Call for Proposals

Optical Technology

HIRP OPEN 2017

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

If you have any questions or suggestions about HIRP OPEN 2017, please send Email (innovation@huawei.com). We will reply as soon as possible.

Catalog

HIRPO2017030301: Traffic modeling of typical application in datacenter

1 Theme: Optical Technology

2 Subject: Datacenter Traffic Modeling

List of Abbreviations

DC: Datacenter

3 Background

In today's datacenters, the proliferation of modern computer applications such as cloud computing, big data, social networking, multi-media streaming and the Internet-of-Things creates vast amount of traffic loads across the datacenter networks. Importantly, more than 70% of this traffic is forecast to remain within the datacenter, representing high capacity east - west interactions between clusters. The unprecedented intra-datacenter traffic growth and the exploding bandwidth demands are rapidly outpacing the capacity of the existing electronic packet switching datacenter networks, thus motivating the datacenter interconnects to evolve towards more advanced network architectures. Optical switching network emerges as a promising alternative to the traditional datacenters, due to its ultra-high bandwidth capacity, optical transparency, low power consumption, high communication speed and high network connectivity.

In all-optical data center networking, to support on-demand high-capacity service provisioning, a flexible, scalable and bandwidth efficient datacenter network infrastructure needs to be developed. This in turn necessitates the need for an accurate, reliable and scalable data center traffic model, which

provides a basis for traffic scheduling and allows more efficient resource utilization. Traffic characterization and modelling plays a crucial part, as the dynamics in traffic patterns have significant impacts on service quality of datacenter applications. However, most recently DC optical architectures are simulated with Poisson traffic model, which is a simple and widely used stochastic process for modeling the times at which arrivals enter a system. And they are simulated together with all-to-all uniform traffic pattern where traffic demands are uniformly distributed across all servers. But Poisson model and all-to-all uniform pattern is significantly different from the most kind of real DC application traffic patterns, and the simulation results based on these simple models can't represent performance of DC optical network under real DC application scenario. Therefore, when designing a datacenter interconnection network, it is of importance to evaluate the network architecture under realistic communication patterns so as to ensure the robustness and reliability of the network architecture to typical traffic requirements in datacenters.

Hence, we should build mathematical models of typical DC applications such as cloud computing, big data, social networking, multi-media streaming and the Internet-of-Things to numerically characterize the basic behavioral processes in the datacenter traffic flows, that is flow sizes, flow inter-arrival times, flow distribution across the network and so on. Then translate the traffic models of typical DC applications into traffic simulators respectively, and generate traffic flows of real DC applications respectively to evaluate optical datacenter networks performance in simulations and evaluations.

4 Scope

1) Traffic collection, modeling and generation for web search application like google and baidu.

2) Traffic collection, modeling and generation for social networking application such as WeChat and Facebook.

3) Traffic collection, modeling and generation for public cloud application such as Amazon web services, Google cloud, Windows Azure etc.

4) Traffic collection, modeling and generation for multi-media streaming such as video on demand.

Traffic modeling and generation of other kinds of typical DC application is also welcome.

Traffic collection, modeling and generation includes following activities**:** collect adequate typical DC applications traffic traces; analyze the real traces to explore DC traffic characteristics such as packet size and rate, bandwidth and latency requirements. Build mathematical models based on the traffic characteristics to faithfully represent real DC traffic in the context of single application or multiple business fusion scenarios. Translate mathematical models into traffic simulator, which can generate traffic flows of DC to support DC network performance testing and verification.

5 Expected Outcome and Deliverables

1) An accurate, reliable datacenter traffic model which captures the characteristics of web search traffic streams; an accurate and effective simulator which reproduce web search traffic flows; technical report which describes completed design of the above traffic model; source code of above traffic model and simulator;

2) Traffic model of social networking application traffic streams; generate the corresponding traffic simulator; technical report of this traffic model, source code of this traffic model and simulator;

3) Traffic model of public cloud application traffic streams; simulator of public cloud application traffic flows; technical report of this traffic model, source code of this traffic model and simulator;

4) Traffic model of video on demand traffic streams; simulator of video on demand traffic flows; technical report of this traffic model, source code of this traffic model and simulator

6 Acceptance Criteria

The traffic simulators can generate accurate and realistic data center traffic flows of the given application to support DC network system testing and verification. The document will be reviewed by HUAWEI accepted team.

7 Phased Project Plan

Phase1 (~2 months): traffic data collection a.k.a capture adequate traffic traces of real DC network application, such as Google and Baidu web search, WeChat and Facebook, public cloud application, and video on demand. Traffic data collection is the base of following traffic characterizing and modeling work. Some effective monitoring tools may be used to capture the whole spectrum of traffic activity without distortion.

Phase2 (~5 months): data analysis and DC traffic modeling. Analyze DC traffic traces and use statistical or other approaches to build four fine-grain traffic models for the four typical kinds of DC applications respectively to accurately represent real DC traffic characteristics.

Phase3 (~5 months): simulator verification. Develop four traffic simulators to generate DC traffic flows of 4 kinds of typical DC applications respectively based on traffic models. Evaluate and validate the traffic models by testing simulator generated traffic against real DC traffic traces collected.

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HIRPO2017030302: Design and analyze of delayed bit interleaved coded modulation

1 Theme: Optical Technology

2 Subject: Coded Modulation Techniques

List of Abbreviations

BICM: Bit Interleaved Coded Modulation

DBICM: Delayed Bit Interleaved Coded Modulation

3 Background

BICM is a rather pragmatic approach to combine channel coding and modulation. In BICM the channel code and modulation can be designed separately and then combined with an interleaver between them. In general, transmitted signals in BICM convey information about bits from the same codeword. Recently, a new coded modulation scheme called Delayed-BICM (DBICM) [1] was proposed, which generalizes BICM with the mapping of different delayed codewords onto the same signal point. It was shown that DBICM can improve BICM for 8 point constellations.

However, to enhance the attainable spectral efficiency, high order modulation is usually required. Design an optimized DBICM with high order modulation is a challenge.

[1] "Delayed Bit Interleaved Coded Modulation", IEEE Int. Symp. Turbo Codes and Iterative Information Processing (ISTC), 2014.

4 Scope

1) Design rules of DBICM: Analyze the impact of grouping and labeling on DBICM with higher order QAM. Providing theoretical guidance for designing and implementing practical DBICM of a given soft/hard decision FEC scheme.

2) Design an optimized FEC for DBICM: DBICM can be considered a coupling technique to concatenate FEC code in the two-dimensional signal constellation domain. How to design FEC codes to take the full advantages of DBICM scheme?

3) Constellation labeling for DBICM: DBICM has been shown to outperform BICM for constellations for which Gray mapping is not feasible. Consequently labeling rules that minimize the bit error rate of DBICM constellations for high spectral efficiency QAM constellations are required.

5 Expected Outcome and Deliverables

- Technical reports of design rules of DBICM with high order modulation;
- Software package that can help to generate an optimized labeling and grouping of DBICM;
- Simulation platform and source c/c++ codes with detail description;
- 1~2 papers;

6 Acceptance Criteria

Project proposal is accepted by the evaluation team, Huawei.

Project deliverables are accepted by the evaluation team, Huawei.

The designed DBICM scheme outperform BICM about 0.5 dB.

7 Phased Project Plan

Phase1 (~3 months): analyze the impact of grouping and labeling of the constellation on the performance of DBICM and provide the related technical report.

Phase2 (~5 months): design DBICM with high order modulation and provide the related technical report.

Phase3 (~4 months): design a new DBICM scheme using hard-decision decoding and provide related algorithms, simulation results and patents.

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HIRPO2017030303: Modeling and simulating laser beam propagation at 1550 nm through atmospheric turbulence channel

1 Theme: Optical Technology

2 Subject: Free Space Optics

List of Abbreviations

NA

3 Background

Free-space optical (FSO) communication is an optical communication technology that uses light propagating in free-space to enable wireless data transmission. It has advantages of high bit rate, low loss, and license-free with respect to radio communication. Also it has advantages of low cost and easy deployment in comparison with fiber-optic communication.

Atmospheric transmission medium is the environment for the operation of FSO links. Typical channel effects, such as atmospheric attenuation, beam diffraction, and atmospheric turbulence influence the signal-carrying beams. Of special importance is atmospheric turbulence, which can significantly degrade the performance of FSO links, particularly over ranges of the order of 1 km or longer. Inhomogeneities in the temperature and pressure of the atmosphere lead to variations of the refractive index along the transmission path. These index inhomogeneities can deteriorate the beam quality at the receiver and can cause fluctuations in both the intensity and the phase of the received signal. Thus, modeling and simulating laser beam propagation through atmospheric turbulence channel is quite valuable for system design

and performance assessment of FSO links. This is of particular interest at optical wavelengths of around 1550 nm, due to low atmospheric attenuation (one of transmission spectral windows of atmosphere) and commercial availability of high-bandwidth optical components.

4 Scope

The project involves modeling and simulating the laser beam propagation at around 1550 nm (1500 nm~1600 nm) through atmospheric turbulence channel. Detailed information includes, but not limited to, the following:

1) Build models to accurately describe propagation behavior of optical beams at around 1550 nm (1500 nm~1600 nm) for both horizontal and vertical atmospheric channels. After propagation over a long distance (1 km ~ 50 km) in a typical terrestrial or vertical FSO scenario, the models should provide detailed information of the received optical beam, including:

- Intensity distribution and beam size
- Intensity fluctuation (scintillation)
- Phase fluctuation and wave-front distortion
- Angle of arrival fluctuation
- Beam wander

2) Simulate laser beam propagation at around 1550 nm (1500 nm ~ 1600 nm) through atmospheric turbulence channel:

- Build simulation platform with the built models
- Export detailed intensity distribution and beam size/intensity fluctuation/phase fluctuation and wave-front distortion/angle of arrival

fluctuation/Beam wander of the received optical beam by substituting given parameters into the platform, such as beam waist, wavelength and linewidth, propagation distance, temperature and pressure of atmosphere, etc.

5 Expected Outcome and Deliverables

- Comprehensive models of laser beam propagation around 1550 nm (1500 nm ~ 1600 nm) through atmospheric turbulence channel
- Related simulation platform with source codes, descriptions, and detailed parameters

6 Acceptance Criteria

The intensity profiles and beam scintillations predicted by the models and simulation platform show good consistency with experiment results in published papers. The deviation should be less than 20%.

The angle of arrival fluctuations and beam wonders predicted by the models and simulation platform agree well with experiment results in published papers. The deviation should be less than 20%.

The phase fluctuations and wave-front distortions predicted by the models and simulation platform are in good agreement with experiment results in published papers. The deviation should be less than 20%.

7 Phased Project Plan

Phase 1 (~5 months): Build models to accurately describe propagation behavior of optical beams at around 1550 nm (1500 nm~1600 nm) for both horizontal and vertical atmospheric channels.

Phase 2 (~7 months): Simulate laser beam propagation at around 1550 nm

(1500 nm~1600 nm); optimize the models and simulation to give precise predictions.

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HIRPO2017030304: Optimal labeling rule for concatenating N consecutive signals carrying n bits

1 Theme: Optical Technology

2 Subject: Coded Modulation Techniques

List of Abbreviations

NA

3 Background

An arbitrarily *M*-points constellation signal can carry at most $m = \log_2(M)$ bits. However, only an integer number of bits ($<\lfloor m \rfloor$) can be carried by each individual symbol. A super symbol, which concatenated by *N* consecutive symbols, can relax this constrain. These *N* consecutive symbols can carry an arbitrarily integer number of bits *n*, where $n < \lfloor N * m \rfloor$. Comparing to traditional rate adaptive coded modulation scheme, this method provide an alternatives to offer rate adaptive capability. The labeling rule of *n* bits among *N* consecutive *M*-points symbols is critical to the performance.

4 Scope

Research on the design methodology of labeling rule:

Develop a design guidelines and methodology on label rule of *n* bit among *N* consecutive *M*-points symbols. The label rule should be optimized w.r.t. BER performance. The complexity of algorithm generating the optimized labeling rule for large *M*, *n* and *N* of arbitrary *M*-points constellation should be in polynomial time.

5 Expected Outcome and Deliverables

Technical reports of the design methodology;

Software package to generate an optimized labeling rule of arbitrarily M, n and N;

6 Acceptance Criteria

- Project proposal is accepted by the evaluation team, Huawei.
- Project deliverables are accepted by the evaluation team, Huawei.
- Provide optimized labeling rule of some typical value of M, n and N.

7 Phased Project Plan

Phase1 (~3 months): Investigate the parameters and factors which affect the performance of the labeling, build the evaluation function of the labeling and provide the related technical report.

Phase2 (~6 months): Develop a label generation algorithm to generate the labeling with the best value of the evaluation function for arbitrary M and n across N consecutive symbols, provide the related technical report, source codes and simulation results.

Phase3 (~3 months): Develop a label modification algorithm to optimize the existing labeling of some typical M, n and N to get a better evaluation value, provide the related technical report, source codes and simulation results.

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HIRPO2017030401: 56G/112G electro-optical interconnect simulation and test technology

1 Theme: Optical Technology

2 Subject: Electro-Optical interconnect simulation and test Technology

List of Abbreviations

EO	electro-optical
PPG	Pulse pattern generator
BER	bit error rate

3 Background

Data center short distance optical interconnection requirements from 25G will accelerate to 56G/112G, short-distance optical interconnection industry are currently focused on two technologies: Silicon photonics technology and LnP technology, the high speed performance challenge for 56G/112G is very big, need to estimate the 56G/112G electro-optical high speed BER performance and feasibility for production

4 Scope

Research on 56G/112G electro-optical simulation:

design and simulation base on 56G/112G high bandwidth modulator, investigate the parameters and factors which affect the E-O S12 on different bias current

Research on 56G E-O-E high-speed interconnection:

based on the electro-optical modulator, design optical interconnection test EVB, test and analyze the relationship between optical parameter affect the BER (e.g.: EO bandwidth. PI curve)

5 Expected Outcome and Deliverables

56G/112G optical interconnection EVB;

Technical reports of 56G/112G optical interconnection BER simulation and test;

1~2 Invention/patents;

6 Acceptance Criteria

Project proposal is accepted by the evaluation team, Huawei.
Project deliverables are accepted by the evaluation team, Huawei.
EO bandwidth > 30GHz@3dB
E-O-E short optical connection BER <1e-12 (12 hours, 70m MMF)

7 Phased Project Plan

Phase1 (~3 months): Research current situation of the high-speed short-distance optical interconnect technology in the industry, analyze 56G/112G optical interconnection key technology and challenges, provide industry analysis report
Phase2 (~5 months): Based on the commercial optical modulator, or design

new high-speed optical modulator, test the performance of the modulator, develop 56G/112G EVB, set up the high-speed optical interconnection environment and test the BER by PPG, analysis of the impact of BER key design technology, output the simulation and the test report.

Phase3 (~4 months): Research on high speed optical interconnection test results and patents.

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HIRPO2017030402: Large FOV Visible Wavelength Planar Waveguide in Display System

1 Theme: Optical Technology

2 Subject: Image Display Technology

List of Abbreviations

NA

3 Background

Planar waveguide is an important solution in AR glass application. However, the field of view (FOV) is confined due to the limited thickness and size, and multiple-reflective-surface-coupling planar waveguide is a key promising technique to enlarge the FOV. Meanwhile, the stray light is strong due to multi-reflective surface. In order to solve the issue, angle-selective multi-layer coating is designed to eliminate the reflected light. In addition, it is important to coupling light into the waveguide from the optical engine and the coupling structure for the engine and waveguide should be considered in the initial design.

4 Scope

Simulate the multiple-reflective-surface-coupling planar waveguide, including the coating information and provide the simulation report; the performance should satisfy the requirement as below: FOV >40 degree (diagonal, 16:9), MTF >0.3@100 lp/mm, uniforminity >60%, outer transmission efficiency (light from environment) >50%, inside transmission efficiency (light from optical engine)>10%;

Fabricate and coating the planar waveguide, and the eye box of the waveguide should be larger than 10mm*10mm ;

Provide 5 samples at least with the test results, including FOV, outer/inside transmission efficiency;

5 Expected Outcome and Deliverables

We are expecting to get below deliverables through this project:

Simulation report and file of the design;

5 samples and test report;

One patent at least.

6 Acceptance Criteria

Simulation report and design file should meet the requirement;

Samples :FOV >40 degree and outer transmission efficiency >50%;

One patent at least.

7 Phased Project Plan

Phase1 (~3 months): simulation of the planar waveguide, including the coating information;

Phase2 (~7 months): Fabrication, test samples and provide patent.

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HIRPO2017030801: Single Carrier above 800 Gbit/s Transmission Research

1 Theme: Optical Technology

2 Subject: High speed transmission

List of Abbreviations

DWDM: Dense Wavelength Division Multiplexing

3 Background

The relentless need to increase the binary throughout per carrier and the spectral efficiency of fiber optic communication systems is driving a sustained growth of transponder's bandwidth and signaling rate.

4 Scope

Analysis and research of Single Carrier above 800 Gbit/s Transmission(100m,500m,2km,10km,40/80km etc)

5 Expected Outcome and Deliverables

The theoretical analysis, technical status description, the corresponding technical analysis report and detailed design proposal.

6 Acceptance Criteria

Project proposal is accepted by the evaluation team, Huawei.

Project deliverables are accepted by the evaluation team, Huawei.

7 Phased Project Plan

Phase1 (~1 month): The analysis of technology status.

Phase2 (~10 months): Provide the corresponding technical analysis report and detailed design proposal.

Phase3 (~12 months): The simulation and results verification

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HIRPO2017030802: ROF Research

1 Theme: Optical Technology

2 Subject: High speed transmission

List of Abbreviations

ROF: Radio over Fiber

3 Background

RoF technology combines the optical fiber and wireless technology. The low attenuation and almost unlimited bandwidth advantages of optical fiber technology meet the need of high speed, high frequency millimeter-wave's long distance transmission, and the wireless technology provides a convenient access way in user terminal. Nowadays, RoF technology focuses on the generation of millimeter-wave signal, long distance transmission and demodulation technology more and more.

4 Scope

The scope and/or target meet one of the following:

1) Analysis and research of ROF which will cover V/W band

2) Low cost, high speed (more than 5 Gbps) access systems based on ROF

5 Expected Outcome and Deliverables

The theoretical analysis, technical status description, the corresponding technical analysis report and detailed design proposal.

6 Acceptance Criteria

Project proposal is accepted by the evaluation team, Huawei.

Project deliverables are accepted by the evaluation team, Huawei.

7 Phased Project Plan

Phase1 (~1 month): The analysis of technology status.

Phase2 (~10 months): Provide the corresponding technical analysis report and detailed design proposal.

Phase3 (~12 months): The simulation and results verification.

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HIRPO2017030803: OAM Research

1 Theme: Optical Technology

2 Subject: High speed transmission

List of Abbreviations

OAM: orbital angular momentum

3 Background

In recent years, to meet the demand of the growth of the mobile data service, urgently need to be more efficient and intelligent new generation of high-speed wireless mobile communication technology, to further improve the system capacity and spectrum efficiency. Orbital angular momentum (OAM) as a reuse technology in wireless communication gradually becomes a research hot topic. Theoretically, the OAM states value for one photonic infinite, and the values vary from negative infinity to positive infinity. Furthermore, different OAM states are mutually orthogonal. Due to these properties, OAM states attract a lot of attention recently.

4 Scope

The scope and/or target meet one of the following:

1) Analysis and research of the application of OAM in signal processing and transmission;

2) Analysis and research of the photoelectric device which used in the OAM transmission.

5 Expected Outcome and Deliverables

The theoretical analysis, technical status description, the corresponding technical analysis report and detailed design proposal.

6 Acceptance Criteria

Project proposal is accepted by the evaluation team, Huawei.

Project deliverables are accepted by the evaluation team, Huawei.

7 Phased Project Plan

Phase1 (~1 month): The analysis of technology status.

Phase2 (~10 months): Provide the corresponding technical analysis report and detailed design proposal.

Phase3 (~12 months): The simulation and results verification.

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HIRPO2017030804: The technical study on the large size InP wafer

1 Theme: Optical Technology

2 Subject: Wafer

List of Abbreviations

InP：Indium Phosphide

OEIC：Optoelectronic Integrated Circuit

3 Background

In order to reduce the cost of the chip, it's useful to increase the size of InP wafer.

4 Scope

The technical study on the large size (4~6")InP wafer

5 Expected Outcome and Deliverables

Point to the large size InP wafer, the theoretical analysis, technical status description, the corresponding technical analysis report and detailed design proposal.

6 Acceptance Criteria

Project proposal is accepted by the evaluation team, Huawei.

Project deliverables are accepted by the evaluation team, Huawei.

7 Phased Project Plan

Phase1 (~1 months =): The analysis of technology status.

Phase2 (~10 months): Provide the corresponding technical analysis report and detailed design proposal.

Phase3 (~12 months): The simulation and results verification.

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HIRPO2017030805: The technical study on the material which will be used in the MZ modulator

1 Theme: Optical Technology

2 Subject: High speed Optoelectronic Devices

List of Abbreviations

MZ: Mach-Zehnder interferometer

3 Background

Electro-optic modulator is one of the key components of the optical communicating system. As the rapid development of IT and continuous demand of communication bandwidth, Traditional modulator has obviously become an bottleneck of the communication bandwidth.

4 Scope

The technical study on the material which will be used in the MZ modulator, such as: graphene, polymer, plasmonic, organic-inorganic hybrid materials, Si, GeSi, InP, LiNbO3 etc.

5 Expected Outcome and Deliverables

The theoretical analysis, technical status description, the corresponding technical analysis report and detailed design proposal.

6 Acceptance Criteria

Project proposal is accepted by the evaluation team, Huawei.

Project deliverables are accepted by the evaluation team, Huawei.

7 Phased Project Plan

Phase1 (~1 month): The analysis of technology status.

Phase2 (~10 months): Provide the corresponding technical analysis report and detailed design proposal.

Phase3 (~12 months): The simulation and results verification.

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HIRPO2017030806: The technical study on the OEIC

1 Theme: Optical Technology

2 Subject: OEIC

List of Abbreviations

SOI：silicon on insulation

OEIC：Optoelectronic Integrated Circuit

3 Background

Opto-electronic integrated circuit (OEIC) integrates optoelectronic components and electronic components onto one chip. It has the advantages of small size, cost-effective and high reliability, and will be very widely used in the optical communication.

4 Scope

The scope and/or target meet one of the following:

1) Monolithic opto-electronic integrated circuit(MOEIC)

2) Si Photonic Devices

3) InP Photonic Devices

5 Expected Outcome and Deliverables

The theoretical analysis, technical status description, the corresponding technical analysis report and detailed design proposal.

6 Acceptance Criteria

Project proposal is accepted by the evaluation team, Huawei.

Project deliverables are accepted by the evaluation team, Huawei.

7 Phased Project Plan

Phase1 (~1 month): The analysis of technology status.

Phase2 (~10 months): Provide the corresponding technical analysis report and detailed design proposal.

Phase3 (~12 months): The simulation and results verification.

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HIRPO2017030807: Laser Research

1 Theme: Optical Technology

2 Subject: High speed Optoelectronic Devices

List of Abbreviations

DML: direct modulate laser

EML: electro-absorption modulate laser

3 Background

DML/EML is the most critical devices of the optical communication transmission systems.

4 Scope

The scope and/or target meet one of the following:

1) DML which bandwidth will be more than 25 GHz

2) EML which bandwidth will be more than 56 GHz

3) Industrial DML(temperature:-45~90 Celsius degree)

5 Expected Outcome and Deliverables

The theoretical analysis, technical status description, the corresponding technical analysis report and detailed design proposal.

6 Acceptance Criteria

Project proposal is accepted by the evaluation team, Huawei.

Project deliverables are accepted by the evaluation team, Huawei.

7 Phased Project Plan

Phase1 (~1 month): The analysis of technology status.

Phase2 (~10 months): Provide the corresponding technical analysis report and detailed design proposal.

Phase3 (~12 months): The simulation and results verification.

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HIRPO2017030808: Optical Receivers Research

1 Theme: Optical Technology

2 Subject: High speed Optoelectronic Devices

List of Abbreviations

APD: avalanche photodiode

3 Background

An optical-to-electrical (O/E) signal interface device is a key element of these systems, and a photodiodes (PD) is widely used as the O/E device for various applications. In general, bandwidth and quantum efficiency are important figures of merit for high-speed PDs in optical communication systems.

4 Scope

The scope and/or target meet one of the following:

1) A photodiodes which bandwidth will be more than 100 GHz(-3dB)

2) PIN/APD which baud rate will be more than 56 GHz

5 Expected Outcome and Deliverables

The theoretical analysis, technical status description, the corresponding technical analysis report and detailed design proposal.

6 Phased Project Plan

Phase1 (~1 month): The analysis of technology status.

Phase2 (~10 months): Provide the corresponding technical analysis report and

detailed design proposal.

Phase3 (~12 months): The simulation and results verification.

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HIRPO2017030809: The technical study on the light source

1 Theme: Optical Technology

2 Subject: High speed Optoelectronic Devices

List of Abbreviations

VCSEL: vertical-cavity surface-emitter laser

3 Background

Light source is one of the key components of the optical communicating system.

4 Scope

The scope and/or target meet one of the following:

1) The narrow line width laser which output will cover C+L band

2) The low power dissipation, high power output (20dBm), the narrow line width laser which output will cover C band

3) The 1310/1550 nm VCSEL

5 Expected Outcome and Deliverables

The theoretical analysis, technical status description, the corresponding technical analysis report and detailed design proposal.

6 Acceptance Criteria

Project proposal is accepted by the evaluation team, Huawei.

Project deliverables are accepted by the evaluation team, Huawei.

7 Phased Project Plan

Phase1 (~1 month): The analysis of technology status.

Phase2 (~10 months): Provide the corresponding technical analysis report and detailed design proposal.

Phase3 (~12 months): The simulation and results verification.

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HIRPO2017030810: QDL Research

1 Theme: Optical Technology

2 Subject: High speed Optoelectronic Devices

List of Abbreviations

QDL: Quantum dot laser

3 Background

Quantum dot laser (QDL) shows lower threshold current, better higher temperature performance, and higher power efficient than quantum well laser and quantum wire laser, which have potential application in the next generation optical network.

4 Scope

The scope and/or target meet one of the following:

1) Analysis and research of high qualification QD epitaxy wafer

2) C-band QDL design and realization

3) Fiber amplifier or semiconductor optical amplifier based on QD technology

5 Expected Outcome and Deliverables

The theoretical analysis, technical status description, the corresponding technical analysis report and detailed design proposal.

6 Acceptance Criteria

Project proposal is accepted by the evaluation team, Huawei.

Project deliverables are accepted by the evaluation team, Huawei.

7 Phased Project Plan

Phase1 (~1 month): The analysis of technology status.

Phase2 (~10 months): Provide the corresponding technical analysis report and detailed design proposal.

Phase3 (~12 months): The simulation and results verification.

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