

# KVM performance tuning

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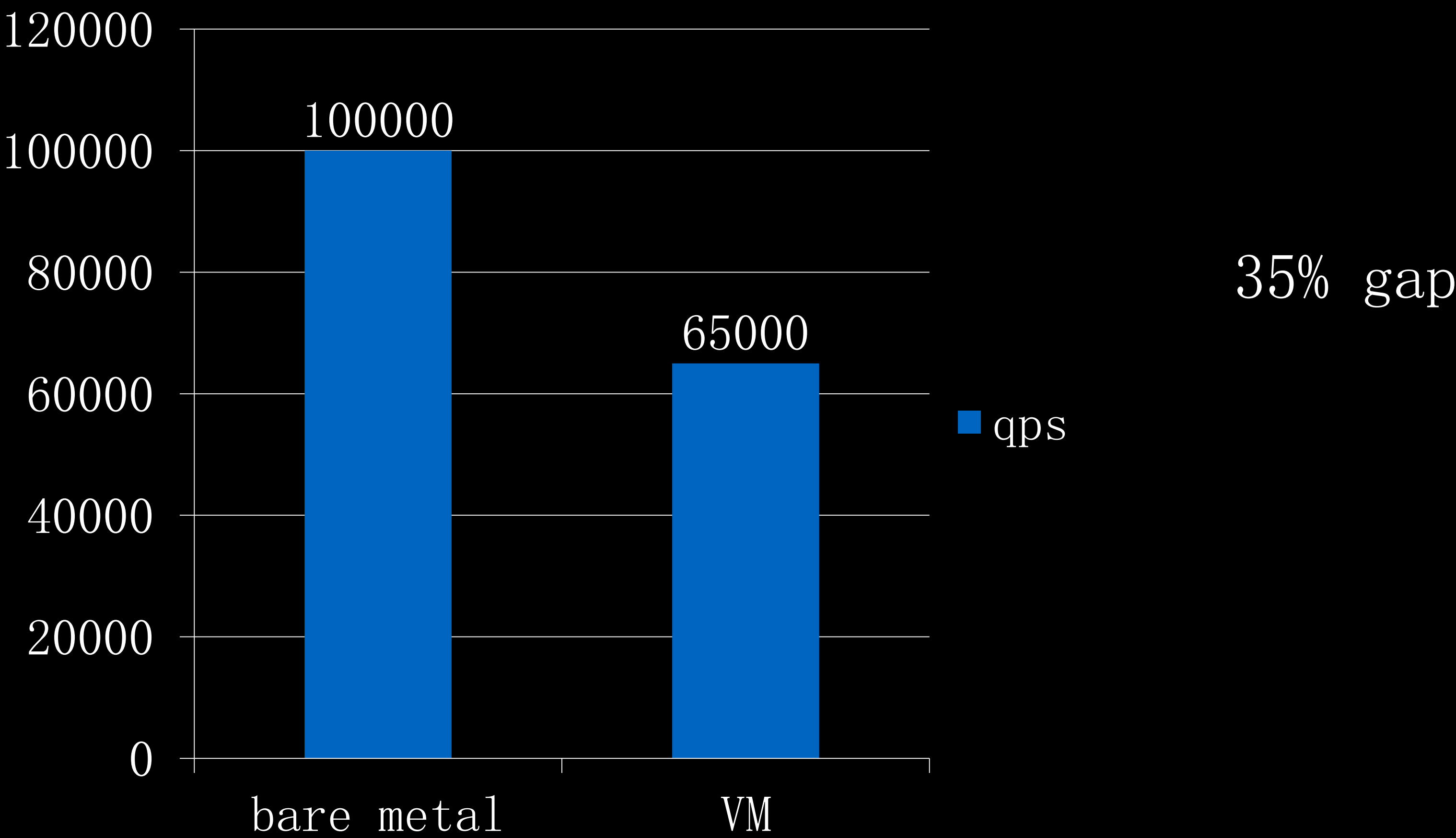
# Problems in KVM Cloud

- Alibaba Cloud: millions of VMs run in KVM
- Typical problems are observed from real scenarios
  - Idle latency
  - Timer
  - Scheduler

## Idle latency

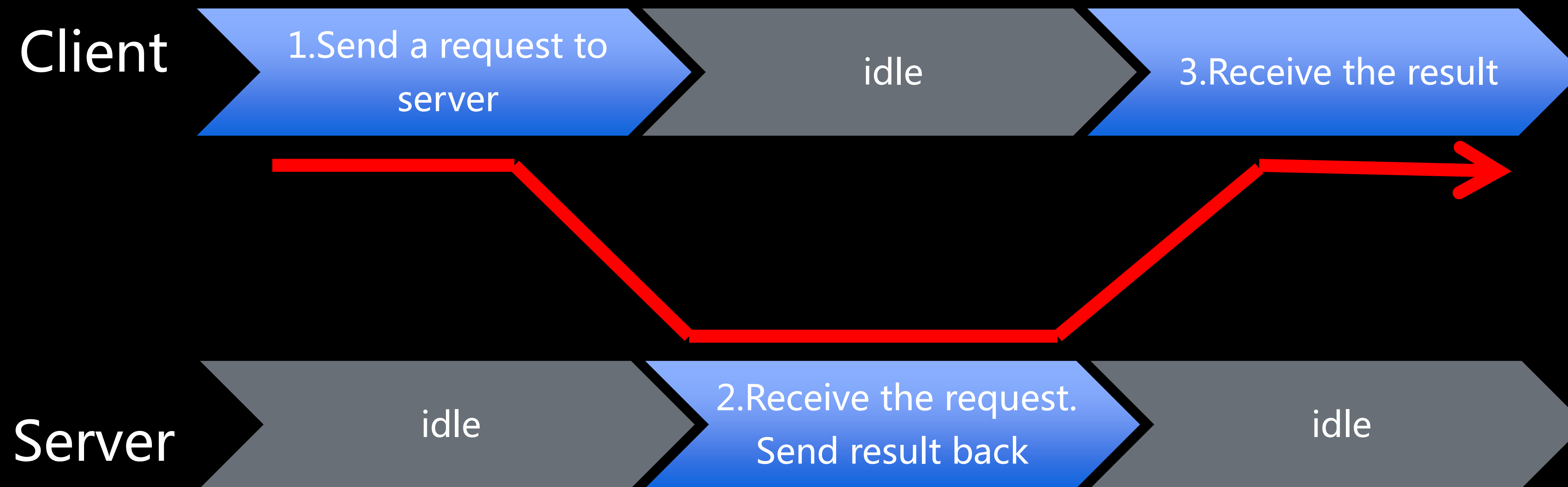
- Topic in KVM forum 2013: “KVM vs. Message Passing Throughput”
- Topic from David Matlack: Message Passing Workloads in KVM
- Cost in idle -> running and running -> idle transition is amplified in real businesses.

# Data of real business scenario (java)

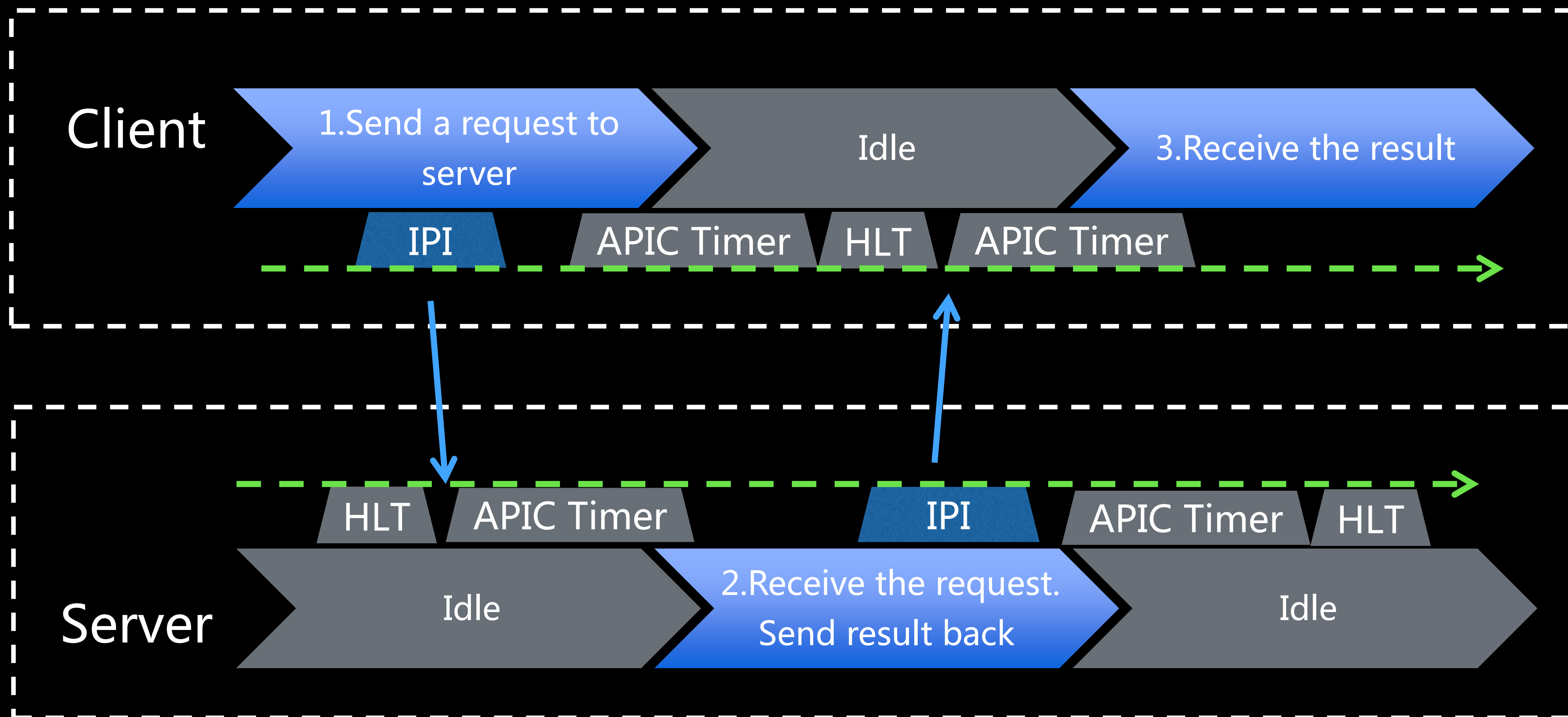


## Real Scenario

- Communication over the network



# Where is the Overhead?



Overhead from: IPI  
APIC Timer  
HLT

## Existing Solution

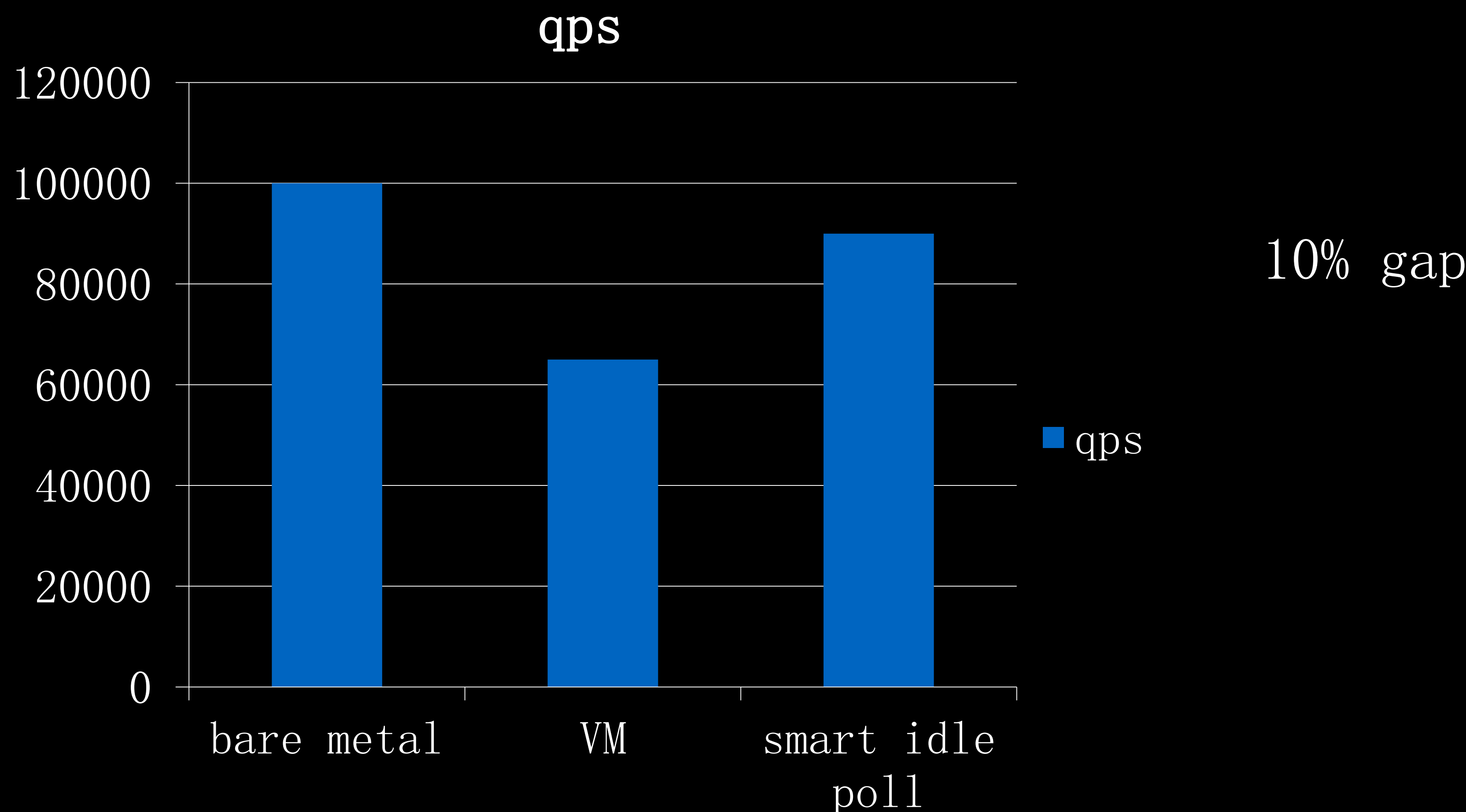
- Idle = Poll: Waste CPU cycle, hurt others performance(HT)
- Disable NOHZ: Not the default configuration in modern distros
- KVM halt polling : eliminate overhead of scheduler

## Our Solution – smart idle poll

- Poll inside VM: poll in idle path
  - Eliminate all overhead: IPI, TIMER, HLT
- Use dynamic poll to get better performance
  - Change the poll time based on the prediction
- RFC here <https://lkml.org/lkml/2017/8/29/279>



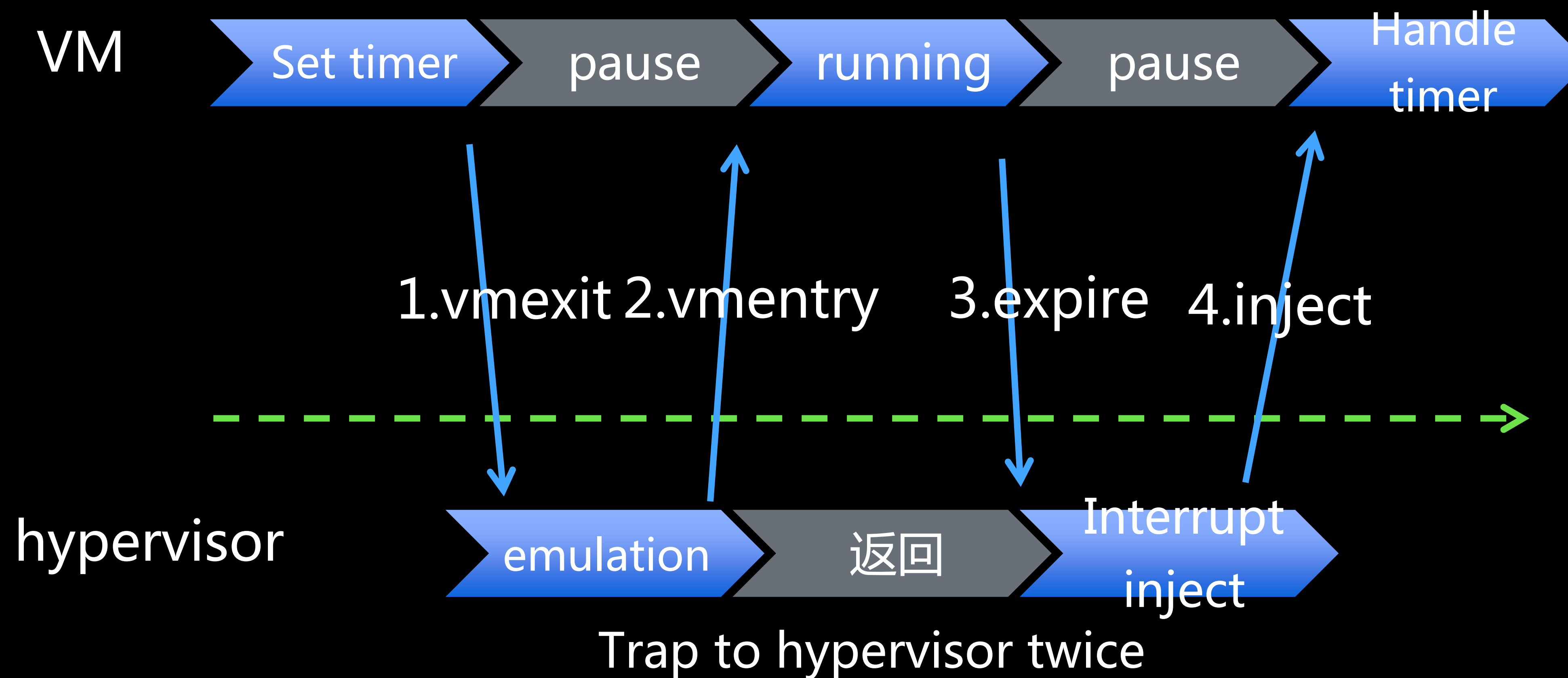
# Data of real business scenario (java)



# Fio 4k latency

	kvm halt poll=0 smart idle poll=0	kvm halt poll=100000ns smart idle poll=0	kvm halt poll=0 smart idle poll=100000ns	kvm halt poll=100000ns smart idle poll=100000ns
inject 1us	42.31us, stdev=3.54	31.98us, stdev=3.68	25.98us, stdev=3.37	25.95us, stdev=3.15
inject 20us	69.01us, stdev=4.79	53.74us, stdev=3.59	52.02us, stdev=3.38	46.94us, stdev=3.36
inject 50us	98.85us, stdev=3.66	84.25us, stdev=3.36	82.06us, stdev=9.36	77.41us, stdev=4.16

## Problem with Timer



# Exitless Timer

## New PV timer: Exitless Timer

- Share page: share timer info and sync info
- Agent timer: set timer in hardware

# Exitless Timer

- Share page:
  - Per vcpu share page between guest and kvm
  - Guest: store next timer info, read next sync info
  - KVM: set next timer in hardware, store next sync info

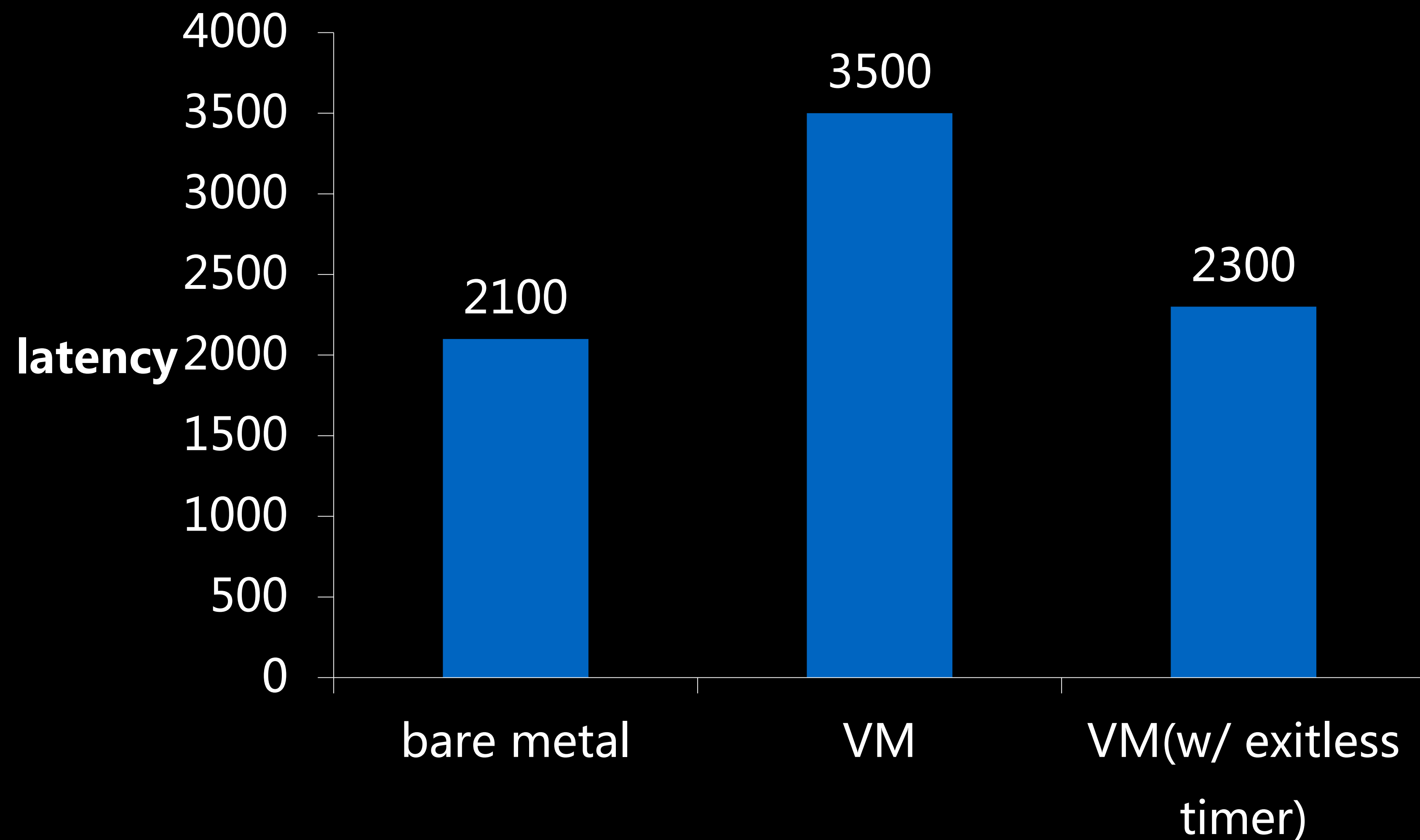
# Exitless Timer

- Agent timer:
  - Scan share page regularly
  - Set next sync time
  - Dedicate CPU

# Exitless Timer

- Timer inject:
  - Timer fire in another CPU
  - Inject interrupt thru PI: no vmexit

## Timer overhead ( ns )



Bare metal :  
Skylake +  
Centos7u2

VM :  
Skylake +  
Centos7u2



## Next Plan

- Resource isolation
  - Share low level resource impact performance:
    - Cache, Memory bandwidth, PCIE bandwidth
- RDT

# Thank You