Switching the JLab Accelerator Operations Environment from an HP-UX Unix-based to a PC/Linux-based environment

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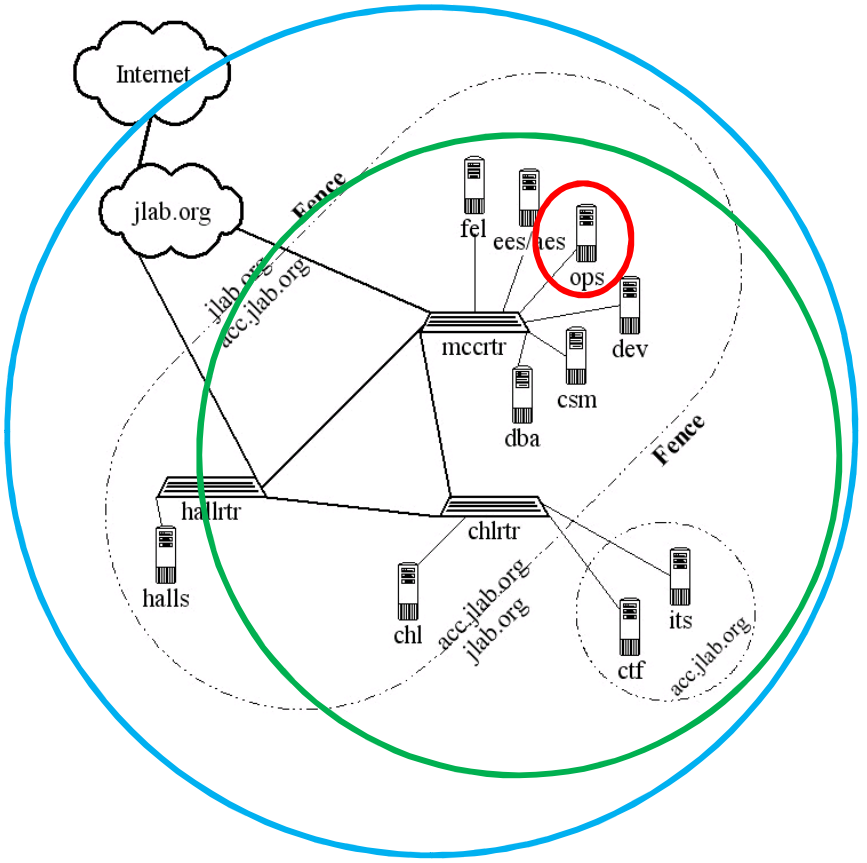
Overview

- Overview of JLab/ACE network
- Historical Control Room (MCC) Configuration
- Reasons and Goals for Switch-over to Linux
- New MCC Computer Configuration
- Hurdles
- Areas Linux is NOT used
- New Control Room Layout
- Future Upgrades
- Conclusions

Overview of JLab Network

- Overall JLab network is maintained by the Common User Environment (CUE) group.
- JLab's accelerator network maintained by the Accelerator Computing Environment (ACE) team.
- The OPS-subnet is the operationally critical subnet that runs the accelerator and the Machine Control Center (MCC) control room operations computers.



OPS Server (circa 2004)

- Opsrv – fileserver, boothost, webserver, compiler, etc. for the subnet
  - Very old hp k370
  - All services bundled in one large machine
  - Initial system cost (1999) ~$40k
  - Maintenance ~$10k/year
- Two k370's actually in service
  - Mdlsrv – shared some services with opsrv and acted as "hot spare" in some regards
  - So double the cost numbers

Pictures: hp.com

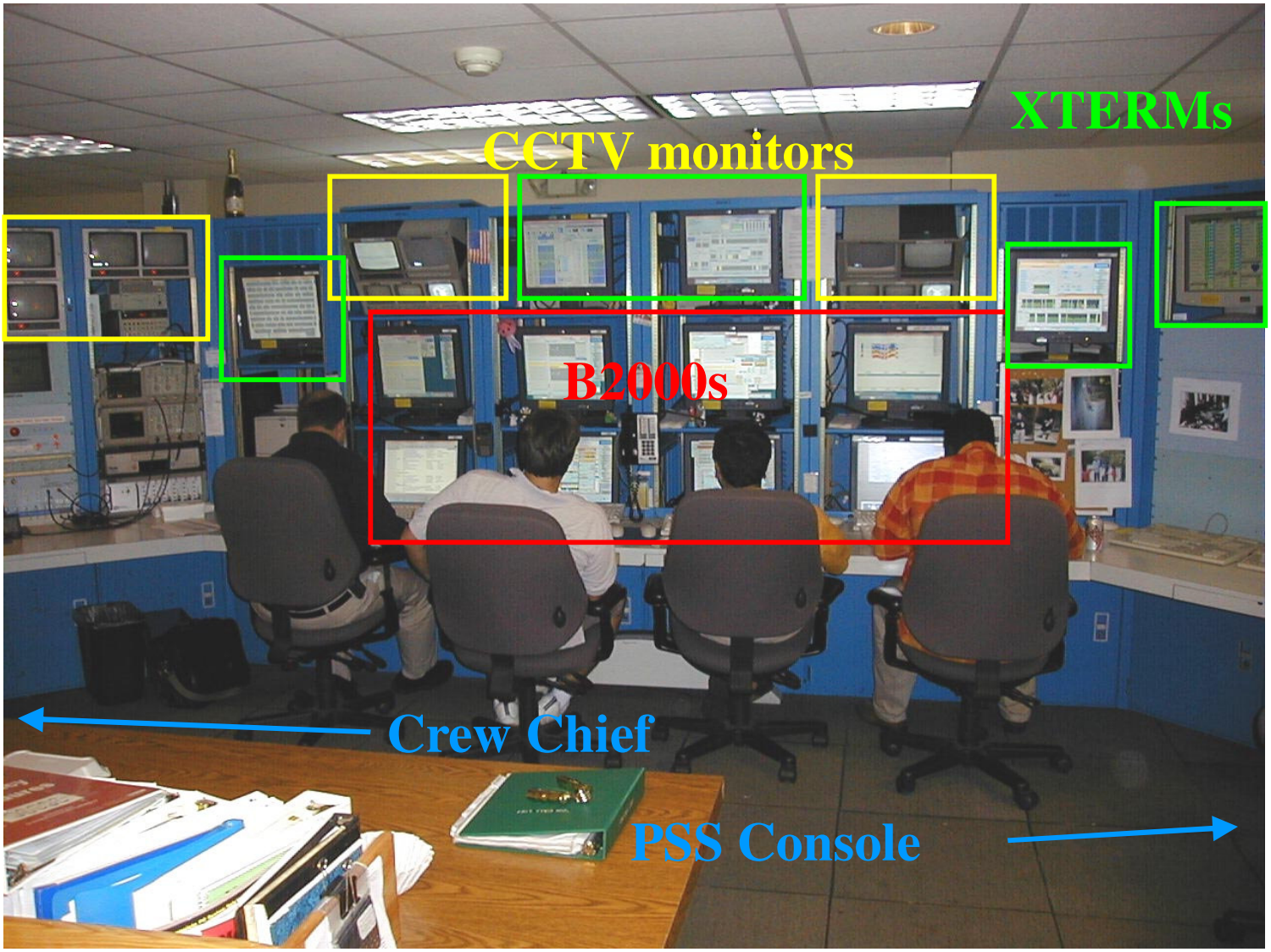
OPS Workstation (circa 2004)

- 2x HP B2000 Workstation
  - 450MHz PA-RISC2 processor
  - 1GB memory
  - HP-UX 11.11
- 2x 19” Flat panel monitor
- Cost: ~$8000 total

One OPS Unix Workstation

Pictures: hp.com

Pre-2004 MCC Configuration



Reasons for switch-over to Linux

- Control Room upgrade was the perfect time to re-examine the computer architecture
- Linux a growing operating system, HP-UX was becoming harder to support
- Take advantage of inherent PC capabilities (sound, multi-head displays, extensive drivers, etc.)
- Early adoption of Linux had already taken place
- EPICS-support available
- Availability of (supported) Open Source utilities
  - OpenOffice
  - Firefox
  - Thunderbird

Goals for switch-over to Linux

- Replace aging hardware and software
- Provide more cost-effective long-term solution
- Ensure that all required tools are supportable under new architecture
- Distribute services across multiple faster, cheaper machines
- Minimize negative impact on Accelerator Operations (zero-impact desired)

Why Redhat Enterprise Linux (RHEL)?

- Versioning control
  - Guarantees stable versions of core applications
  - Certified patches available via Satellite Server
- Many early-adopters were already using flavors of Redhat/Fedora
- Supportable on Dell computing systems available through lab purchasing plan (allowed for same systems for Linux and Windows XP)
- Cost
  - Initial purchase of 1200 licenses (site-wide): ~$50k
  - Linux Support (ACE): ~$4000/year (< $50/comp)
  - HP Support (ACE) originally: ~$80k/year

Standard Workstation (Control Room)

- Dell Precision Workstation
  - Quad core Intel 2.4GHz processor
  - 4GB memory
  - RHEL v4
- 2x 24” Widescreen flat panel monitors
- Cost: ~$3000

One OPS Linux Workstation

Pictures: dell.com

Standard Server

- Dell PowerEdge 1950/2950 rack- mounted system
  - Dual Quad-core 3.0GHz processor
  - 4GB+ memory
- RHEL v4
- Single-purpose software installed as needed
- Cost: ~$3500-$4500 each

Pictures: dell.com

Distributed Servers

- Login servers
- Webservers
- Archivers
- Channel Access Gateway servers
- Network Monitoring
- Terminal server managers
- Database servers

Programming Hurdles

- Very few programs/scripts had to be rewritten to work under Linux architecture
  - Out of 100 applications:
    - 5 had to be rewritten
    - 24 needed to be recompiled
    - 71 needed no changes
  - Compiling on Linux much easier than old HP machines
- Some new applications were developed that could not be developed under HP
  - Allowed for some desktop user-customization
  - Menu for accessing screens was rewritten as a stand-alone, architecture independent application

Psychological Hurdles

- Convincing users to begin using new workstations in an operationally critical environment
- "PC mentality" of being able to do anything to a computer
  - Had to break users of habit of tweaking systems
  - "More, more, more" mentality
- Gradual switch-over of critical systems
- In contrast, new systems quickly became the desired environment

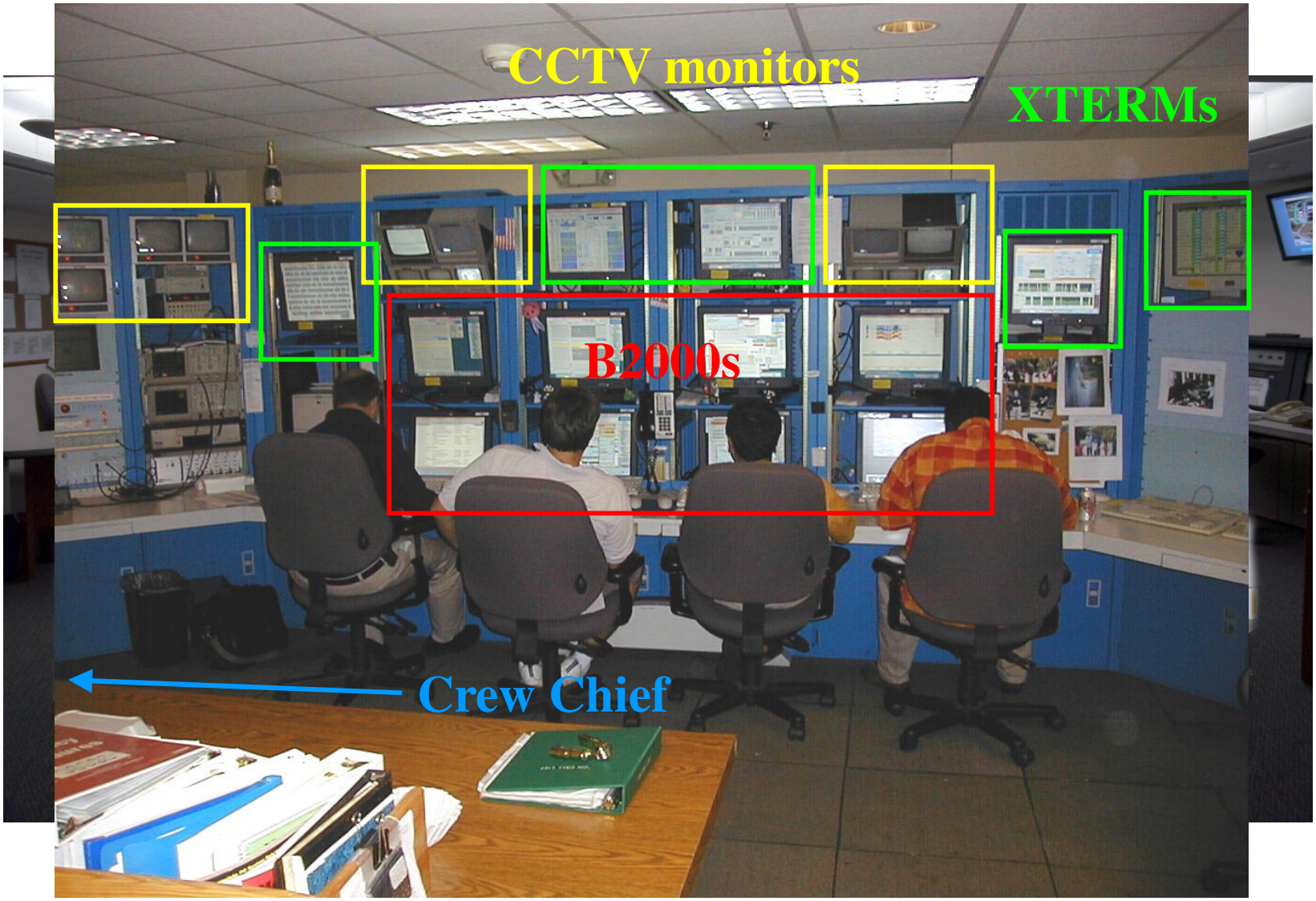
Financial Hurdles

- Cost of changing entire site over to new architecture mandated a multi-year project
- Multi-year project mandated purchasing systems that would be available long-term
- Systems also had to be robust enough to last for a multi-year cycle to make upgrade worthwhile
- Dell systems chosen because of these main two factors (cost and robustness) and because of existing site-contract

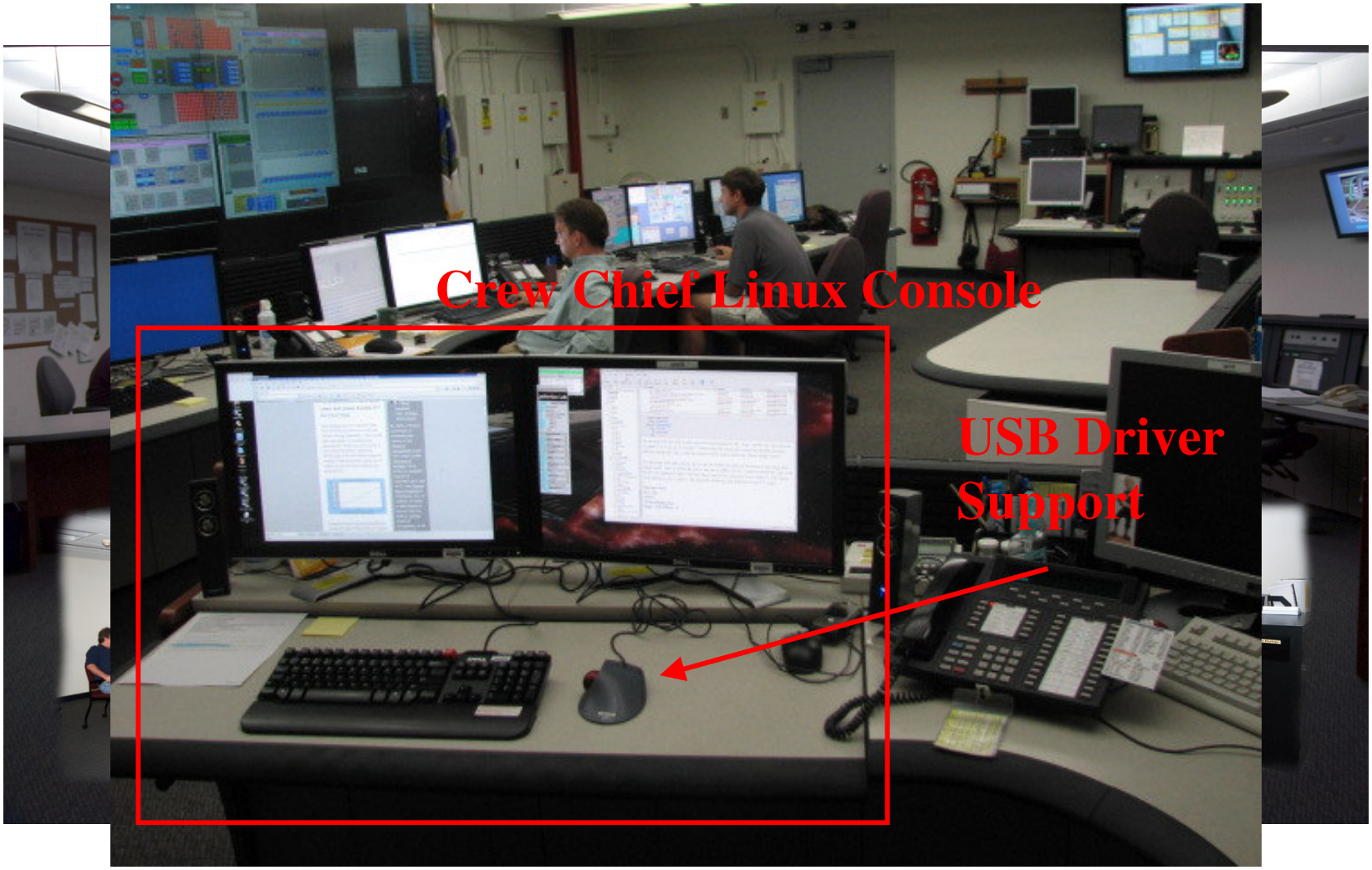
Areas where Linux is NOT used (Cont.)

- Ops Display Wall
  - Linux not offered by vendor, only Windows XP
- File Servers (NFS/NIS/DNS)
  - Solaris 10 machines used instead
    - Solid NFS support
    - Very reliable/redundant hardware configuration
- Hardware: scanners, paging-systems and other devices
  - Some Home-grown utilities that currently only run on other architectures
  - Some available Linux solutions that have not been implemented yet
- Software: non-Linux supported applications
  - A few specialized/in-house developed apps only run under Windows
  - FrameMaker software not available for Linux
  - Some apps only run on Sun (Tornado)

New Control Room Layout



New Control Room Layout (Cont.)



Future Upgrades

- Convert over last few services to use Linux
  - CUPS for printing
  - SANE for scanning
- Expand Linux replacement site-wide (ACE)
  - Free Electron Laser control room
  - Central Helium Liquefier control room
- Drop or replace unsupportable software

Conclusions

- Converting from HP-UX to Linux allowed upgrade of the OPS subnet and Control Room environment
  - Cost
  - Usability
  - PC processing power
- Reasonable expectations of what can be accomplished, and in what timeframe
  - Linux not a panacea for all situations
  - Had to except that some legacy systems would remain
- User buy-in
  - Short problem-reporting/resolution cycle
- Had to schedule work around Accelerator schedule
  - Extended project lifetime
  - Turned to an advantage by allowing users time to adjust

Hvala Lepa

(Thank You)