THE MESHDYNAMICS **MD4000** IS THE IDEAL MESH NODE FOR VIDEO AND SURVEILLANCE APPLICATIONS. ITS COMPACT SIZE ALONG WITH SUPERIOR TECHNOLOGY AND EASE OF USE MAKE FOR A SWIFT INSTALLATION AND EFFORTLESS OPERATION.

VIDEO APPLICATIONS TEND TO BE BANDWIDTH-INTENSIVE. MANY WIRELESS SYSTEMS SUFFER FROM JITTERY VIDEO DUE TO LACK OF AVAILABLE BANDWIDTH TRANSFERRED ACROSS THE BACKHAUL. THE **MD4000** USES THIRD GENERATION MESH TECHNOLOGY TO MAINTAIN BANDWIDTH OVER NUMEROUS HOPS WITHOUT DEGRADATION.

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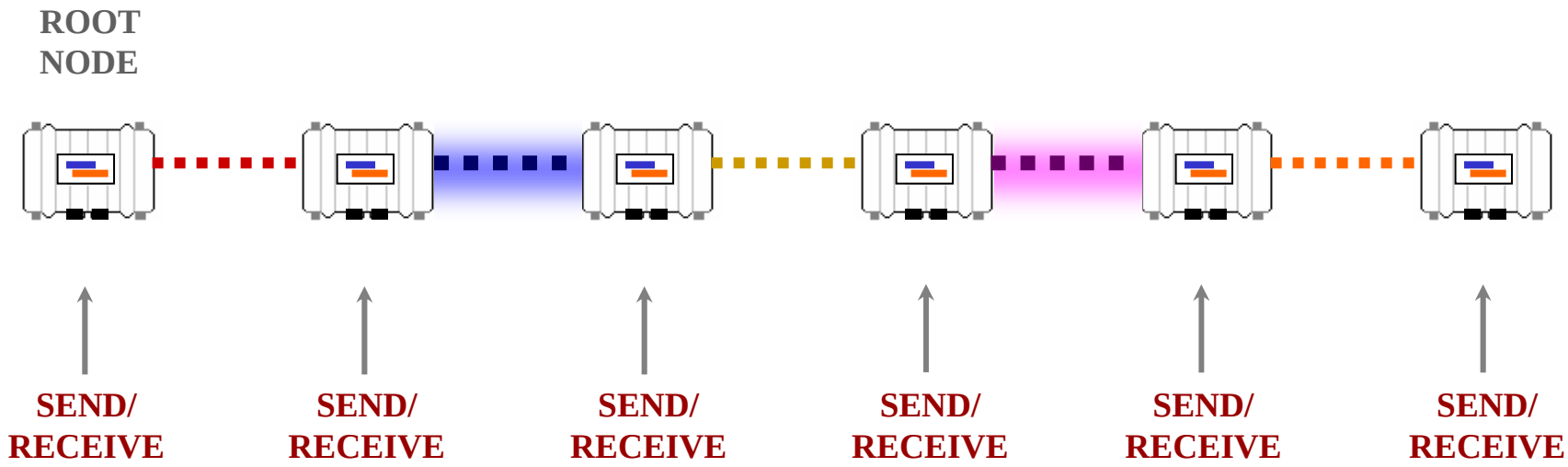
THE THIRD GENERATION BACKHAUL OF THE **MD4000** USES MULTIPLE CHANNELS SIMULTANEOUSLY *WITHIN* THE UTILIZED SPECTRUM IN ORDER TO ENSURE MINIMAL BANDWIDTH LOSS AS THE NUMBER OF HOPS INCREASES.

TYPICALLY, THE 5GHz SPECTRUM IS USED FOR THE BACKHAUL. SINCE DIFFERENT 5GHz CHANNELS ARE USED BY ADJACENT LINKS IN THE MESH, THERE IS NO INTERFERENCE ALONG THE BACKHAUL. THIS ALLOWS EACH NODE TO SEND AND RECEIVE AT THE SAME TIME. THEREFORE CONSERVING BANDWIDTH OVER *MANY* HOPS.



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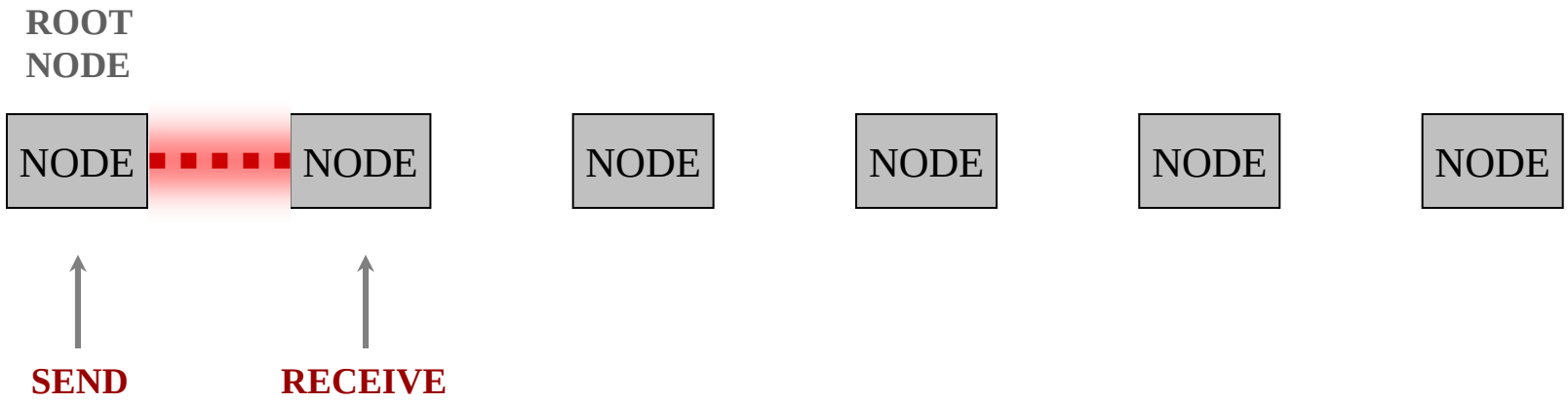
FIRST AND SECOND GENERATION MESH NODES USE ONLY ONE CHANNEL OF A CERTAIN FREQUENCY SPECTRUM ACROSS ALL LINKS OF A BACKHAUL DURING OPERATION.

A NODE IN THE MESH CANNOT SEND AND RECEIVE AT THE SAME TIME SINCE THE SAME FREQUENCY IS USED FOR BOTH FUNCTIONS. THIS MAKES FOR A VERY INEFFICIENT PROCESS THAT SEVERELY EFFECTS BANDWIDTH AS THE NUMBER OF HOPS INCREASES. THE NUMBER OF CAMERAS THAT CAN BE INSTALLED ONTO A NETWORK IS THEREFORE LIMITED.

VIDEO APPLICATIONS CAN START TO ENCOUNTER ISSUES AFTER ONLY A FEW HOPS IN FIRST AND SECOND GENERATION MESHES.



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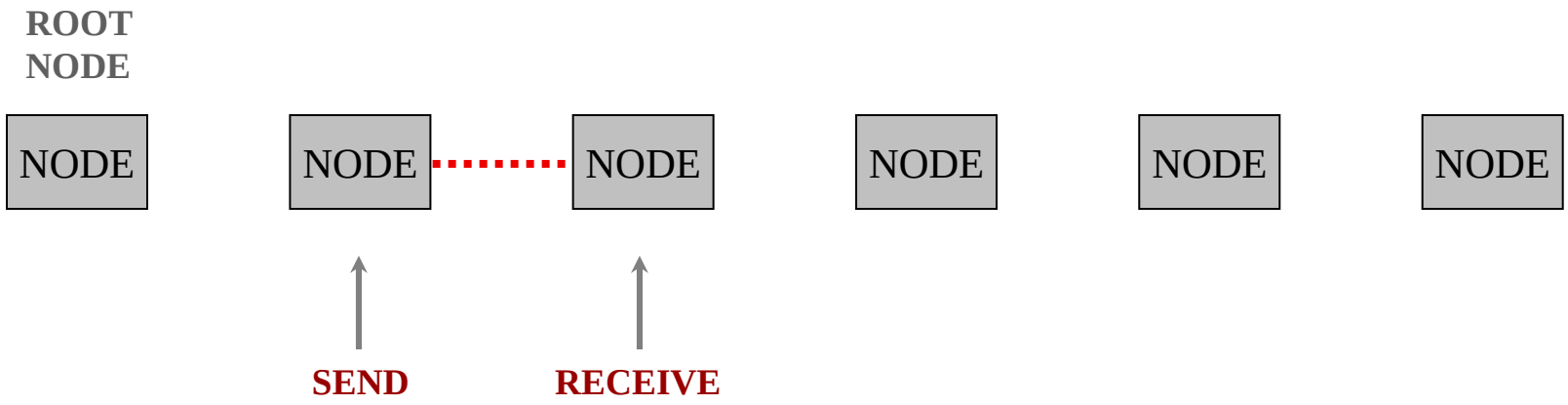

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ALTHOUGH MESHDYNAMICS THIRD GENERATION MESH NODES TYPICALLY USE THE **5GHz** SPECTRUM FOR THE MULTI-CHANNEL BACKHAUL, THE **2.4GHz** SPECTRUM AND THE **4.9GHz** PUBLIC SAFETY BAND CAN ALSO BE USED.

THE **5GHz** SPECTRUM IS USED MAINLY FOR TWO REASONS: THERE IS MORE AVAILABLE CHANNEL SPACE IN THIS SPECTRUM ALLOWING FOR THE MOST NUMBER OF CHANNELS TO BE USED, AND BECAUSE IT IS A RELATIVELY CLEAN RF SPACE WHICH CATERS TO SMOOTH, GLITCH-FREE VIDEO.

THE **2.4GHz** SPECTRUM IS USUALLY USED FOR THE BACKHAUL IN RURAL AREAS WHERE GREAT DISTANCES ARE NEEDED, AND THE RF POLLUTION IS MUCH LIGHTER THAN IN CIVILIZED AREAS.

THE **4.9GHz** PUBLIC SAFTEY BAND IS A LICENSED BAND RESERVED FOR POLICE AND EMERGENCY SERVICES.

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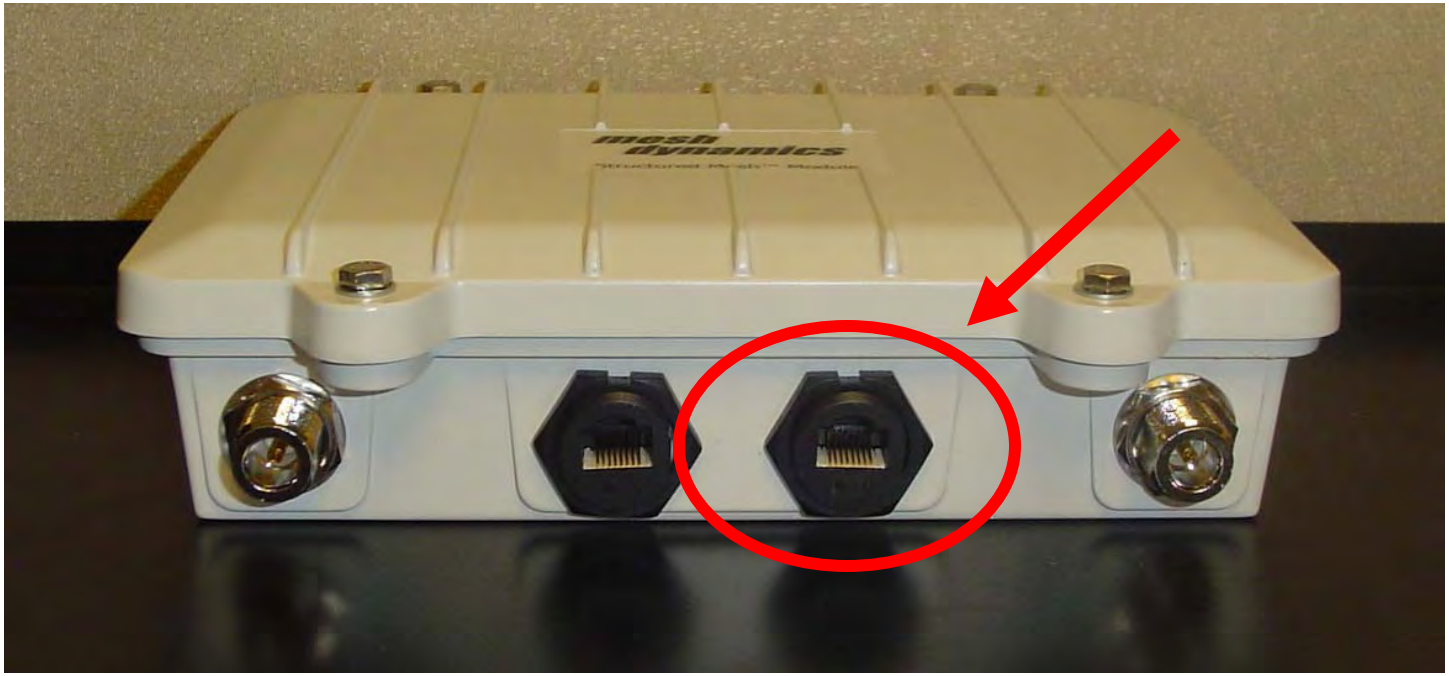
THE *RIGHT-HAND* ETHERNET PORT ON THE **MD4000** MESH NODE SERVES AS SWITCH PORT TO NETWORK DEVICES. THE DATA FROM CLIENTS OR DEVICES CONNECTED TO THIS PORT WILL BE SENT WIRELESSLY THROUGH THE MESH TO THE MAIN NETWORK.

THE MOST BASIC WAY TO CREATE A WIRELESS SURVEILENCE SYSTEM USING THE **MD4000** IS TO SIMPLY CONNECT AN IP CAMERA TO THE RIGHT-HAND ETHERNET PORT ON THE MESH NODE.



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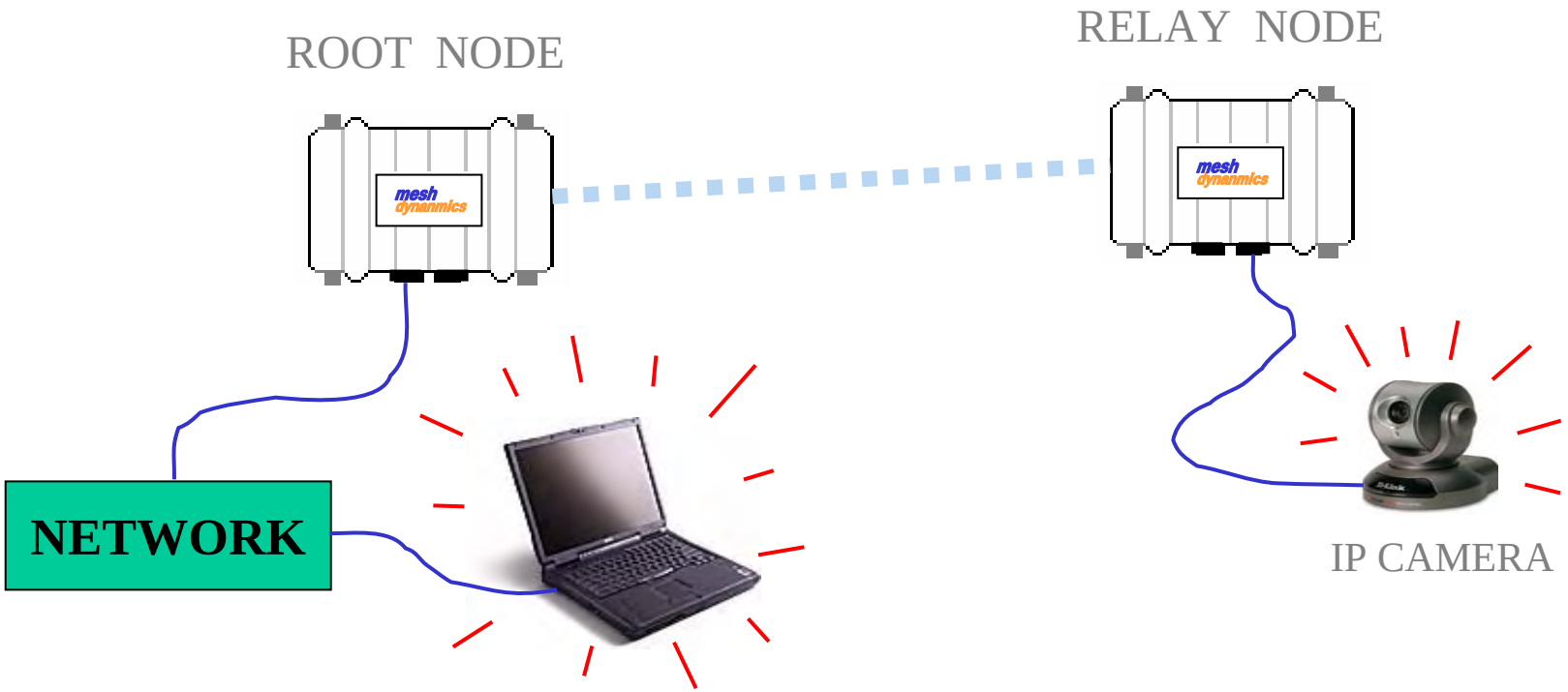

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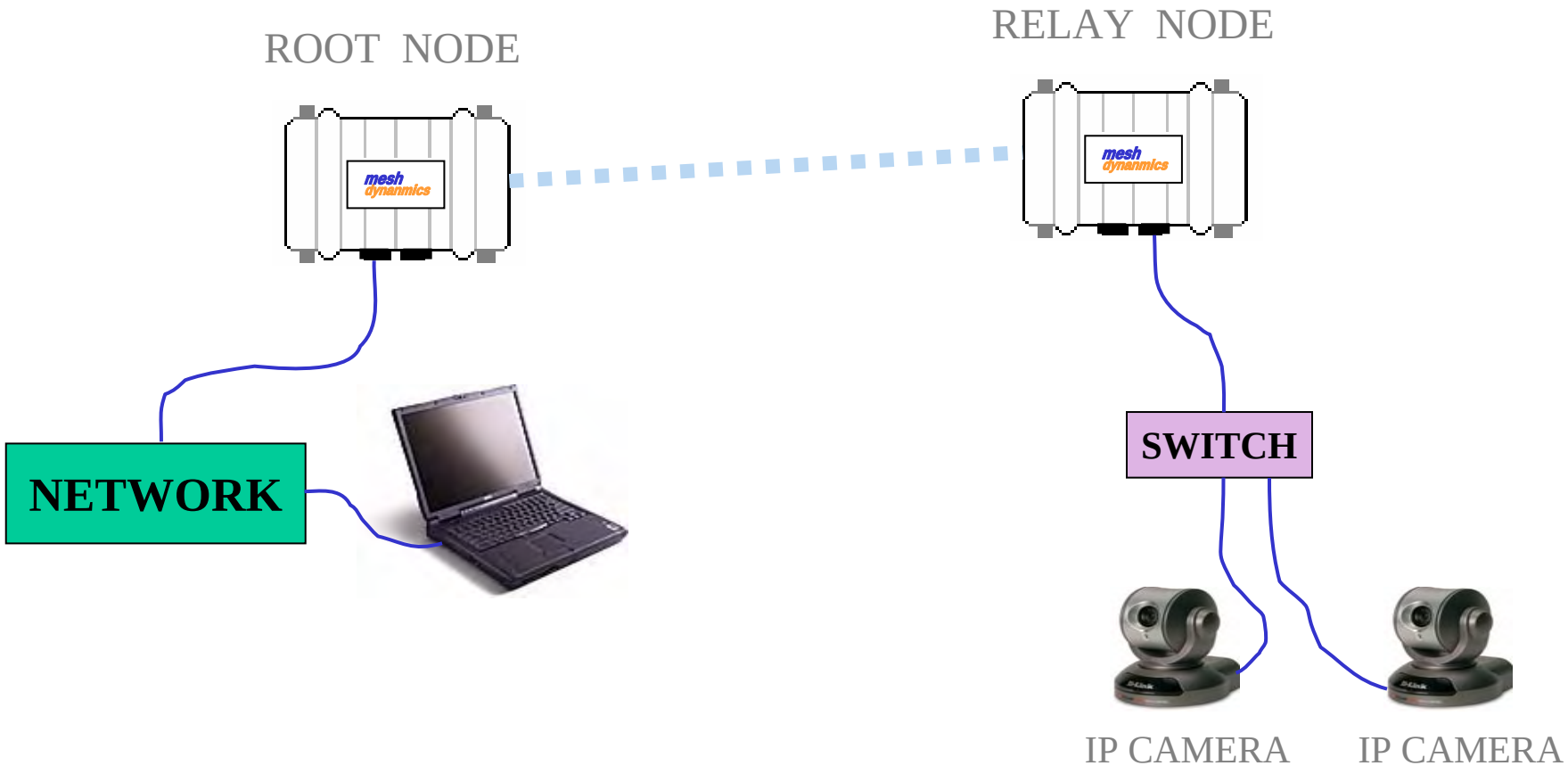
IF MULTIPLE CAMERAS ARE NEEDED ON A SINGLE NODE, CONNECT A SWITCH TO THE RIGHT-HAND ETHERNET PORT, THEN CONNECT THE DESIRED NUMBERS OF CAMERAS TO THE SWITCH.



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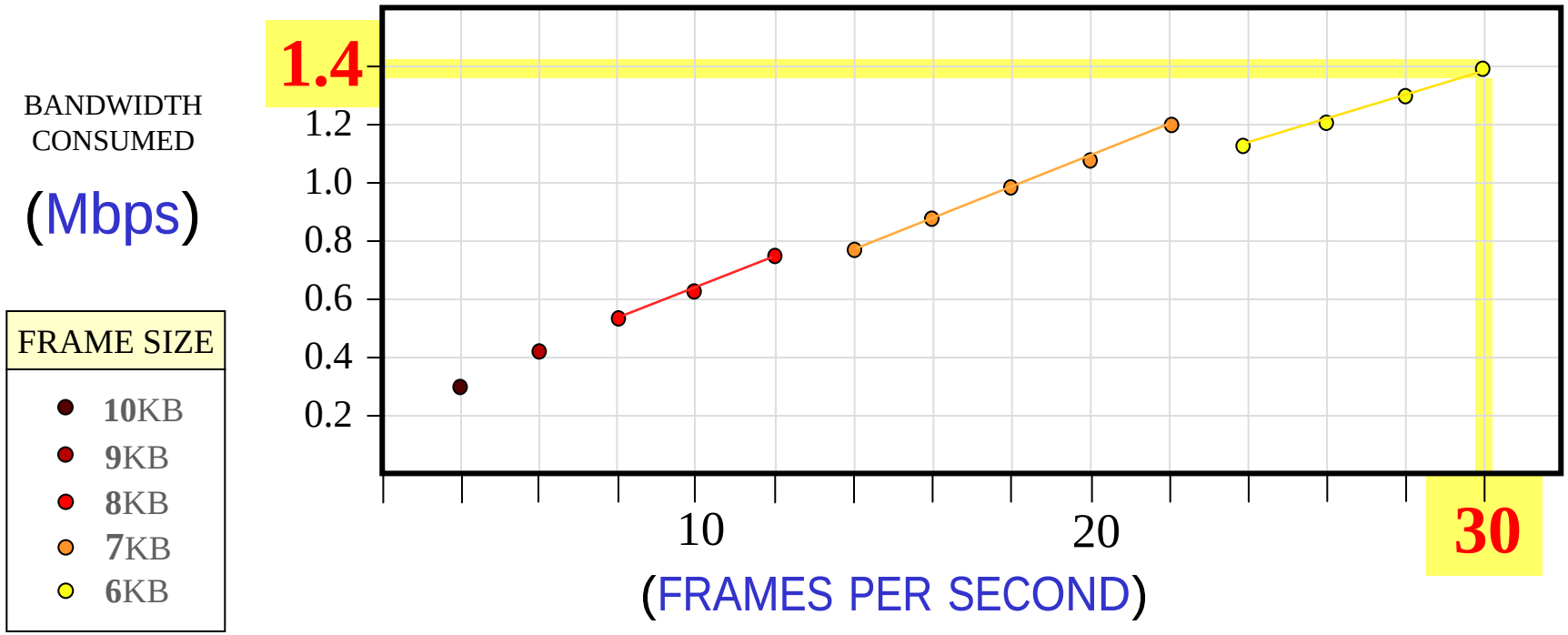
TO DETERMINE THE MAXIMUM NUMBER OF CAMERAS THAT CAN BE INSTALLED ONTO A NETWORK, CAMERA *SETTINGS* MUST FIRST BE TAKEN INTO ACCOUNT.

THE SETTINGS OF A CAMERA EFFECT HOW MUCH BANDWIDTH THE CAMERA WILL REQUIRE. THERE ARE SEVERAL SETTINGS THAT CAN BE APPLIED TO CAMERAS SUCH AS FRAME RATE, RESOLUTION, AND COMPRESSION TO NAME A FEW.

THE TABLE BELOW GIVES BANDWIDTH VALUES FOR SOME COMMON CAMERA SETTINGS (640 x 480 RESOLUTION, MPEG4-30) WITH VARYING FRAME RATES.



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THE 802.11a PROTOCOL, WHICH IS USED BY THE 5GHz BACKHAUL, CAN SUPPORT ROUGHLY 22Mbps OF *THROUGHPUT* ON EACH OF ITS NON-OVERLAPPING CHANNELS. IF A CAMERA IS SET TO CONSUME 1Mbps OF THROUGHPUT, THIS IMPLIES THAT AN 802.11a LINK CAN SUPPORT THE BANDWIDTH NEEDED BY 22 SUCH CAMERAS. TYPICALLY, THE NUMBER OF CAMREAS IS CUT BACK SLIGHTLY TO ALLOW FOR OTHER WIRELESS OVERHEAD ON THE LINK.

IN ADDITION TO THE MULTI-CHANNEL, 3RD GENERATION BACKHAUL OF THE **MD4000** WHICH ENABLES IT TO CARRY THIS 22Mbps OVER *NUMEROUS* HOPS WITHOUT BANDWIDTH DEGRADATION, THE **MD4000** OFFERS FEATURES THAT CAN EVEN FURTHER INCREASE THE AVAILABLE BANDWIDTH ON THE NETWORK: BONDED CHANNEL TECHNOLOGY, AND MULTIPLE DOWNLINK RADIOS.

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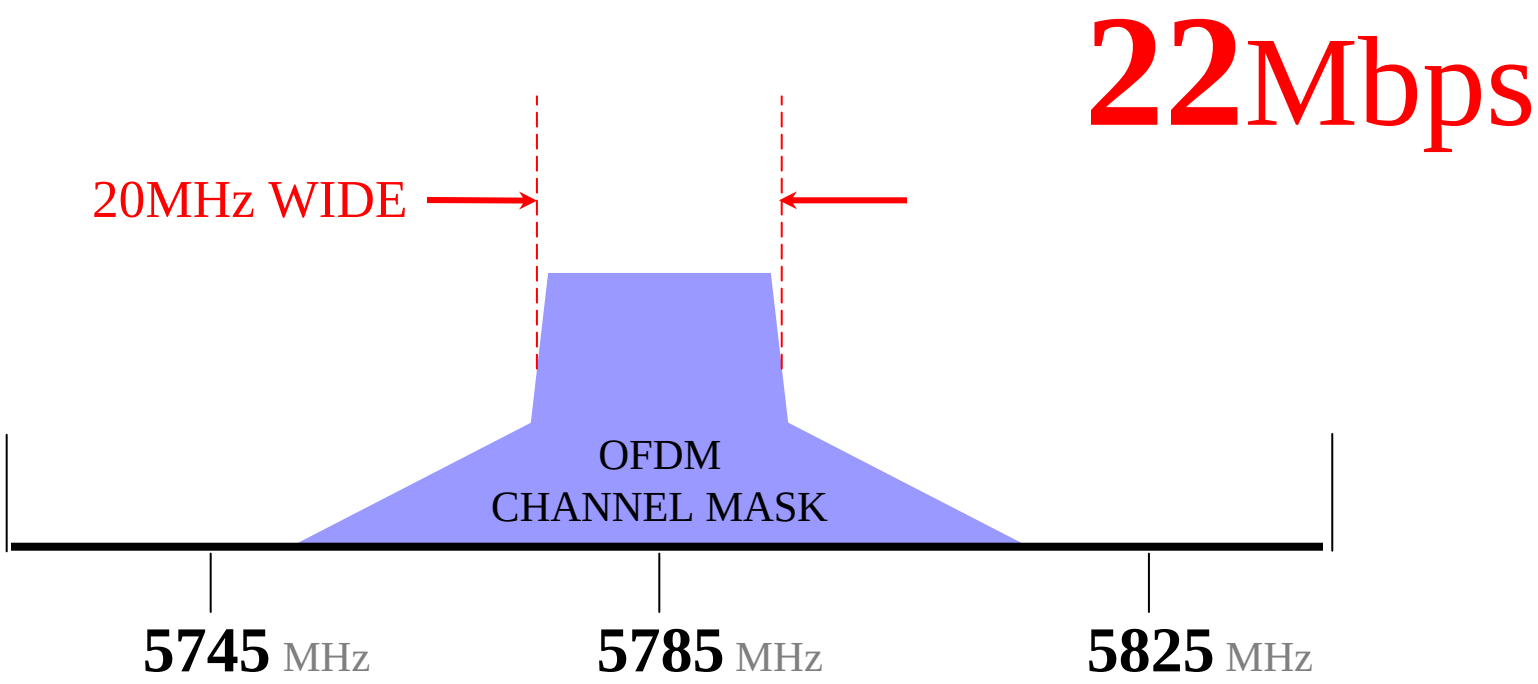
BONDED CHANNEL TECHNOLOGY USES *TWICE* THE CHANNEL WIDTH AS STANDARD 802.11a/g CHANNELS (WHICH ARE TYPICALLY 20MHz WIDE), BUT GIVES TWICE THE THROUGHPUT OF THE STANDARD CHANNELS. A LINK USING BONDED CHANNEL TECHNOLOGY SUPPORTS APPROXIMATELY 44Mbps OF THROUGHPUT.



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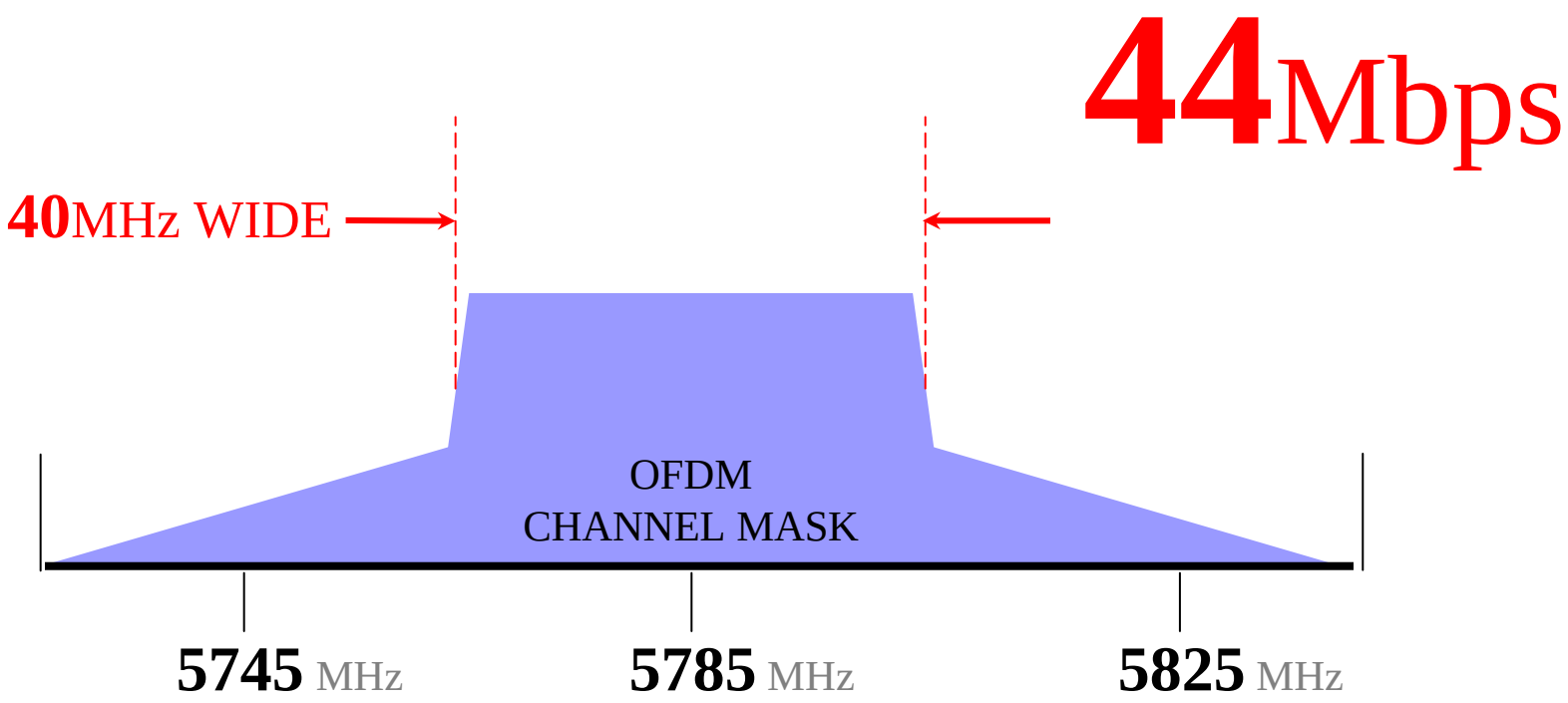

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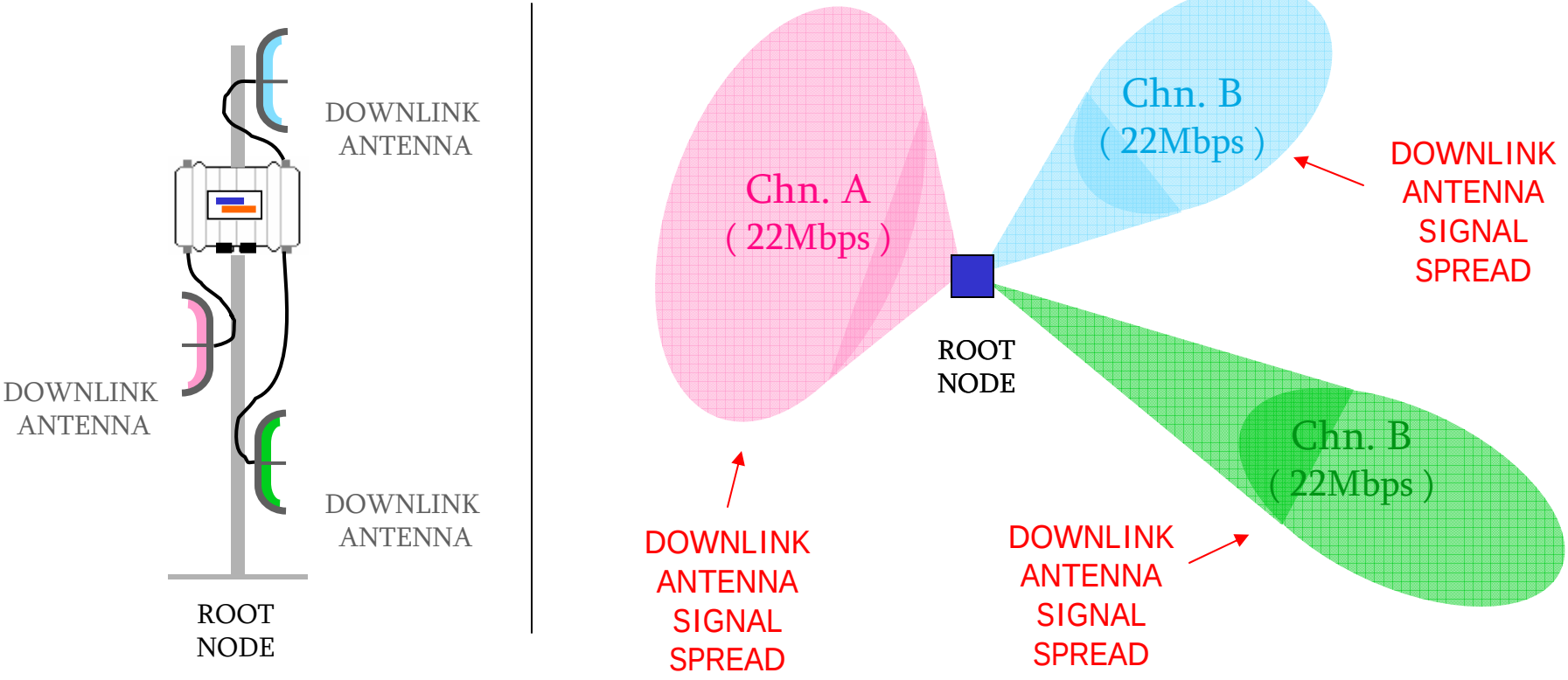
MULTIPLE DOWNLINK RADIOS WILL GIVE A MESH MULTIPLE 22Mbps SOURCES OF BANDWIDTH. EACH DOWNLINK RADIO ON A ROOT NODE WILL PROVIDE A SEPARATE CHANNEL FOR RELAY NODES TO ASSOCIATE TO. WITH THE APPROPRIATE USE OF SECTOR ANTENNAS, THE MULTIPLE SOURCES OF BANDWIDTH CAN BE DISTRIBUTED ACROSS THE MESH.



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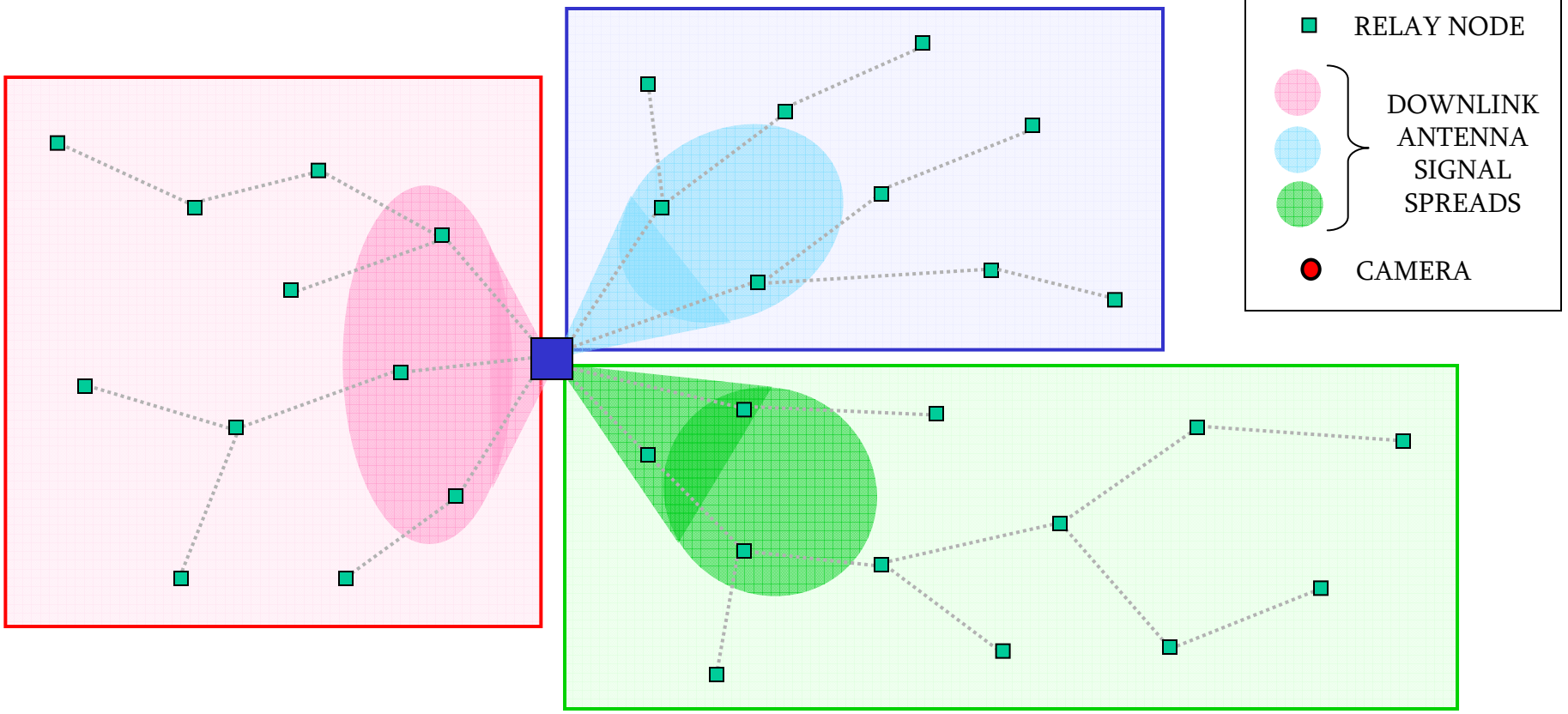
THE DIAGRAM BELOW ILLUSTRATES HOW DIFFERENT GROUPS OF RELAY NODES GET THEIR OWN 22Mbps SOURCE OF BANDWIDTH FROM EACH OF THE ROOT NODE'S DOWNLINKS. ANTENNA SPREADS ARE SELECTED BASED ON THE LOCAL DISTRIBUTION OF RELAY NODES. THREE DOWNLINK RADIOS ARE USED IN THIS EXAMPLE.



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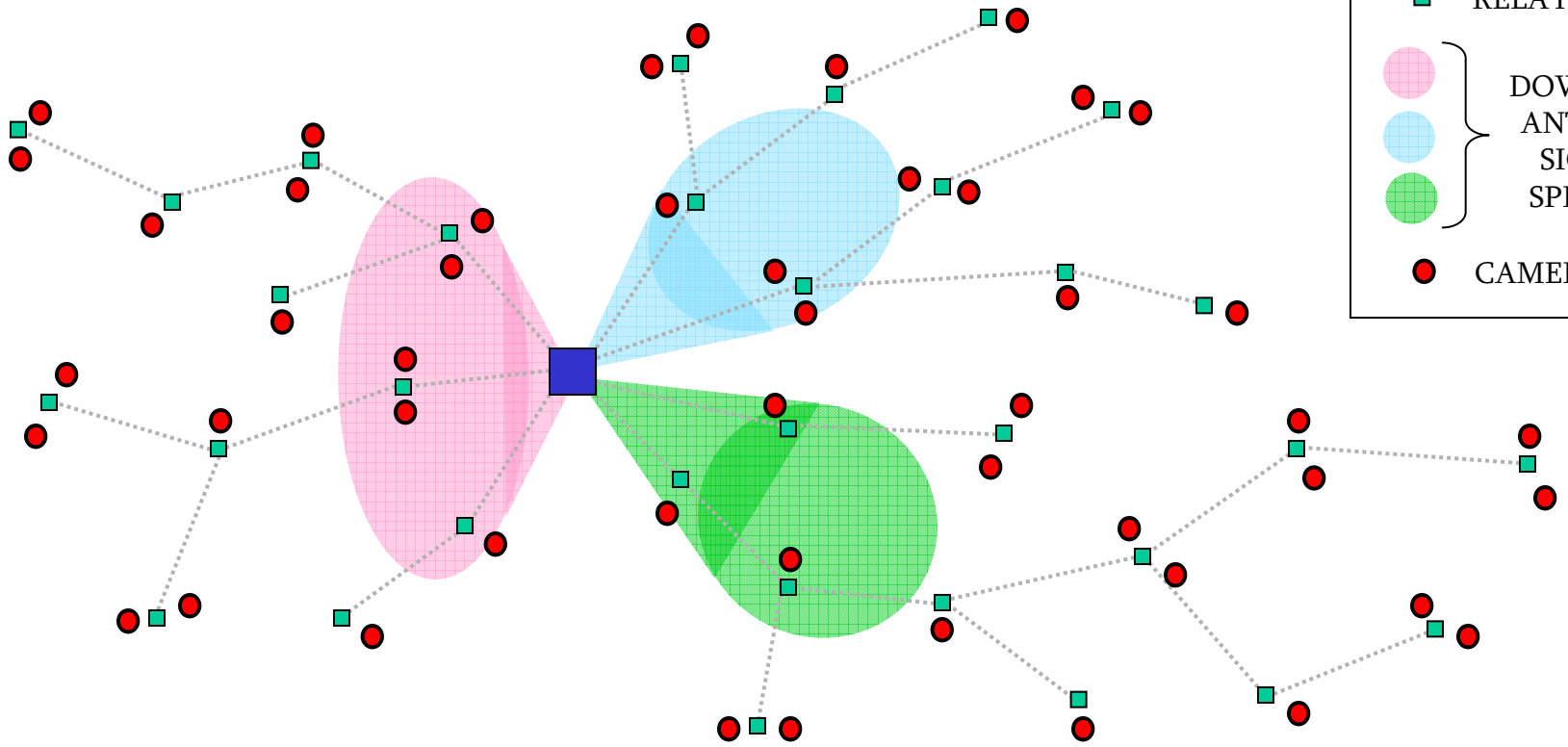
WHILE OTHER VENDORS OFFER ONLY A SINGLE DOWNLINK RADIO ON THE ROOT NODE, WHICH CAN SEVERELY LIMIT THE NUMBER OF CAMERAS THAT CAN BE INSTALLED ON A NETWORK, THE ABILITY OF THE **MD4000** TO UTILIZE MULTIPLE DOWNLINK RADIOS ALLOWS FOR A SUBSTANTIAL INCREASE IN THE NUMBER OF NETWORK CAMERAS.



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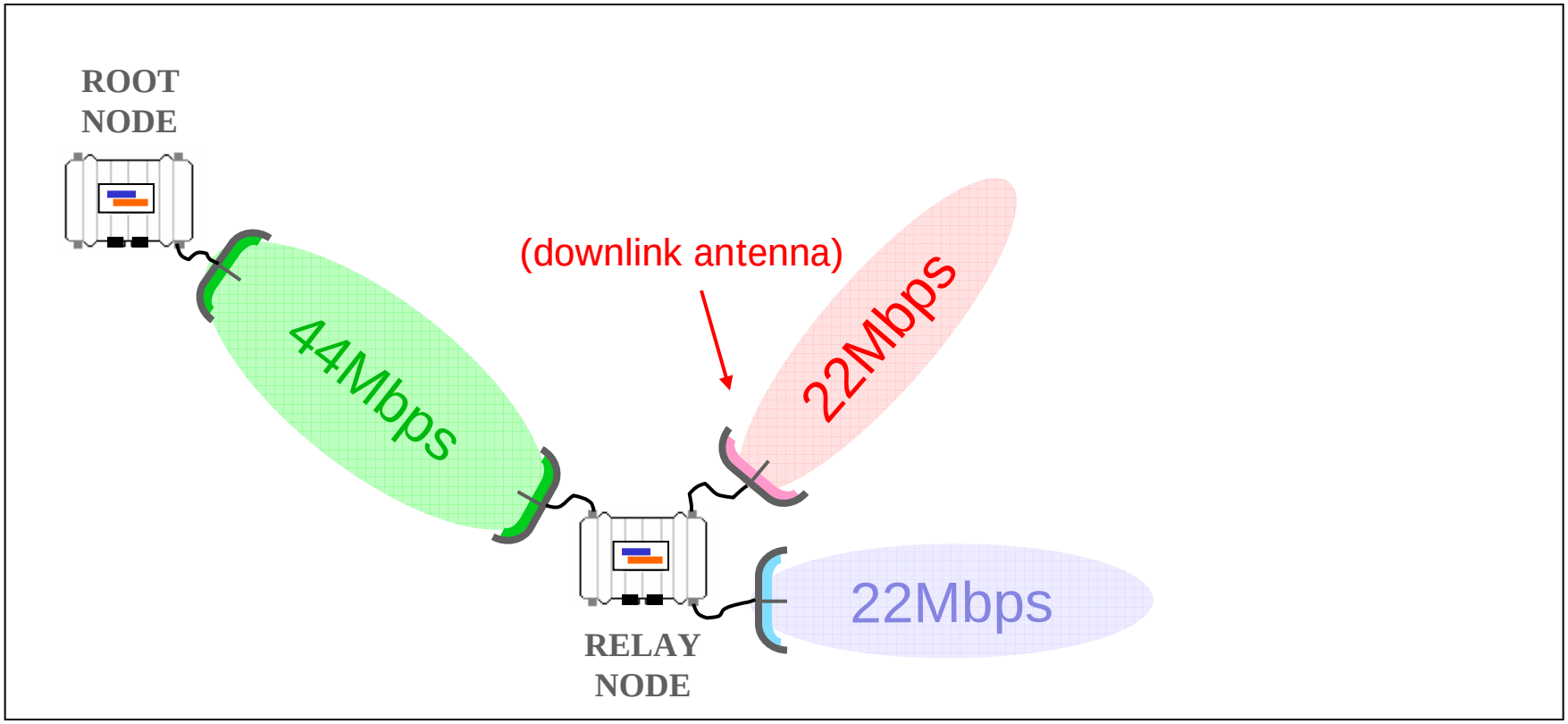
THE BENEFIT OF MULTIPLE DOWNLINK RADIOS CAN ALSO BE APPLIED TO RELAY NODES. A RELAY NODE'S UPLINK THAT HAS A BONDED-CHANNEL CONNECTION (44Mbps) CAN PROVIDE SEPARATE DOWNLINK CONNECTIONS OF 22Mbps TO DIFFERENT GEOGRAPHICAL LOCATIONS. THIS IS ESPECIALLY HELPFUL WHEN THERE ARE NODE CLUSTERS AND SURVEILLANCE AREAS ARE THAT ARE NON-LINE-OF-SITE FROM THE ROOT NODE.



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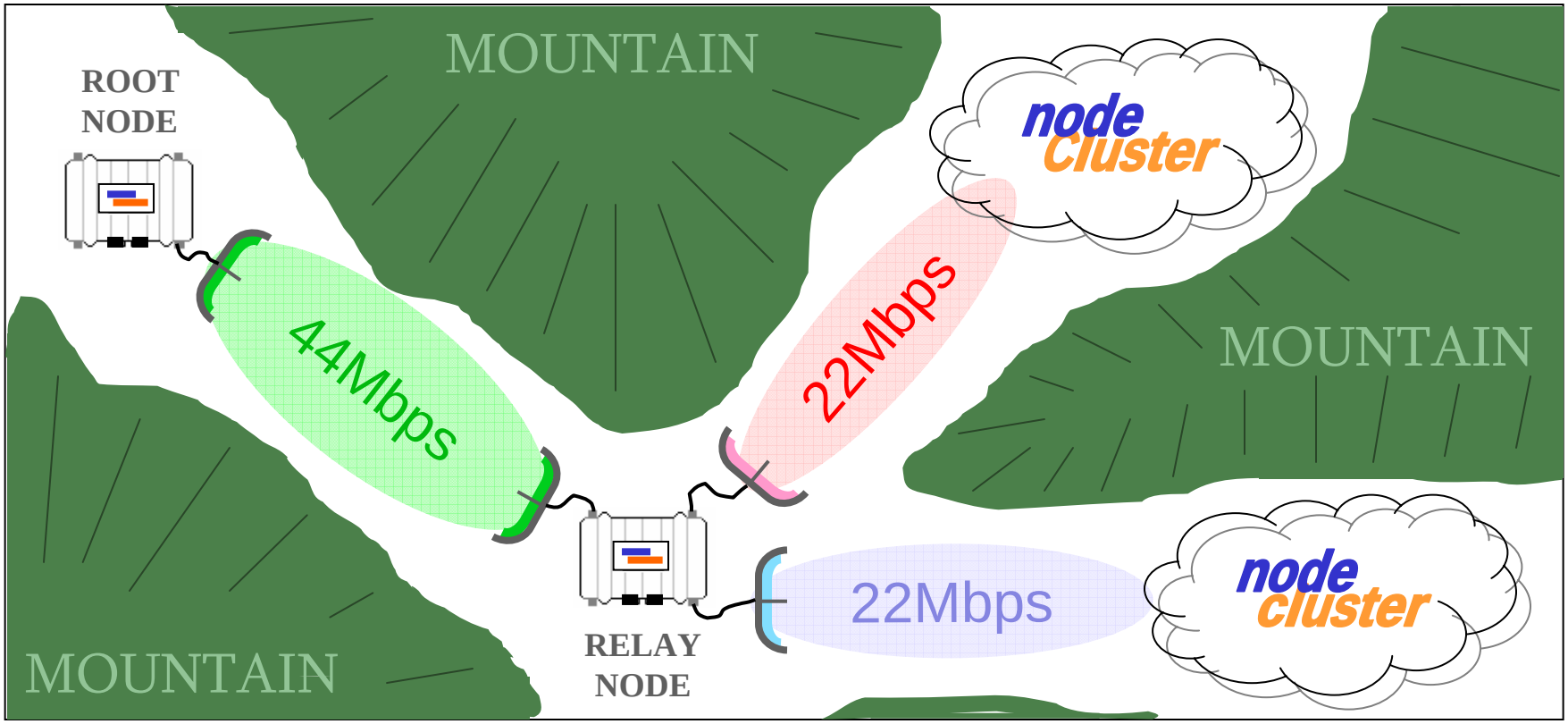

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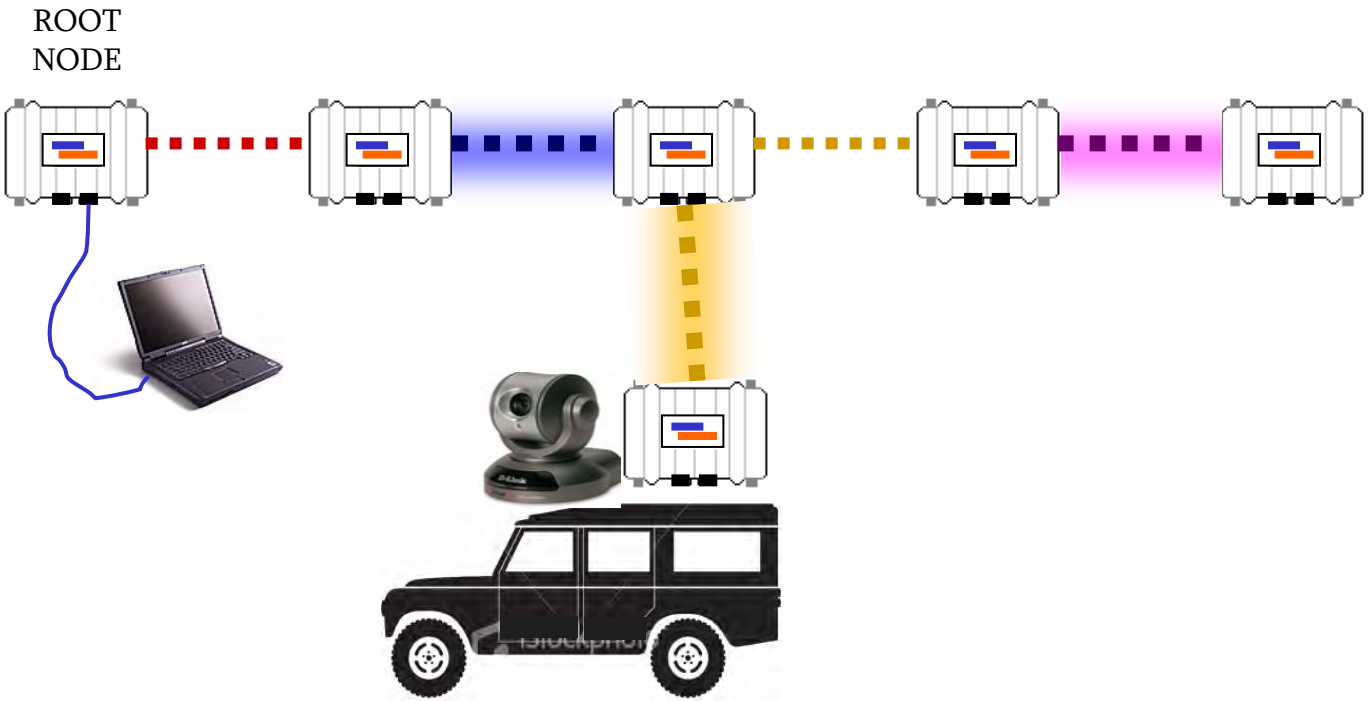
THE COMBINATION OF THE THIRD GENERATION BACKHAUL AND SEAMLESS NODE-TO-NODE SWITCHING MAKE THE **MD4000** MOBILE NODES IDEAL FOR MOBILE VIDEO APPLICATIONS.

THE **MD4000** HAS BEEN TESTED AT 65Mph WHILE SENDING GLITCH-FREE VIDEO OVER 5 HOPS. DURING THIS TEST, AN AVERAGE OF **10Mbps** OF THROUGHPUT WAS MEASURED. THE CONNECTIVITY OF THE MOBILE NODE WAS SET AT 24Mbps IN ORDER TO UTILIZE THE ROBUST 16-QAM MODULATION SCHEME.



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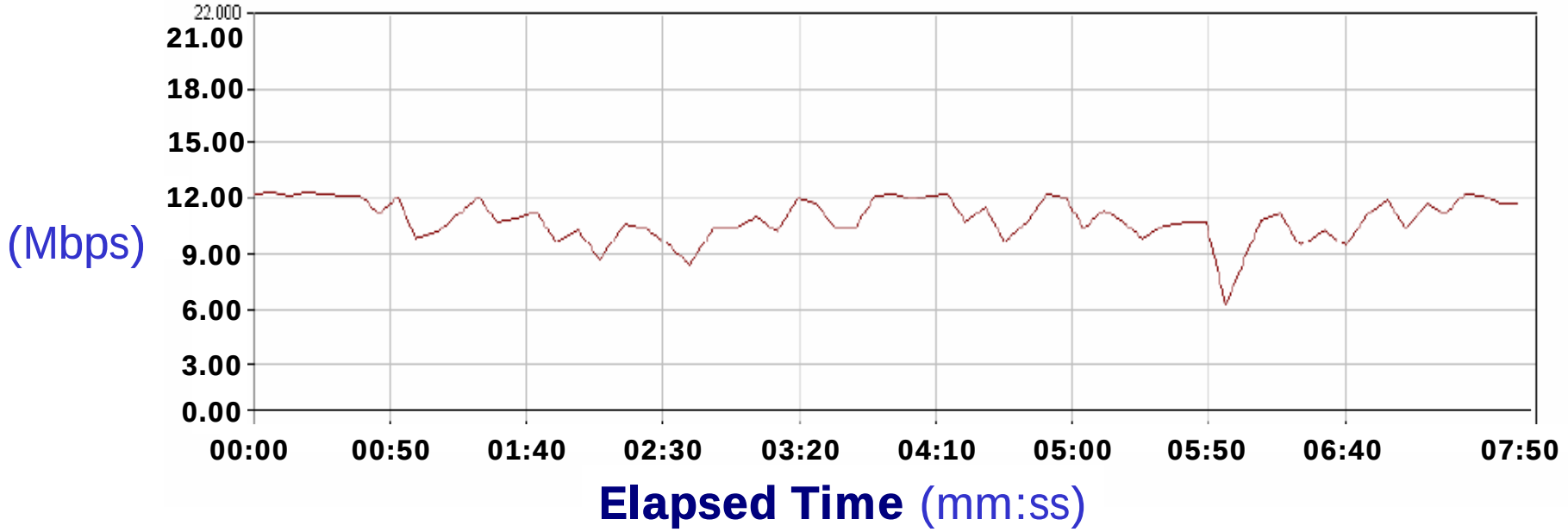
Throughput



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