



HIRP OPEN 2017

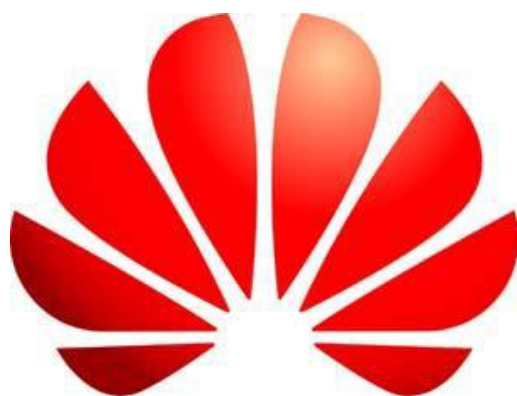
Operation System

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# Call for Proposals

**Operation System**

**HIRP OPEN 2017**



**HUAWEI**



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Application Deadline: 09:00 A.M., 16<sup>th</sup> June, 2017 (Beijing Standard Time, GMT+8).

If you have any questions or suggestions about HIRP OPEN 2017, please send Email

([innovation@huawei.com](mailto:innovation@huawei.com)). We will reply as soon as possible.



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## **HIRPO2017180501: Taming Cloud Tail Latency via Real-time Resource Scheduling**

- 1 Theme: OS**
- 2 Subject: Controlling Tail Latency in Cloud  
Computing Systems**

### **List of Abbreviations**

QoS	Quality of Service
VM	Virtual Machine
OS	Operating System
VMM	Virtual Machine Monitor

### **3 Background**

Existing cloud computing systems are unable to provide strong QoS guarantees to applications. This is due to 1) the complex interference among concurrent applications in a highly consolidated environment; and 2) the lack of support for timeliness guarantees from resource schedulers at various layers of the cloud stack. As a result, long tail latencies exhibit in many services hosted on cloud resources. This project is proposed to address the lack of QoS guarantees in cloud computing and the resulting long tail latencies in cloud services

## 4 Scope

This project will take a bottom-up approach to address the tail latency problem in cloud computing and provide strong QoS guarantees to cloud applications. In this approach, deadline-aware resource schedulers will be developed for the cloud system starting from the lower levels (VM guest OS and VMM) of the software stack. Moreover, cross-layer optimizations will be enabled across these different levels of schedulers to allow them collaboratively enforce the required QoS guarantees. The outcome of the project will be a new cross-layer, real-time cloud resource scheduling framework, RTVirt. It will be able to satisfy stringent QoS requirements from cloud applications while still provide efficient resource utilization. In particular, the project will consider one of the important cloud applications (memcached) as a case study to evaluate and demonstrate the effectiveness of RTVirt.

## 5 Expected Outcome and Deliverables

- RTVirt : A cross-layer, real-time resource scheduling framework for virtualized applications
- 1~2 Invention/paper;

## 6 Acceptance Criteria

The items under the delivery table will be checked for completeness.

## 7 Phased Project Plan

Phase No.	Phase description	Time( months )	Main task content	Output Standard that should achieve
1	Cross-layer scheduling	4	Develop RTVirt to support cross-layer	Ability to support periodic applications with strong



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			virtual resource scheduling	deadline guarantees (>99%) and efficient resource usage (<1% overhead)
2	Sporadic scheduling	4	Extend RTVirt to provide sporadic scheduling and support non-periodic applications	Ability to support non-periodic applications with strong deadline guarantees (>99%) and efficient resource usage (<1% overhead)
3	Case study	4	Extend RTVirt to support one of the important cloud services (e.g., memcached)	Ability to support real-world cloud applications (memcached) with strong QoS guarantees (>99%) and efficient resource usage (<1% overhead)

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## **HIRPO2017180502: Task Latency Modeling and scheduling Modeling**

**1 Theme: OS**

**2 Subject: LibOS**

### **List of Abbreviations**

QoS	Quality of Service
4G/5G	The fourth/fifth generation of wireless mobile telecommunications technology
OS	Operating System
CDT	C: the worst execution time, D: deadline, T: task cycle

### **3 Background**

Different business scenarios, the demand for latency is differentiation: base station 4G/5G flow dynamic adjust the wave trough, demand for computing resources dynamic adjustment; Mobile baseband, 4G/5G multimode concurrent processing business, need to meet the latency requirements of the business differentiation and the highest energy efficiency ratio at the same time; Storage services have different business which need different latency, at the same time, meeting the latency requirement need to maximize the sharing resources, improve resource utilization. OS requires providing business latency under the requirement of resource management model of flexible scheduling ability of latency, there are two major difficulties:

(1) How to ensure the flexible resource scheduling under ultra low latency, both to ensure low latency demands of the business, achieve the optimal resource utilization and best energy efficiency ratio at the same time.

(2) The deployment business is complex, different business latency appeal, it is difficult to through the way of manual adjustment priority scheduling strategy to meet business different latency demand.

## 4 Scope

Business-oriented build latency abstract template, providing service ability for users based on latency. System awareness and meet the demand of diversified business different latency, shielding business perception of system resources and making hardware to resources pooling, providing on-demand QoS scheduling.

Put forward two important innovation of the specific methods:

1. The latency perception programming framework: hardware resources abstract into distribution, recycling, query perceived latency of the application of resources, simplify application programming complexity.
2. The latency scheduling model: based on the latency abstract model of CDT, matching the best App - > threads- > core resources scheduling

## 5 Expected Outcome and Deliverables

We expect the outcome and deliverables as following:

- Latency programming model: Support abstracting task model, simplify programming. Provided under the multi-core efficient scheduling mechanism based on latency.
- 1~2 Invention/paper;



## 6 Acceptance Criteria

The items under the delivery table will be checked for completeness.

## 7 Phased Project Plan

Phase No.	Phase description	Time( months )	Main task content	Output Standard that should achieve
1	Event driven model and scheduling mechanism	4	provide a guarantee event-driven scheduling mechanism of latency	Ability to support periodic applications with strong deadline guarantees (>99%) and efficient resource usage (<1% overhead)
2	Abstracting task model	4	Provide task model under the multi-core abstract, such as: task, service, etc.	Ability to support non-periodic applications with strong deadline guarantees (>99%) and efficient resource usage (<1% overhead)
3	Case study	4	Extend Latency programming model to support one of the important products (e.g., mobile baseband)	Ability to support real-world realtime applications with strong QoS guarantees (>99%) and efficient resource usage (<1% overhead)

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**HIRPO2017180503: Exploration and investigation on  
next generation user interaction system**

- 1 Theme: OS**
- 2 Subject: Next Generation user Interaction system  
research**

### **List of Abbreviations**

QoS	Quality of Service
4G/5G	The fourth/fifth generation of wireless mobile telecommunications technology
OS	Operating System

### **3 Background**

One of most important technology for computer industry and ICT industry is about how human interact with computer. From keyboard, mouse, display and touch pad/touch screen play critical successful roles for evolution of computer. With all latest technology development and academic research progress. What is the key engine for next generation of computing era? Which factors, technologies or solutions will be fundamental for next wave consumer products and what technology will be best and will be widely adopted?

### **4 Scope**

We are open for this scope. Any key technologies, user interacting modeling methods and tools, any software or hardware prototype with strong

competition/strengths or concepts which can be demonstrated its cutting edge advantage are highly welcome.

## 5 Expected Outcome and Deliverables

Outcome will be discussed among Huawei internal ICT user interaction experts and researchers. And mainly will include but not limited to below parts:

- 5.1 Investigate next generation interaction mechanism from software and operating system perspective.
- 5.2 Exploration on future consumer electronics use cases, scenarios and what is the fundamental technology
- 5.3 What is key factors for natural, efficient and intelligent way of next generation of interaction? What is possible option paths to build a solid technical product and technology roadmap
- 5.4 Key technologies study, patent research on innovative interaction system Acceptance Criteria

The items under the delivery table will be checked for completeness.

## 6 Acceptance Criteria

The items under the delivery table will be checked for completeness.

## 7 Phased Project Plan

Phase No.	Phase description	Time( months )	Main task content	Output Standard that should achieve
1	User Interaction modelling, research and industry progress and	4	Summary report of user interaction competition report	Pass technical experts review



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	trend summary			
2	Focus areas identification	4	Investigation focus areas	Pass technical experts review
3	Solution and technical proposal	4	Proposal of technical investigation areas, key technical solutions and roadmaps	Pass technical experts review

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