



Leibniz-Rechenzentrum  
der Bayerischen Akademie der Wissenschaften



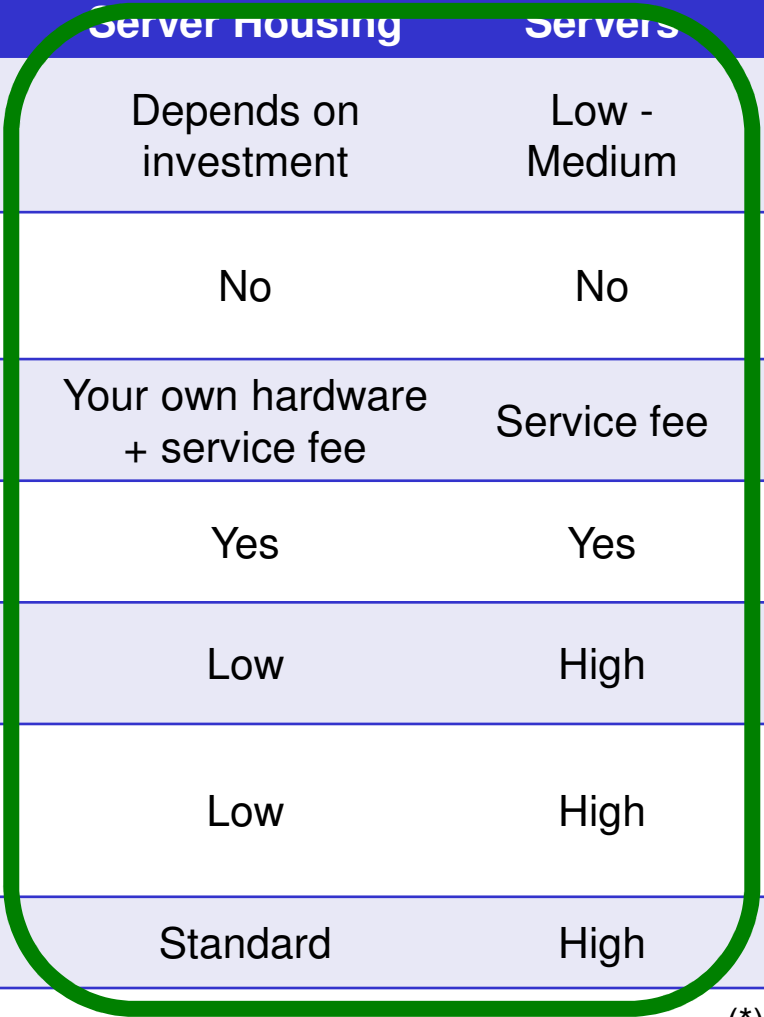
## Dedicated resources: Housing and virtual Servers

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# Comparison of computational services at LRZ

	SuperMUC	Linux-Cluster	Linux-Cluster Server Housing	Virtual Servers	HPC Cloud
<b>HPC capabilities</b>	Extreme	High	Depends on investment	Low - Medium	Low - Medium
<b>Formal proposal necessary</b>	Yes + HPC experience	No	No	No	No
<b>Cost Model</b>	Free	Free	Your own hardware + service fee	Service fee	Free (*)
<b>Dedicated resources</b>	No	No	Yes	Yes	Yes
<b>Flexible configuration</b>	Low	Low	Low	High	High
<b>IT System Know-How required</b>	Medium	Low	Low	High	High
<b>Reliability</b>	Standard	Standard	Standard	High	Standard





# Linux-Cluster Housing

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- **Basic idea**
  - You buy your own hardware and let LRZ run it as a part of the linux cluster
  - You have exclusive access to your part of the cluster
- **Cost model**
  - You buy and own the hardware
  - You pay a service fee to LRZ
  - Electricity and cooling is usually paid directly by the university
- **When to use?**
  - You like the linux-cluster and need dedicated resources

## Potential Advantages

- Systems operated by professionals in a data center
- Dedicating scientists to IT operations is not necessary - you can focus on science
- „Quick start“ and less risk compared to building your own cluster
- Complete and tested Linux-Cluster software stack is available
- Dedicated access to your own resources - no waiting

## Potential Difficulties

- You cannot show „your cluster“ to visitors
- Hardware type must be approved by LRZ
- System configuration is defined by LRZ
- While costs are competitive, it could be difficult to find a budget for them



# Linux-Cluster Attended Housing: Pricing

Item	Price
<b>Prerequisite: your own hardware</b>	
<b>One-time Setup per server</b>	100 Euro
Network connection to LRZ network	depending on # of 10 GigE ports
<b>Service fee per server per year</b>	368 Euro
<b>OS license (2 socket) per year</b>	20 Euro
<b>Rack space per rack unit per year</b>	20 Euro
<b>Power consumption</b>	In most cases paid directly by TUM or LMU

**Example #1:** 10 servers, quad-socket with 2 HE each: **4480 Euro per year**

**Example #2:** 30 servers, dual-socket with 1 HE each: **12240 Euro per year**



# Virtual Servers

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- **Basic idea**
  - You rent a virtual server from LRZ and do whatever you want with it (almost)
- **Cost model**
  - You pay a service fee to LRZ
- **When to use?**
  - You want to run a web server, web portal or a database with a connection to the internet
  - You need a simple, dedicated server as an alternative to working on your laptop

## Potential Advantages

- Your own virtual server
- Highly available and suitable for internet-facing portals and databases,
- Low cost: starts at 250 Euro per year per server
- All data transfers included
- Operating system is provided (Windows 2012 or SLES Linux)
- You can install any applications
- Very flexible: e.g., add more memory at any time

## Potential Difficulties

- Scaling for HPC applications is limited: 1-4 cores, max. 32 GB of RAM
- You cannot install your own operating system
- You have to maintain your own software – no access to linux-cluster applications or data



# Virtual Servers: Pricing for TUM & LMU

Item	Price
<b>One-time Setup</b>	100 Euro
<b>Base fee (per server per year)</b> including 1 vCPU, up to 4 GB RAM, up to 100 GB Disk	250 Euro
<b>Additional vCPU</b> (max. 4 total)	30 Euro per year
<b>Additional RAM per GB</b> (max. 32 GB total)	10 Euro per year
<b>Additional Disk per GB and year</b>	0,53 Euro per year

**Example #1:** small server 1 vCPU, 4 GB RAM, 100 GB Disk:

**250 Euro per year**

**Example #2:** large server 4 vCPUs, 32 GB RAM, 2000 GB Disk:

**1627 Euro per year**





## How to proceed?

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- If you are interested - please talk to us!
- Write to [servicedesk@lrz.de](mailto:servicedesk@lrz.de), include your phone number and we'll be glad to call you back and discuss your ideas and requirements