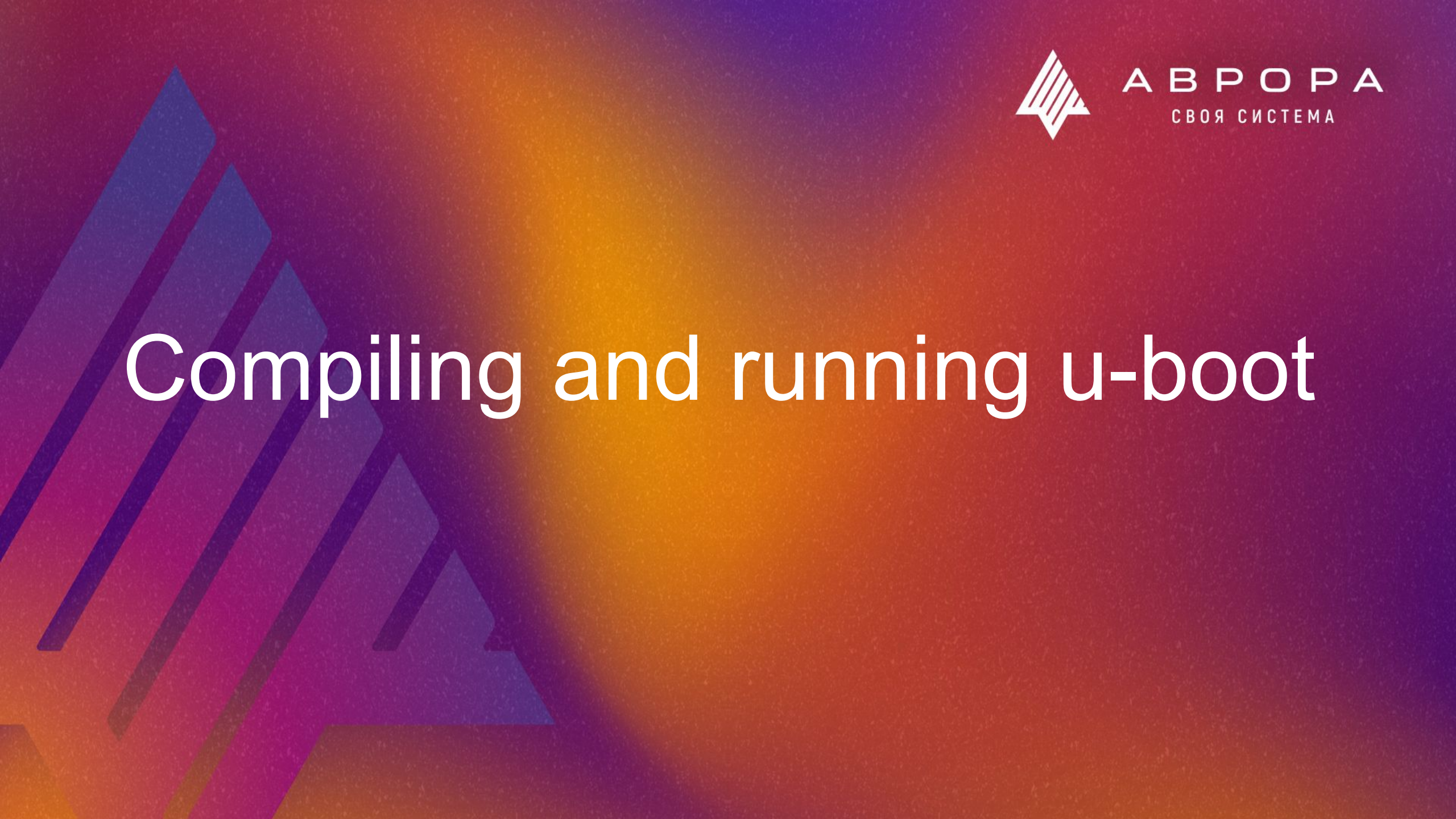
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Compiling and running u-boot

What is u-boot?

- Das U-boot (Universal Bootloader) is an open source primary (1st-stage) bootloader commonly used on embedded devices
- Source code: https://github.com/u-boot/u-boot
- It supports many architectures along with booting Linux Kernel or 2nd-stage bootloaders (GRUB/systemd-boot)
- It has support for many storage devices, basic I/O, networking, file transfer and so on.

What is qemu?

- QEMU (Quick Emulator) is a generic and open source machine emulator and virtualizer
- Source code: https://github.com/qemu/qemu
- It supports a lot of architectures, custom modules, any kind of device emulation
- It also supports hardware-assisted accelerators (KVM, HVF), kernel subsystems for I/O virtualization and device pass-through (virtio, VFIO)

Step-by-step guide part 1 ☺️

- 1. Install qemu, qemu-system-arm, GNU cross toolchain
- 2. Clone U-boot repo and checkout latest stable version

```
git clone https://github.com/u-boot/u-boot/
git checkout v2022.01
```

- 4. Compile u-boot for vexpress dev board (you can make optional configurations too)

```
export ARCH=arm
export CROSS_COMPILE=arm-linux-gnueabihf-
make vexpress_ca9x4_defconfig
make
```

- 5. Check if your u-boot image works

```
qemu-system-arm -M vexpress-a9 -kernel u-boot -m 512M
```

Step-by-step guide part 2 ☺️

- 6. Compile Linux Kernel for vexpress board

```
export ARCH=arm
export CROSS_COMPILE=arm-linux-gnueabihf-
make vexpress_defconfig
make zImage
make modules
make dtbs
```

- 7. Check if your kernel works in qemu

```
sudo qemu-system-arm -M vexpress-a9 -m 512M -kernel arm/boot/zImage -append "console=ttyAMA0“ -dtb
arch/arm/boot/dts/vexpress-v2p-ca9.dtb
```

TASK, part 1

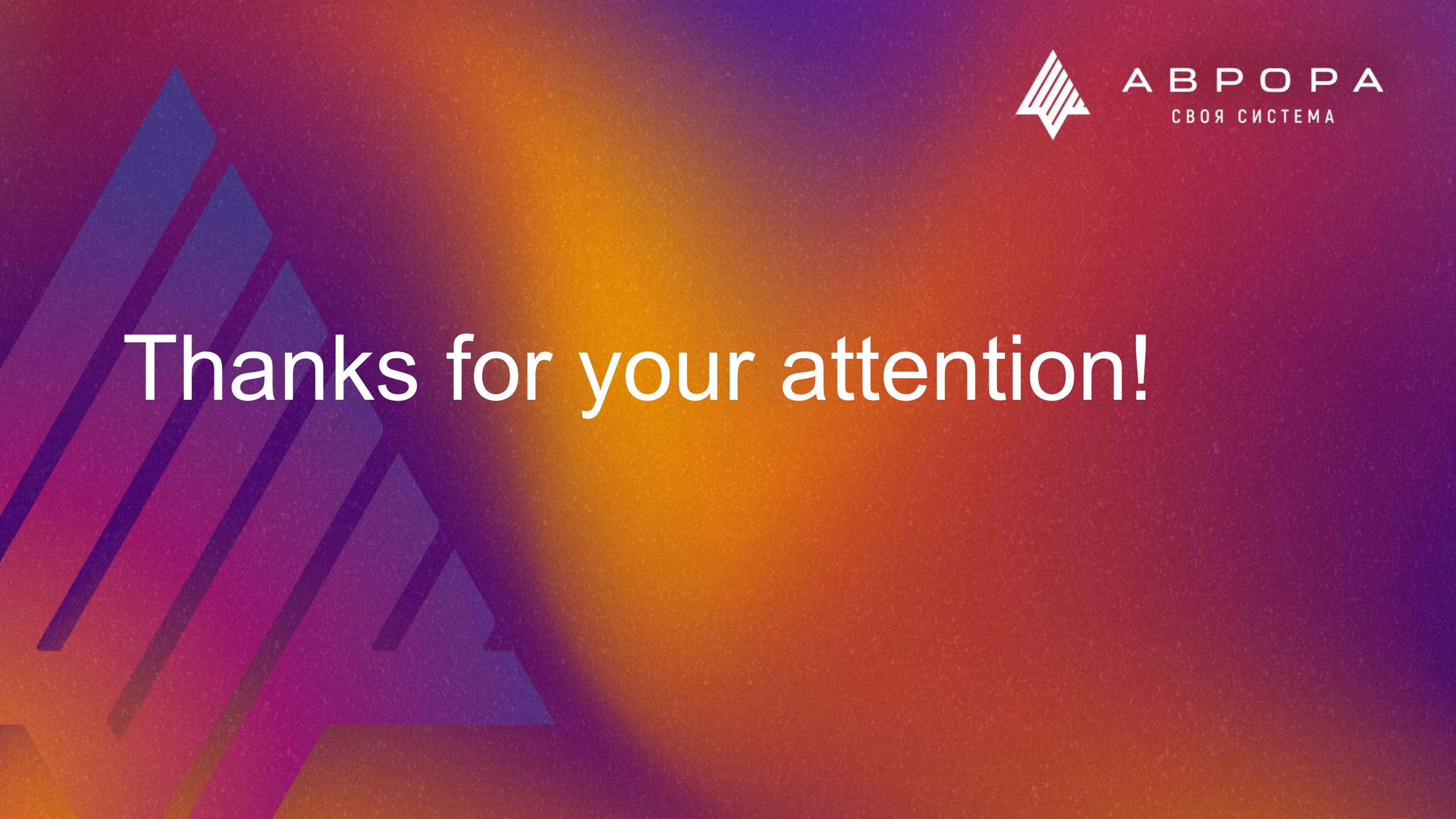
- Setup development environment:
  1. Install **git** and **qemu-system-arm** packages
  2. Download a mainline *linux kernel* sources
  3. Download a 1st-stage bootloader (any of *u-boot, coreboot,* etc.) sources
  4. Download an embeddable toolset of UNIX programs (*busybox, u-root*, etc.)
  5. Download a GNU cross toolchain

TASK, part 2

- For a **vexpress-a9** qemu target:
  1. Build bootloader for ARM arch (u-boot, coreboot, etc.)
  2. Prepare initrd/initramfs (busybox, u-root, etc.)
  3. Prepare rootfs (also can be done using busybox, u-root, etc.)
  4. Build the mainline linux
  5. Run everything in qemu
- Boot into rootfs using booting flow: bootloader -> initramfs -> rootfs (important!)
- Write a PDF report with the full demonstration and description of the boot flow
- Graded output: report including screenshots. (in PDF)

Acceptance criteria

- **A (20 points) –** boot flow is correct. Student can describe the usage of initramfs.
- **B (15-19 points)** – minor issues but the boot flow is correct.
- **C (10-14 points)** – one of boot stage is missing (usually students miss initramfs).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Thanks for your attention!

About US

Open Mobile Platform, LLC

Shortly:

- Founded in 2016
- Offices in Moscow, Nizhny Novgorod, Innopolis and St.Petersburg
- 300+ qualified IT specialists

Main products:

- OS Aurora + Aurora SDK
- Cloud Platform
  Aurora Center (Enterprise Mobility Management)
- Aurora TEE & Trusted Boot