

Advanced Computer Networking (ACN)

Exercise 1 – Intro

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Outline



Announcements

Bonus

How to get access?

ACN Infrastructure

Exercise

Tutorial 1

For questions and problems:

- Always use this mail address: acn@net.cit.tum.de
- If you have problems with our infrastructure / setup write us a mail

`creditsExercise` $\in [0, 60]$

`creditsProject` $\in [0, 10]$

`creditsExam` $\in [0, 75]$

`creditsBonus` = $\min(15, (\text{creditsExercise}/6 + \text{creditsProject}))$

$$\text{finalGrade} = \begin{cases} \text{grade}(\text{creditsExam} + \text{creditsBonus}) & , \text{ if } \text{grade}(\text{creditsExam}) \in [1.0, 4.0] \\ \text{grade}(\text{creditsExam}) & , \text{ otherwise} \end{cases}$$

Remarks:

- the bonus is valid for both the endterm and retake exam!
- the bonus of the previous semester is NOT valid for this semester!

How to get access?

- Every TUM student has an LRZ Gitlab account, use your LRZ ID to login (e. g. ta12xiz)
- We need to match you (especially your TUMonline account) to your Gitlab account
- For this we have a webservice:

<https://acn.net.cit.tum.de/auth>

- The website asks you to login both into TUMonline and Gitlab
- Once this was successful, you are granted access to the required Git repositories
- If this is not the case, let us know so we can help you
- Additionally, pos can fetch all ssh public keys you uploaded to Gitlab for ssh access to the testbed management host

You get access to these repositories:

- Your personal repository
- Material
- Template

TUMonline



GitLab



Getting access

1. Login to <https://acn.net.cit.tum.de/auth>
2. Login to <https://testbed.acn.net.cit.tum.de>
3. Go to: <https://testbed.acn.net.cit.tum.de/profile>
4. Press: "Fetch your SSH keys from GitLab"
5. Press: "Activate key"
6. After that you can login to the testbed via
`ssh -P 10022 s[gitlabid]@testbed.acn.net.cit.tum.de`

Hint

- Please ensure that you uploaded an SSH key to the LRZ GitLab here:
https://gitlab.lrz.de/-/user_settings/ssh_keys

How to use pos¹

In this example we use i1-router0 as the node to work on. We assigned a set of nodes to each student. Use an available node accordingly.

- Create a calendar event using the cli or the website <https://testbed.acn.net.cit.tum.de/calendar>
`pos calendar create i1-router0 -start now -duration 60`
- Create an allocation for the node
`pos allocations allocate i1-router0`
- Free a previously present allocation (from another student) `pos allocations free -k i1-router0`
- Configure the node to use the tutorial image `debian-bookworm-acn-tutorial`:
`pos nodes image i1-router0 debian-trixie-acn-tutorial`
- Reset the node so it reboots into an image including your personal keys
`pos nodes reset i1-router0`

¹ <https://testbed.acn.net.cit.tum.de/poscli/>

Listing 1: Exemplary SSH configuration file to access experiment nodes (usually located at ~/.ssh/config)

```
# Configuration to access the management host
Host testbed.acn.net.cit.tum.de
    Hostname testbed.acn.net.cit.tum.de
    User ugitlabUserID
    IdentityFile path/to/your/acn_key
    Port 10022

# Configuration to access a particular experiment node
Host *.acn
    ForwardAgent yes
    AddKeysToAgent yes
    HostName %h.net.cit.tum.de
    User root
    IdentityFile path/to/your/acn_key
    ProxyJump testbed.acn.net.cit.tum.de
    StrictHostKeyChecking no
    UserKnownHostsFile /dev/null
```

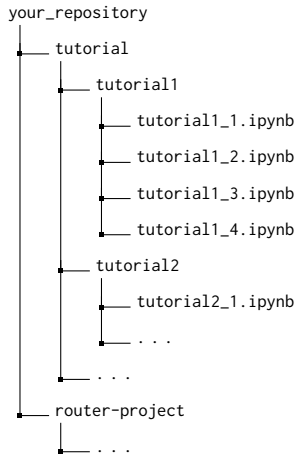
Connecting to the node and working on your exercise

- SSH into your router (i1-router0) from your device

ssh

root@i1-router0

Git Repository

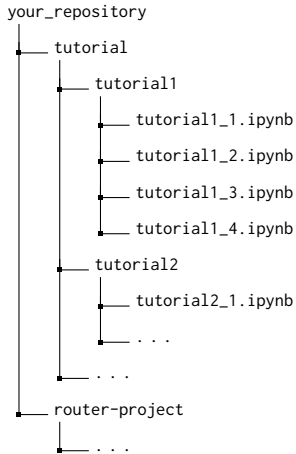


Connecting to the node and working on your exercise

- SSH into your router (i1-router0) from your device
 - Use a port forward of the remote port 1337 to a local port (e.g., 1337)

```
ssh -L 1337:localhost:1337
```

```
root@i1-router0
```

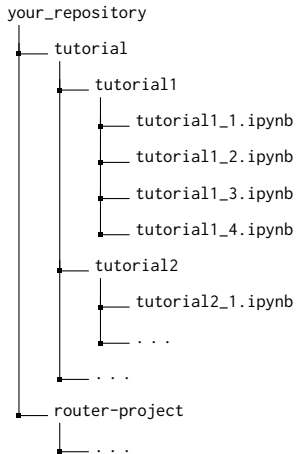
Git Repository

Connecting to the node and working on your exercise

- SSH into your router (i1-router0) from your device
 - Use a port forward of the remote port 1337 to a local port (e.g., 1337)
 - Use the [proxy jump](#) feature of ssh to directly access the node from your local machine
 - Check our ssh config in the instructions file

```
ssh -L 1337:localhost:1337 -J testbed.acn.net.cit.tum.de root@i1-router0
```

Git Repository



Connecting to the node and working on your exercise

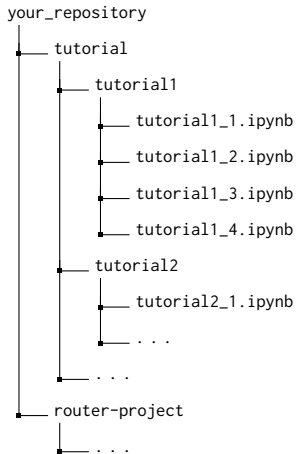
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```
ssh -L 1337:localhost:1337 -J testbed.acn.net.cit.tum.de root@i1-router0
```

- Clone your personal repository to the testbed node

```
git clone git@gitlab.lrz.de:acn/terms/2026ws/students/uGITLABID.git
```

Git Repository



Connecting to the node and working on your exercise

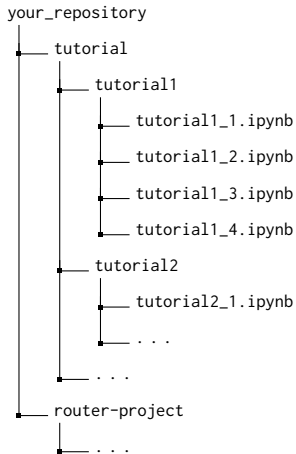
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- Access the Jupyter notebook in your browser from your laptop at:
<http://localhost:1337>

Git Repository



Exercise

Connecting to the node and working on your exercise

- SSH into your router (i1-router0) from your device
 - Use a port forward of the remote port 1337 to a local port (e.g., 1337)
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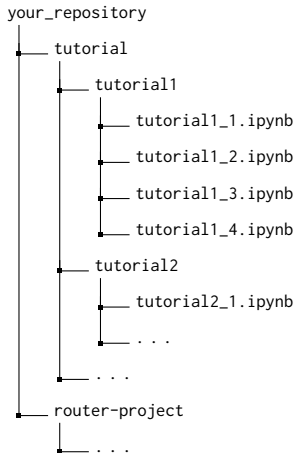
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ssh -L 1337:localhost:1337 -J testbed.acn.net.cit.tum.de root@i1-router0
```

- Clone your personal repository to the testbed node
`git clone git@gitlab.lrz.de:acn/terms/2026ws/students/uGITLABID.git`
- Access the Jupyter notebook in your browser from your laptop at:
`http://localhost:1337`
- Ensure you **commit and push** your Jupyter Notebook file regularly
[pos nodes are ephemeral](#) → [all content is lost after reboot](#)
[Your node will shut down after 12 hours](#)
- The CI configured for your ACN repository will fail if you do not adhere to the given project structure. [We do not grade your submission if it fails this check](#)

Useful Git and SSH Commands

- Merge resources into your repository
`git remote add template git@gitlab.lrz.de:acn/terms/2026ws/template.git`
`git remote update`
`git merge --allow-unrelated-histories template/tutorial`

Git Repository



Procedure

- Each tutorial consists of multiple Jupyter Notebook files (e.g. tutorial1_1.ipynb)
- You submit your solutions via Git before the deadline
- We present a solution approach in the lecture afterwards
- You can correct / update your submission accordingly (Do not just copy-paste the solution)
- We provide a solution eventually
- **The content of the exercise is part of the exam!**

Grading

- Probably 6 tutorial sheets, overall 60 bonus credits
- Both submissions are considered for the grading
- We provide the achieved credits after the correction via your Git repository
- Make sure your submission can be executed without errors
 - We do not fix syntax / runtime errors
 - If the notebook cannot be executed on the provided nodes → no credits

Academic Misconduct

- We check your submissions for plagiarism
- Violating the academic code of conduct results in exclusion from the bonus system
- This means the exercise **and** the project

Deadlines

Start	October 29, 14:00
First submission	November 5, 14:00
Exercise lecture	November 5, 14:00
Second submission	November 10, 16:00

October						
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

November						
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

Content

- Will be available on Thursday in the template Git (branch: tutorial)
 - tutorial/tutorial1/tutorial1_1.ipynb
 - tutorial/tutorial1/tutorial1_2.ipynb
 - tutorial/tutorial1/tutorial1_3.ipynb
 - tutorial/tutorial1/tutorial1_4.ipynb
- Contains short questions about SSH, Git, Jupyter Notebook and the spanning tree protocol