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Cisco Expo 2010

24.-26. ožujka 2010.

Hotel Le Méridien Lav Split

Kolaboracija -  
nova snaga poslovne suradnje



welcome to the human network. CISCO



Cisco Expo  
2010

# Implementacija CRS-1 usmjerivača u okosnicu mreže

Kolaboracija -  
nova snaga poslovne suradnje



**Goran Stjepanović, T-HT**

**Goran Sokol, T-HT**

**Mario Pešut, RECRO-NET**



# Agenda

- Recro-Net d.o.o.
- T-HT Hrvatski Telekom
- Projektni koraci
- Topologija mreže
- Testiranja
- Buduća topologija mreže
- Pitanja i odgovori

# RECRO-NET

- Više od 130 zaposlenika
- Cjelovita ICT rješenja za krajnje korisnike
- Partner vodećih svjetskih proizvođača informatičke opreme
- Preko 300 stručnih certifikata
- 200+ korisnika u regiji



# RECRO-NET – portfolio usluga

- Sistem integracija
- Usluge i rješenja za IP umrežavanje
  - 12 CCIE inženjera, najviše u RH
- Edukacijski centar
  - jedini Cisco Learning partner u RH
- Poslovna rješenja
  - ERP, CRM
- Rješenja za povećanje sigurnosti
- Partnerstvo s proizvođačima opreme
  - Cisco, Microsoft, Tandberg, Arbor, HP, Ironport, Compuware

# T-HT Hrvatski Telekom

- utemeljen u siječnju 1999. godine
- u listopadu 2004. postao je dijelom globalnog T-branda, robne marke Deutsche Telekom
- Brandovi:

■ ■ ■ **T** Hrvatski  
Telekom

■ ■ ■ **T** ■ ■ Com ■     ■ ■ ■ **T** ■ ■ Mobile ■

- članice T-HT Grupe su i tvrtke Iskon Internet d.d. i KDS d.o.o.

# T-HT Hrvatski Telekom

- vodeći pružatelj telekomunikacijskih usluga u Hrvatskoj
- T-HT Grupa u Hrvatskoj pruža sve telekomunikacijske usluge :
  - fiksne i mobilne telefonije
  - širokopojasni Internet
  - IPTV
- Korisnici
  - 1.4M POTS i FGSM telefonskih linija
  - 2.9M T-Mobile pretplatnika
  - 555k ADSL/ADSL2+ linija
  - 236k IPTV korisnika





# Hardware i software

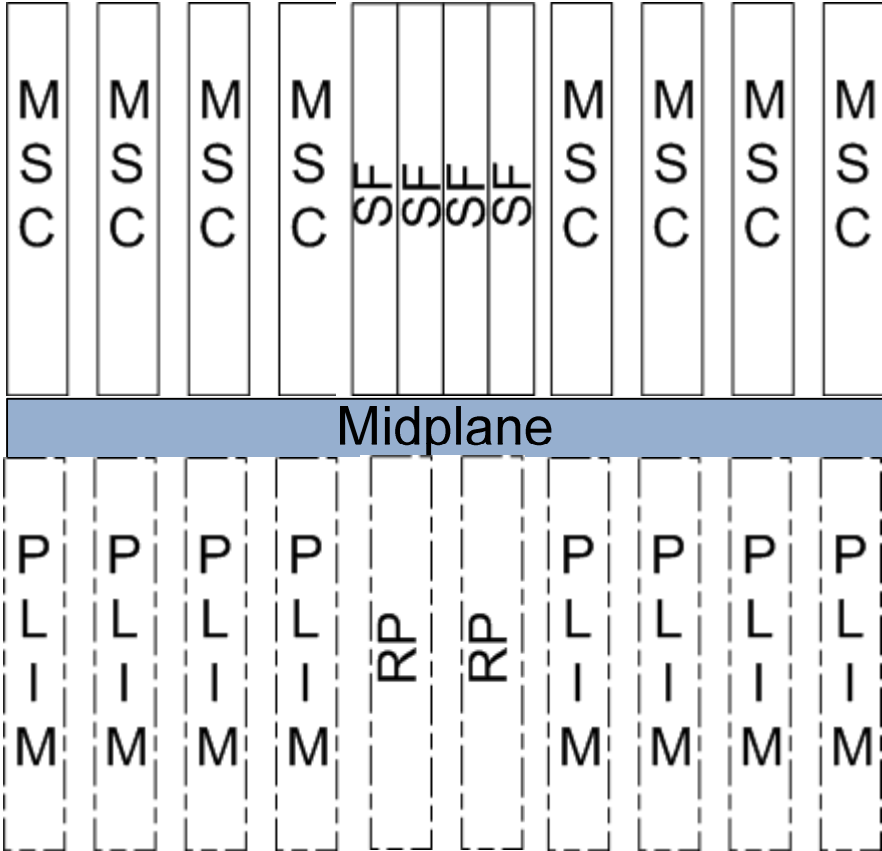
- Cisco CRS-1 16-slot line card chassis
  - Ukupni switching kapacitet of 1.2 Tbps
  - Puna redundancija
- CRS-16-RP-B
- CRS1-SIP-800
- SPA-1X10GE-L-V2 and SPA-10X1GE-V2
- IOS XR verzija 3.6.2





# Hardware

- Midplane dizajn



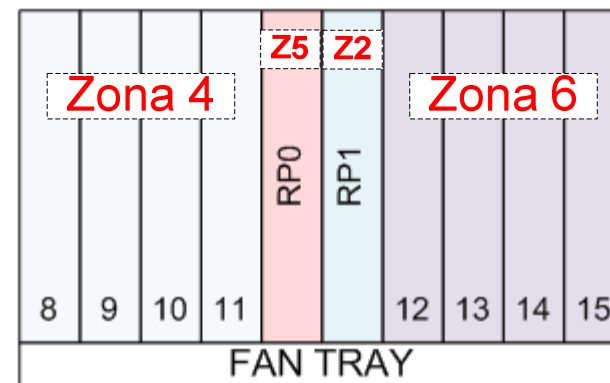
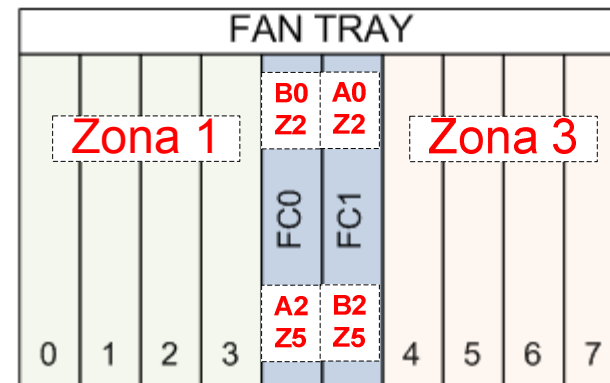
# Instalacijski ciljevi

- Modularnost sustava (software)
- Distribuirani sustav
  - switching
  - forwarding
- Redundantna konfiguracija
- Visoka dostupnost
- Velika propusnost

# Visoka dostupnost napajanja

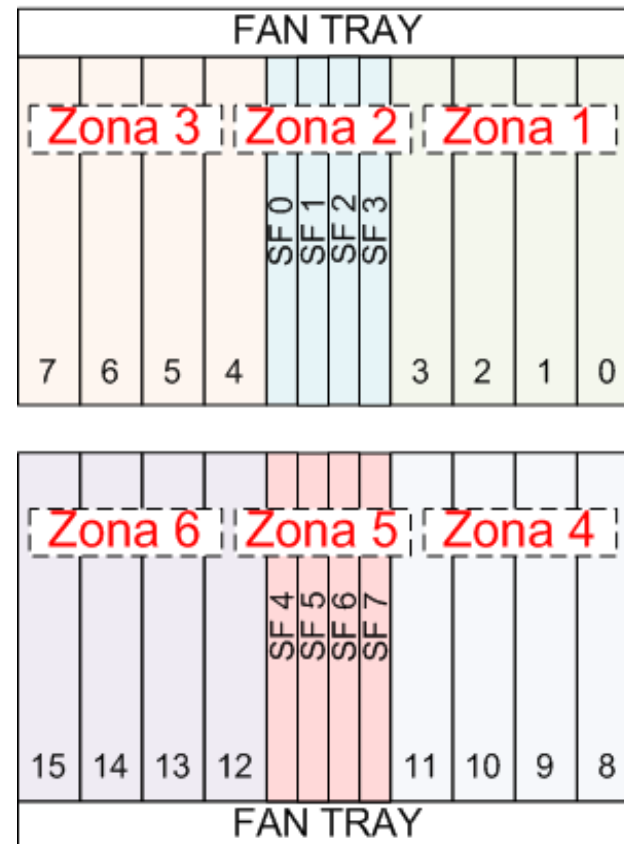
- Prednja (PLIM) strana

		NAPAJANJE					
		0	0	1	1	2	2
A	Z1	Z2	Z3	Z4	Z5	Z6	AM0
B	Z1	Z2	Z3	Z4	Z5	Z6	AM1



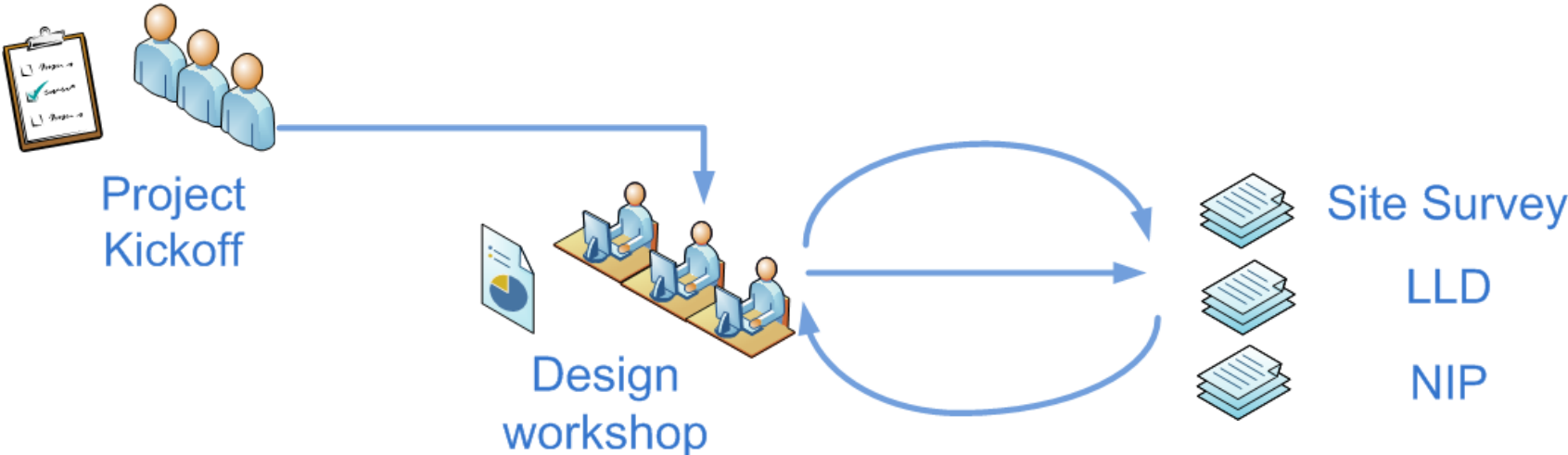
# Visoka dostupnost napajanja

- Stražnja (MSC) strana



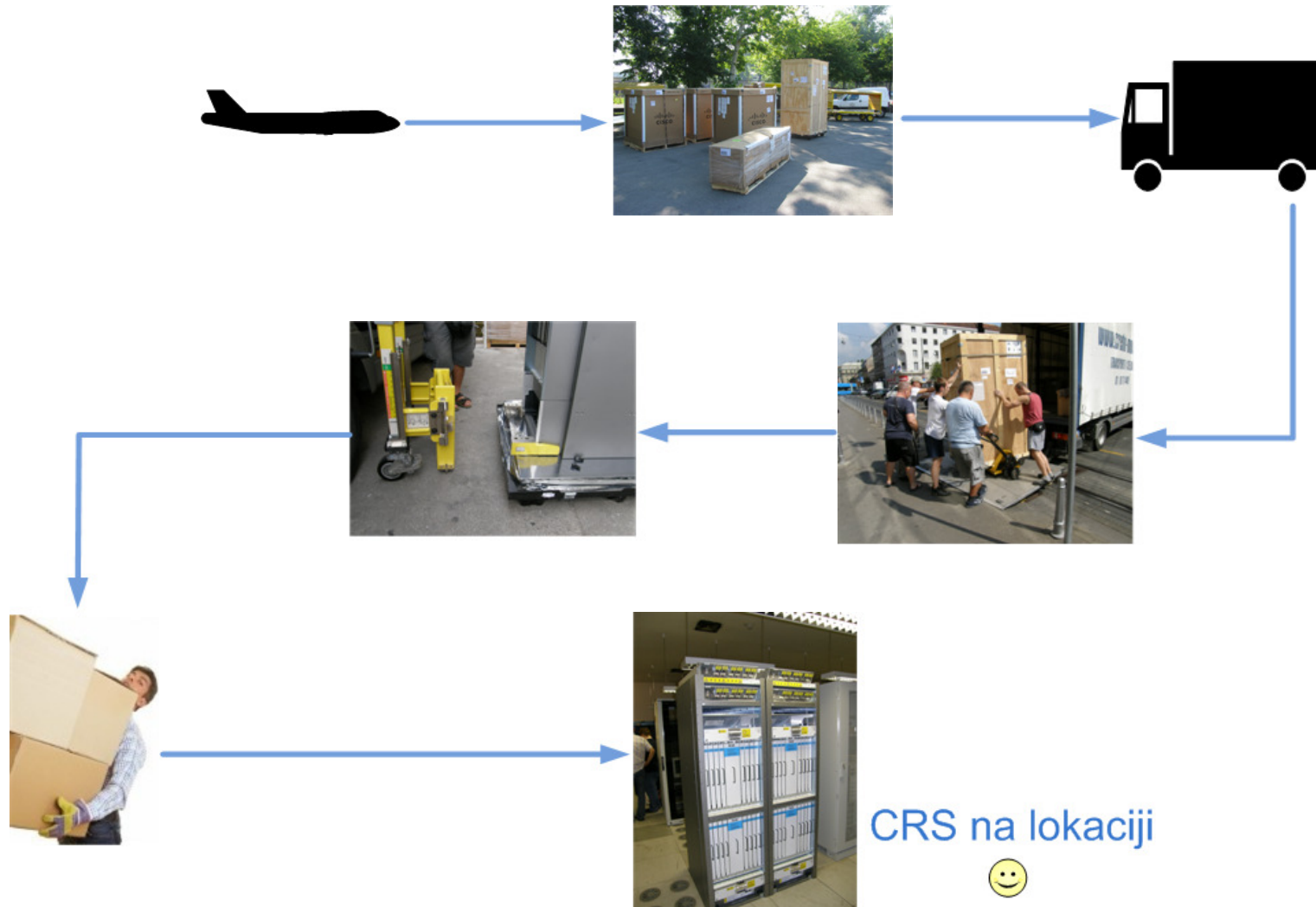
# Projektni koraci

## Priprema



# Projektni koraci

## Logistika



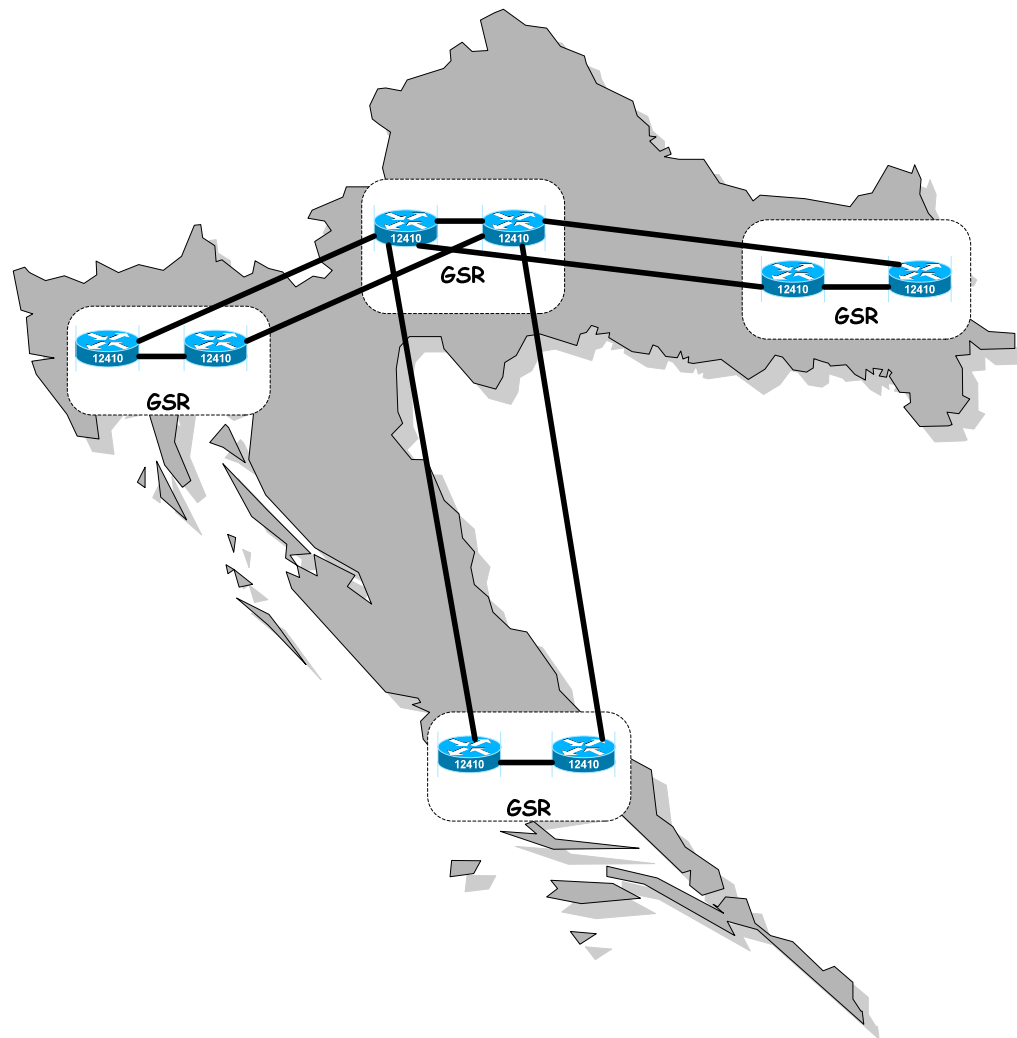
# Projektni koraci

## Logistika

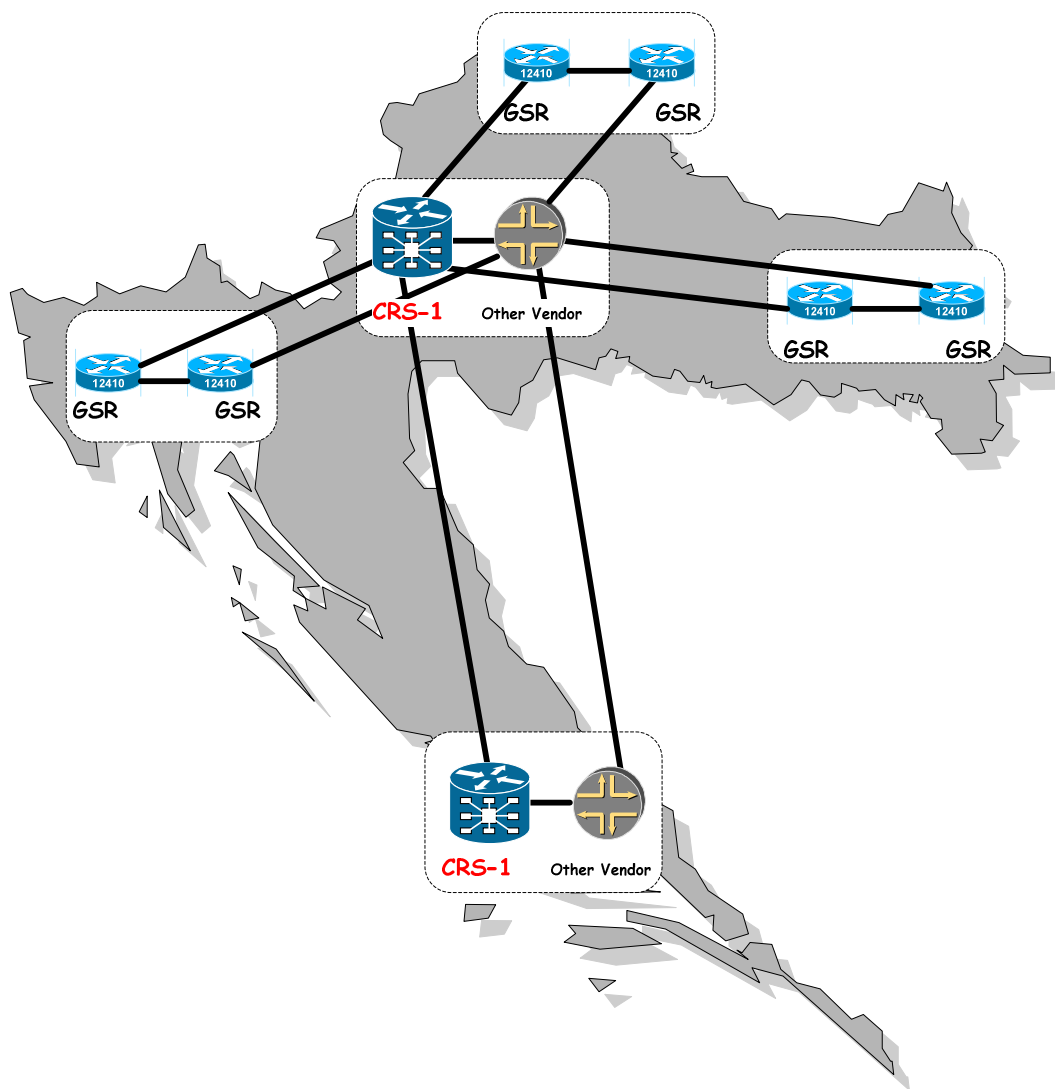




# Početna mrežna topologija



# Nova mrežna topologija



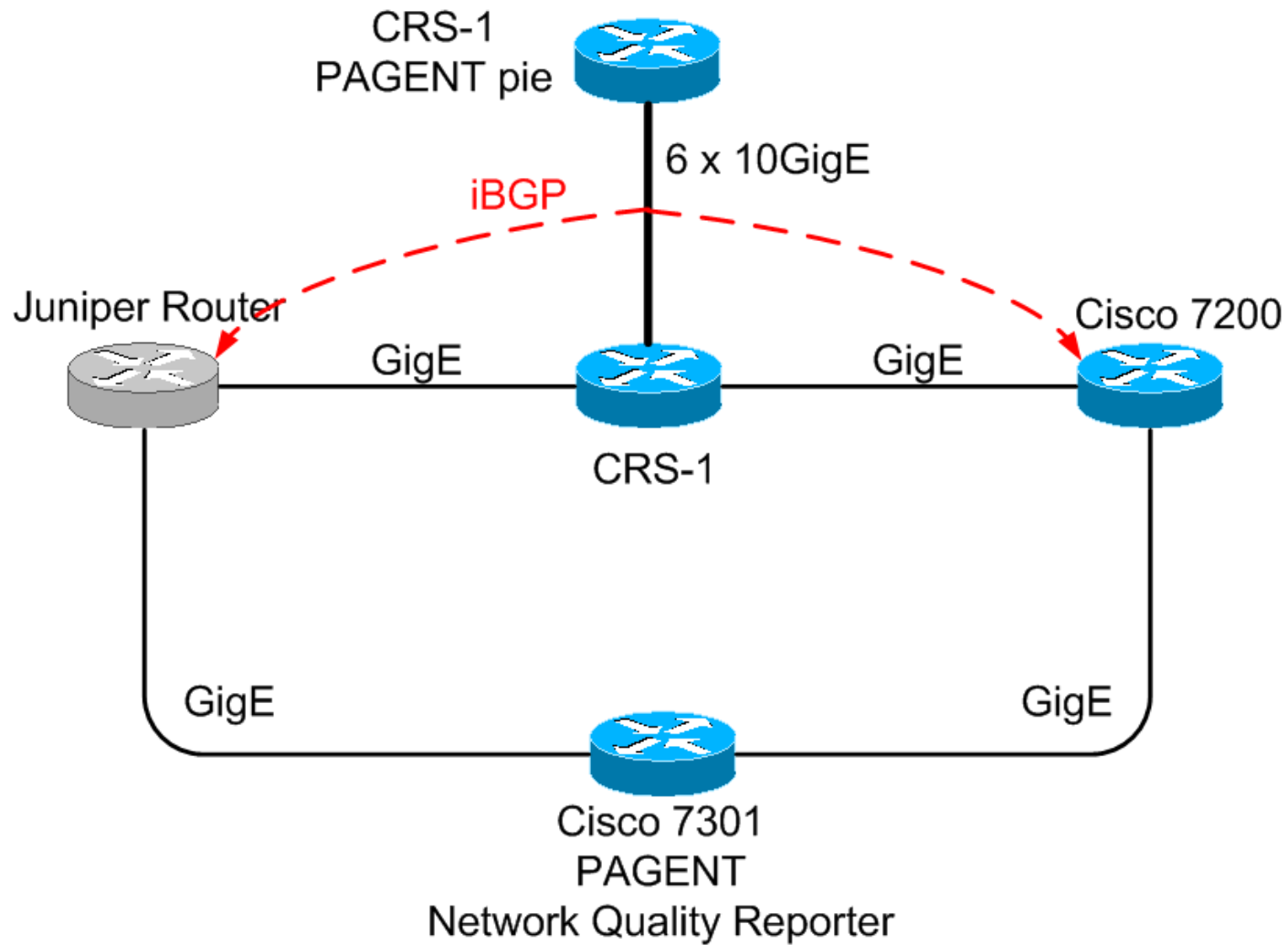
# Testovi

- 1. High Availability (NSF,NSR)
- 2. BFD (OSPF BFD)
- 3. Linecard QoS
- 4. Fabric QoS
- 5. LPTS

## Očekivani cilj testiranja

- 1. Prihvatanje sustava kao funkcionalnog
- 2. Dodavanje uređaja u produkciju

# Testni Setup



# Traffic flows

Traffic Flow	Karakteristika prometa
1	Unicast traffic, IPP 0
2	Multicast traffic, IPP 5
3	Unicast traffic, IPP 2
4	Unicast traffic, IPP 5

- Rate: 1000pps
- Packet size: 256 bytes
- Ulaz na CRS-1: Gi 0/0/0/2
- Izlaz s CRS-1: Gi 0/0/0/1

# Test 1. - High Availability (1/3)

## NSF

- NSF (Non-Stop Forwarding) nastavlja prosljeđivanje paketa u slučaju RP failover-a
- Susjedni uređaji NSF aware

## NSR

- NSR (Non-Stop Routing) migrira TCP konekcije i protokol sesije na standby RP
- Peer-ovi ne znaju za ispad

# Test 1. - High Availability (2/3)

- CRS-1 je iskonfiguriran sa:
  - NSR za MPLS LDP
  - NSR za OSPF
  - NSF za PIM
- Traffic Flows 1 – 4 (3 unicast i 1 multicast)
- Active Route Processor je isključen

```
PAGENT(NQR:ON,Gi0/0:4/4)#sh pk
```

```
WARNING: Traffic generation currently on.  
The packets in transit are counted as dropped
```

```
Summary of packet sequence/drop stats of traffic streams
```

ts#	template	interface	sent	recvd	dropped	out-of-seq	max-seq
1	IP	Gi0/0	2232	2232	0	0	2232
2	IP	Gi0/0	2232	2232	0	0	2232
3	IP	Gi0/0	2232	2232	0	0	2232
4	IP	Gi0/0	2232	2232	0	0	2232



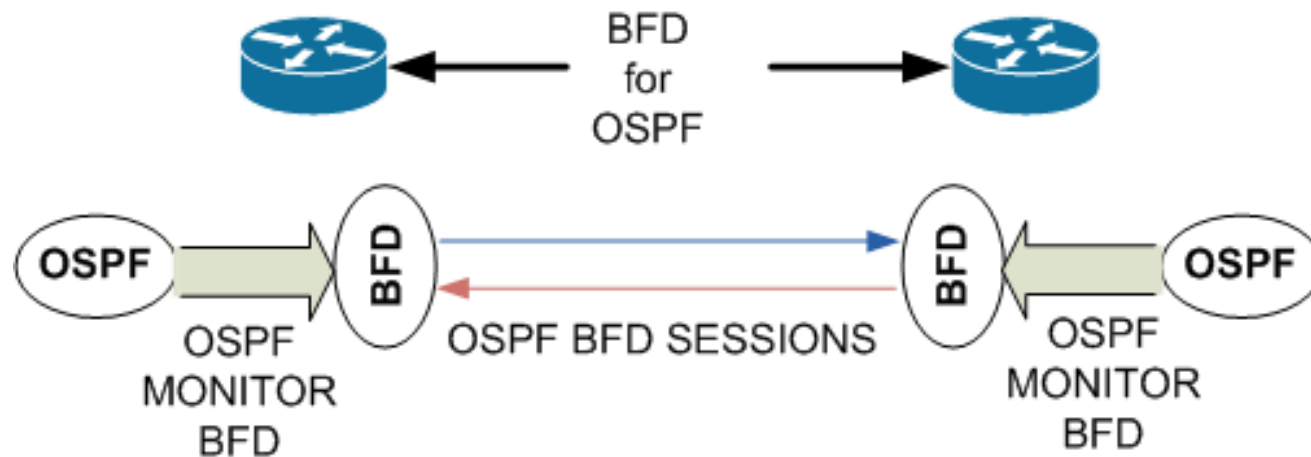
# Test 1. - High Availability (3/3)

Konfiguracija:

```
ospf name-lookup
router ospf 5391
  nsr
  !
mpls ldp
  nsr
  !
multicast-routing
address-family ipv4
  nsf
interface all enable
```

## Test 2 – BFD (1/3)

- Mali overhead, brza detekcija greške u putu između susjednih uređaja
- Brza reakcija na grešku



## Test 2 – BFD (2/3)

- Fokus testa: BFD rad i interoperability
- Layer 2 switch između routera koristi se za simulaciju prekida
- Sa BFD enabled vrijeme konvergencije– 500 ms
- Sa BFD disabled vrijeme konvergencije– 43 s

```
PAGENT(NQR:ON,Gi0/0:3/4)#sh pk
```

```
WARNING: Traffic generation currently on.  
The packets in transit are counted as dropped
```

```
Summary of packet sequence/drop stats of traffic streams
```

ts#	template	interface	sent	recvd	dropped	out-of-seq	max-seq
1	IP	Gi0/0	7919	7419	500	1	5011
2	IP	Gi0/0	7919	5011	2908	0	5011
3	IP	Gi0/0	7919	7419	500	1	5011
4	IP	Gi0/0	7919	7419	500	1	5011

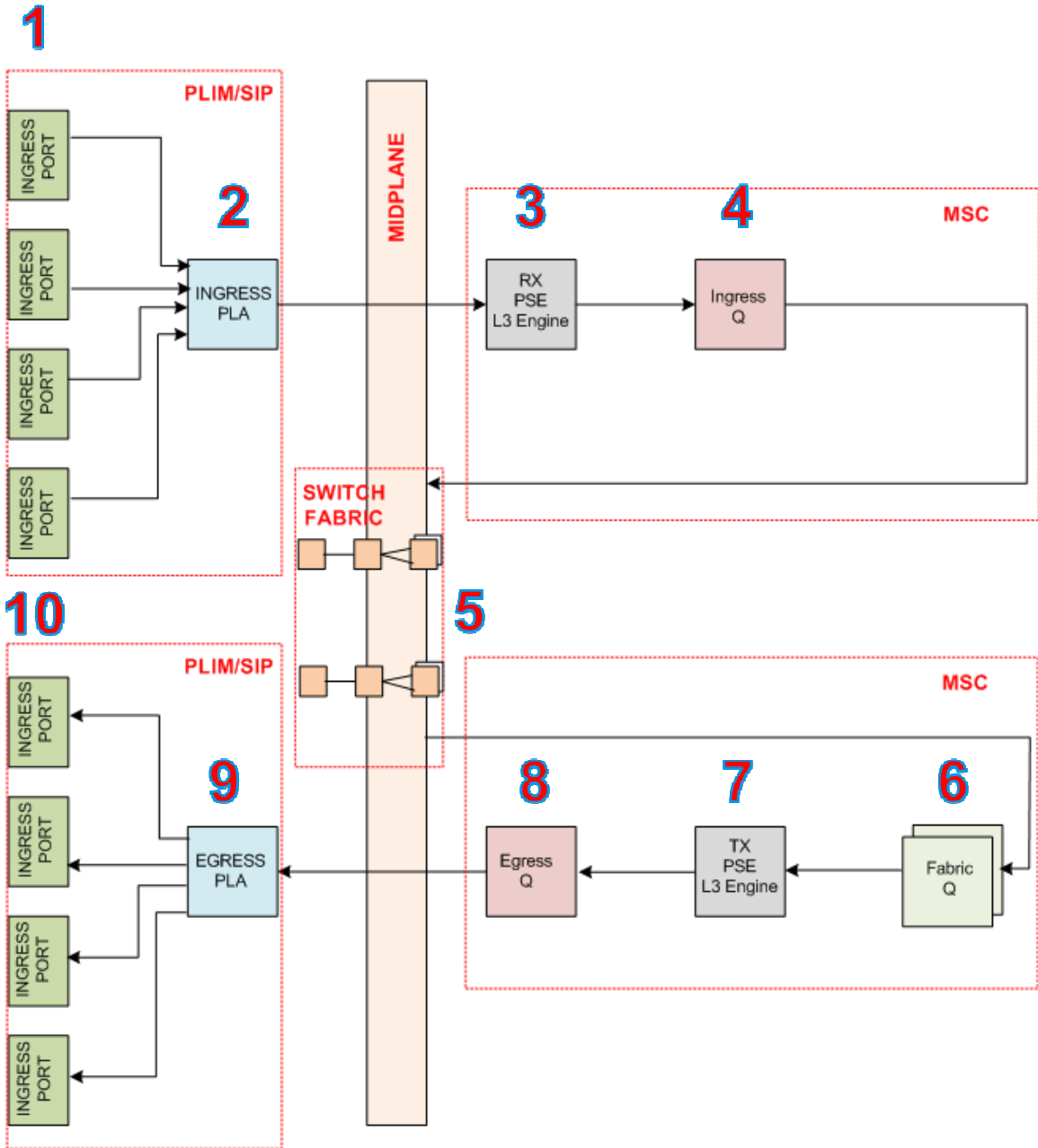
## Test 2 – BFD (3/3)

Konfiguracija:

```
router ospf [process id]
!
interface GigabitEthernet [interface id]
bfd minimum-interval 100
bfd fast-detect
bfd multiplier 3
```

# QoS

QoS preged



# Test 3. – Linecard QoS (1/3)

- Testna konfiguracija

## POLICY-MAP CORE\_QoS

CLASS	QoS Method	Classification Method MPLS EXP / precedence	Bandwidth Reservation
VOICE	Priority	5 / IPP 5	40%
BUSSINES1	Bandwidth allocated	2 / IPP 2	25%
BUSSINES2	Bandwidth allocated	1,3 / IPP 1,3	10%
NETWORK_CONTROL	Bandwidth allocated	6,7 / IPP 6,7	5%
class-default	Bandwidth allocated	default	20%

## Test 3. – Linecard QoS (2/3)

Primjena mape:

```
interface GigabitEthernet0/0/0/1
  service-policy output CORE_QoS
```

- 4 test flow-a kroz CRS-1
- Drugi CRS-1 generira 2 Gb/s IPP 0 kroz isto izlazno sučelje na testiranom CRS-1

```
PAGENT(NQR:ON,Gi0/0:3/4)#sh pk
```

```
WARNING: Traffic generation currently on.
The packets in transit are counted as dropped
```

```
Summary of packet sequence/drop stats of traffic streams
```

ts#	template	interface	sent	rcvd	dropped	out-of-seq	max-seq
1	IP	Gi0/0	292501	150807	141694	53349	46384
2	IP	Gi0/0	292500	292500	0	0	292500
3	IP	Gi0/0	292500	292500	0	0	292500
4	IP	Gi0/0	292500	292500	0	0	292500



# Test 3. – Linecard QoS (3/3)

```
RP/0/RP1/CPU0:HDR01#sh policy-map interface gigabitEthernet 0/0/0/1
GigabitEthernet0/0/0/1 output: CORE_QoS

Class VOICE
  Classification statistics          (packets/bytes)      (rate - kbps)
  Matched                          :          198520/50821120      3954
  Transmitted                       :          198520/50821120      3954
  Total Dropped                     :                0/0              0
  Policing statistics              (packets/bytes)      (rate - kbps)
  Policed(conform)                  :          197992/50685952      3939
  Policed(exceed)                   :                0/0              0
  Policed(violate)                  :                0/0              0
  Policed and dropped               :                0/0
***

Class BUSINESS_2
  Classification statistics          (packets/bytes)      (rate - kbps)
  Matched                          :                0/0              0
  Transmitted                       :                0/0              0
  Total Dropped                     :                0/0              0
***

Class NETWORK_CONTROL
  Classification statistics          (packets/bytes)      (rate - kbps)
  Matched                          :          596/45551            0
  Transmitted                       :          596/45551            0
  Total Dropped                     :                0/0              0
***

  Classification statistics          (packets/bytes)      (rate - kbps)
  Matched                          :          85871/21982976      1943
  Transmitted                       :          85871/21982976      1943
  Total Dropped                     :                0/0              0
***

Class class-default
  Classification statistics          (packets/bytes)      (rate - kbps)
  Matched                          :    229906046/317241623896    2265307
  Transmitted                       :    100120544/138278882752    984070
  Total Dropped                     :    129785502/178962741144    1281237
***
```

## Test 4. – Fabric QoS (1/4)

- 4 test flow-a kroz CRS-1
- Drugi CRS-1 se koristi za izazivanje zagušenja
- Generirani promet 6 x 9Gbps = 54Gbps of IPP 0

# Test 4. – Fabric QoS (2/4)

Prvo mjerenje:

- Bez fabric service-policy

```
RP/0/RP0/CPU0:HDR01(admin)#sh controllers fabricq stat loc 0/0/cpu0
Fabric Queue Manager Packet Statistics
```

```
=====
Location: 0/0/CPU0
Asic Instance: 0
***
```

```
Dropped packets
+-----+
Ucast pkts      :      4608474008 (+      0 )
Mcast pkts      :              0 (+      0 )
***
```

```
PAGENT(NQR:ON,Gi0/0:3/4)#sh pk
```

```
WARNING: Traffic generation currently on.
The packets in transit are counted as dropped
```

```
Summary of packet sequence/drop stats of traffic streams
```

ts#	template	interface	sent	recvd	dropped	out-of-seq	max-seq
1	IP	Gi0/0	2226	42	2184	33	4
2	IP	Gi0/0	2225	2225	0	0	2225
3	IP	Gi0/0	2225	1706	519	193	43
4	IP	Gi0/0	2225	1712	513	192	43

## Test 4. – Fabric QoS (3/4)

- Fabric service-policy

### POLICY-MAP FABRIC

CLASS	QoS Method	Classification Method MPLS EXP / precedence	Bandwidth Reservation
FABRIC-RT	Priority	5 / IPP 5	
FABRIC-AF	Bandwidth remaining	1,2,3,6,7 / IPP 1,2,3,6,7	70%
class-default	Bandwidth remaining	default	30%

### Konfiguracija:

switch-fabric

service-policy FABRIC

# Test 4. – Fabric QoS (4/4)

Drugo mjerenje:

- Uz fabric service-policy

```
PAGENT(NQR:ON,Gi0/0:3/4)#sh pk
```

```
WARNING: Traffic generation currently on.  
The packets in transit are counted as dropped
```

```
Summary of packet sequence/drop stats of traffic streams
```

ts#	template	interface	sent	recvd	dropped	out-of-seq	max-seq
1	IP	Gi0/0	28427	503	27924	388	4
2	IP	Gi0/0	28427	28427	0	0	28427
3	IP	Gi0/0	28428	21721	6707	2162	106
4	IP	Gi0/0	28428	28428	0	0	28428

## Test 5 – LPTS (1/2)

- LPTS (Local Packet Transport Services)
- Dostava lokalno usmjerenog prometa do node-a
- Zaštita od prekomjernog iskorištenja router resursa radi prekomjernog prometa
- Policing lokalno usmjerenih flow-ova

## Test 5 – LPTS (2/2)

- Drugi CRS-1 se koristi za simulaciju broadcast storm-a (10 Million pps)

```
PAGENT(NQR:ON,Gi0/0:3/4)#sh pk
Summary of packet sequence/drop stats of traffic streams
  ts#  template interface      sent      recvd      dropped    out-of-seq  max-seq
  1    IP      Gi0/0          220918    220918         0           0    220918
  2    IP      Gi0/0          220918    220918         0           0    220918
  3    IP      Gi0/0          220918    220918         0           0    220918
  4    IP      Gi0/0          220919    220919         0           0    220919
```

```
RP/0/RP0/CPU0:HDR01#monitor interface
```

```
HDR01                      Monitor Time: 00:00:30                      SysUptime: 70:30:23
```

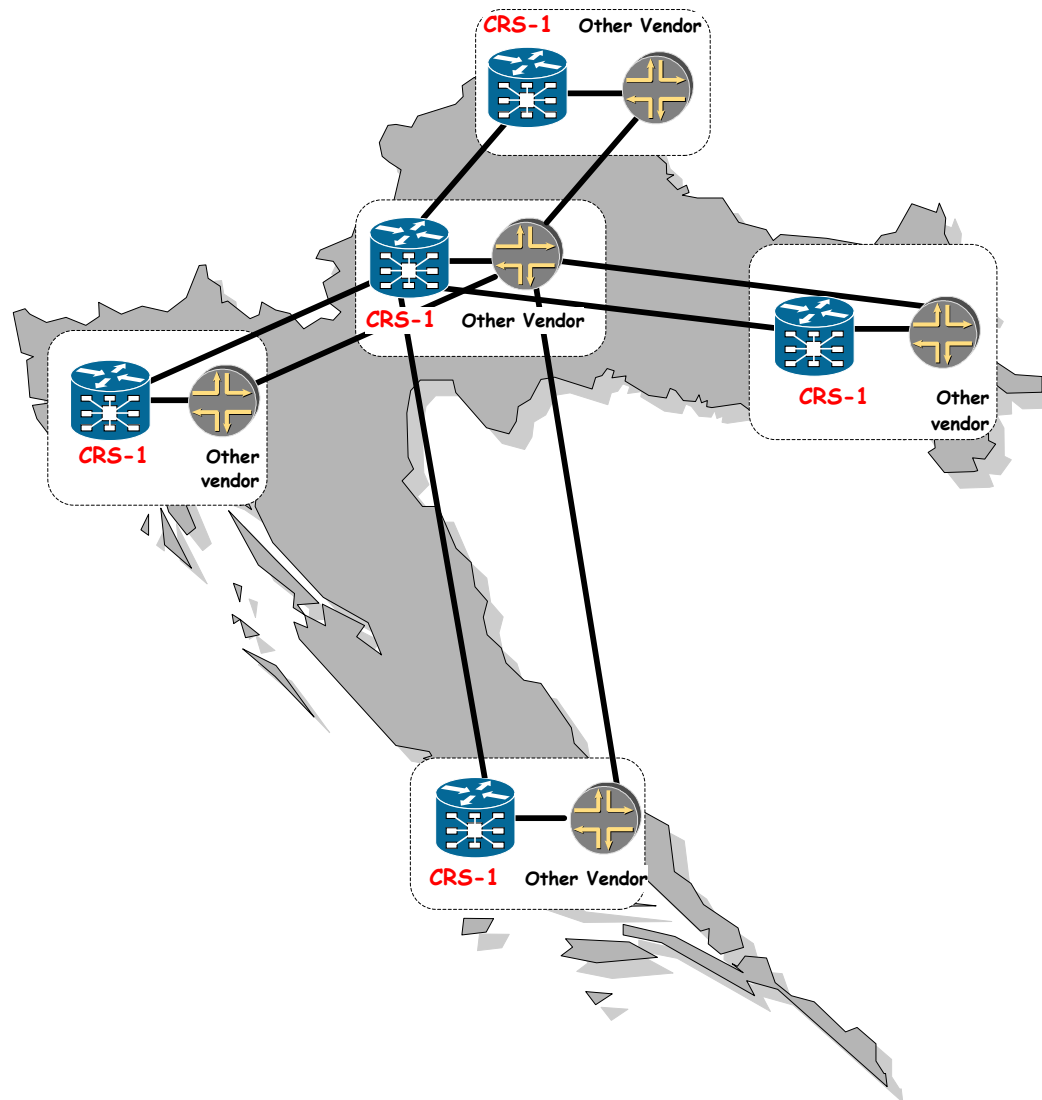
Interface	In(pps)	out(pps)	InPkts/Delta	outPkts/Delta
***				
Gi0/0/0/1	3	4009	416226/6	1.0G/8019
Gi0/0/0/2	4021	12	190.2M/8043	4.0M/24
Te0/0/2/0	9.9M	0	3.0G/19.8M	6957/0
***				

```
RP/0/RP0/CPU0:HDR01#sh proc cpu location 0/0/cpu0 | i utilization
```

```
CPU utilization for one minute: 8%; five minutes: 5%; fifteen minutes: 2%
```



# Ciljana mrežna topologija



# Zaključak

- Projektni koraci
- Mrežna topologija
- Testovi
- Ciljna mrežna topologija

# Q and A



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