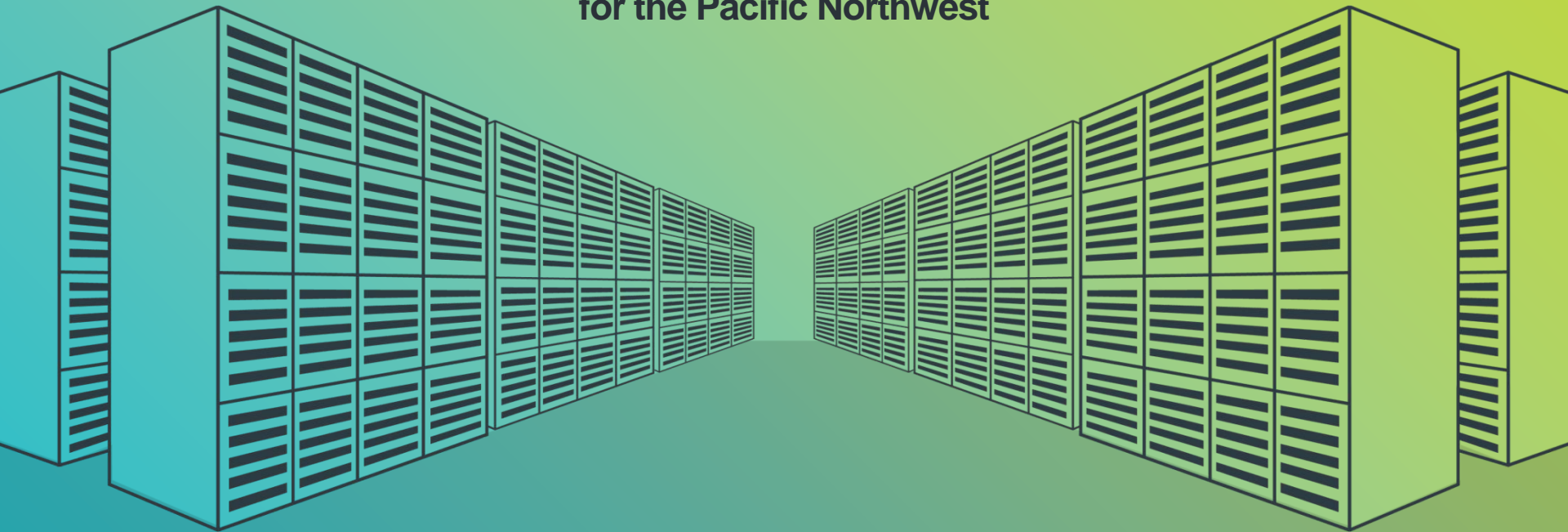


DATA CENTER MARKET STUDY

Market Trends, Actors, and What We Anticipate
for the Pacific Northwest



GOALS OF OUR STUDY

Identify Current
Market Trends

Size, Growth and
PNW Prospects

Role of Utility
Programs



Center Types and
Market Actors

Design, Operations
and Efficiency

MAIN FOCUS TODAY

Identify Current
Market Trends

Size, Growth and
PNW Prospects

Role of Utility
Programs



Center Types and
Market Actors

Design, Operations
and Efficiency

A FEW TERMS TO GET STARTED

IT: Computing equipment

Infrastructure:

Building, HVAC system, power conditioning system, lighting, and anything else not IT

Service Provider:

Provides computing services. Term includes widely divergent services, such as:

The Facebook logo, consisting of the word "facebook" in a white, lowercase, sans-serif font inside a dark grey rounded rectangle.The Netflix logo, featuring the word "NETFLIX" in a bold, black, uppercase, sans-serif font.The Salesforce logo, which includes a dark grey cloud shape with the word "salesforce" in a white, lowercase, sans-serif font inside it.The Amazon.com logo, showing the text "amazon.com" in a black, lowercase, sans-serif font with a curved arrow underneath it.The Microsoft logo, featuring a square icon divided into four smaller squares (two blue, two red) followed by the word "Microsoft" in a black, sans-serif font.The IBM logo, consisting of the letters "IBM" in a bold, black, uppercase, sans-serif font with horizontal lines through the letters.The Digital Realty logo, featuring a square icon with a grid pattern followed by the words "DIGITAL REALTY" in a black, uppercase, sans-serif font.The Polar Systems logo, showing the word "Polar" in a large, black, serif font with a stylized sun or wave symbol above the 'o', and the word "SYSTEMS" in a smaller, black, uppercase, sans-serif font below it.

23 INTERVIEWS ACROSS 10 MARKET ACTOR TYPES



EFFICIENCY IS MEASURED IN PUE

PUE

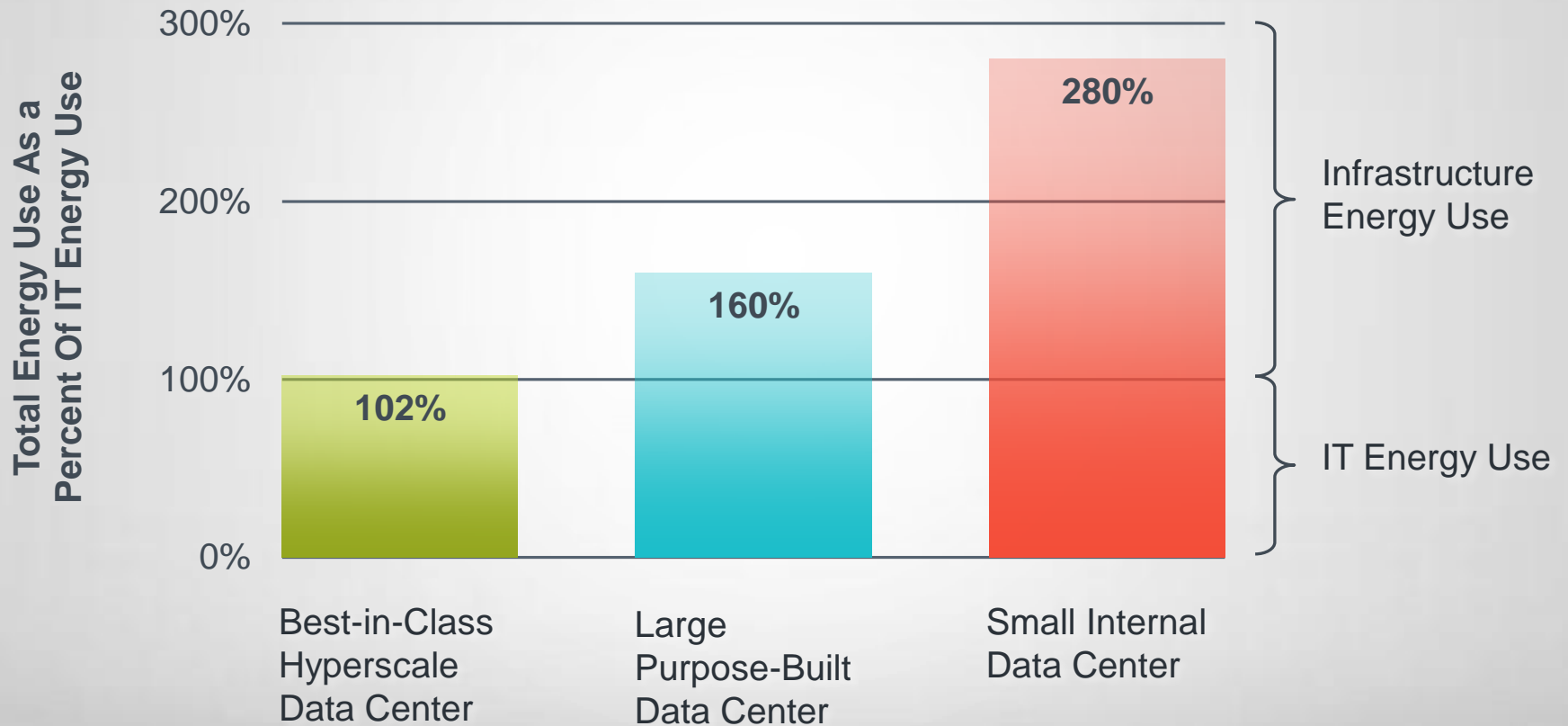
POWER USAGE EFFECTIVENESS

Ratio of total data center energy use to its IT energy use

Does not reflect IT efficiency, which varies by data center size

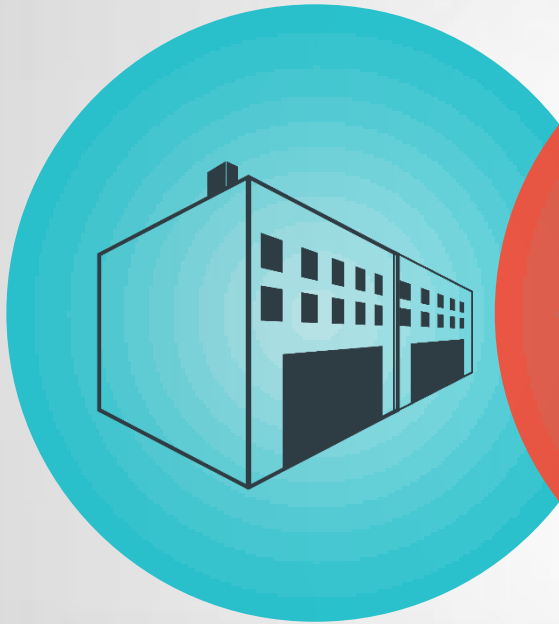
**Average PUE estimated to be 1.8,
meaning for each 100 kWh used by IT, the facility uses
80 kWh for cooling, power conditioning, etc.**

ENERGY USE VARIES WIDELY BY DATA CENTER SIZE



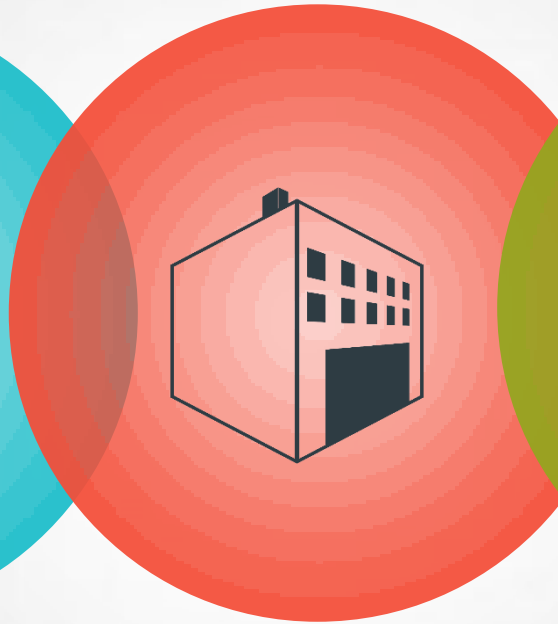
TYPICAL ENERGY CONSUMPTION FOR ILLUSTRATIVE PURPOSES ONLY.

ENERGY EFFICIENCY VARIES WIDELY BY DATA CENTER SIZE



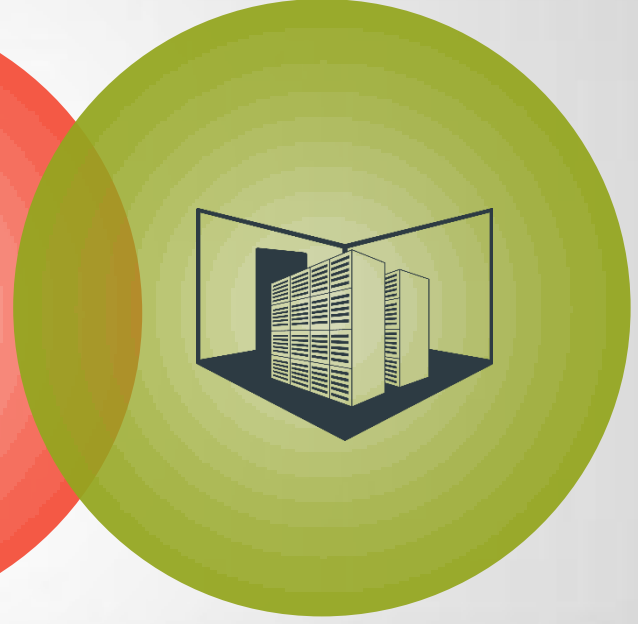
Large

Little Additional
Efficiency Opportunity



Medium

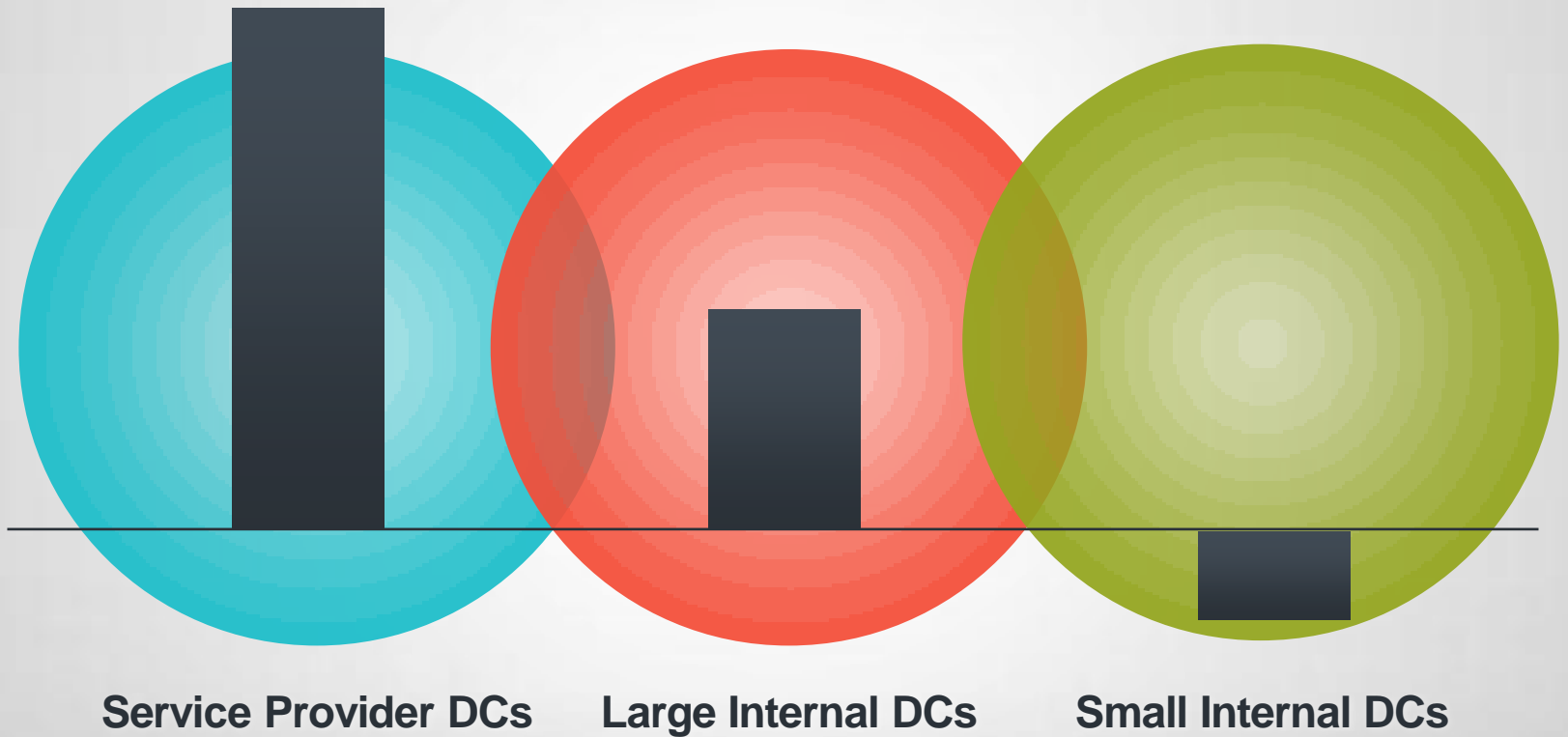
Efficiency Opportunity:
Server Virtualization



Small

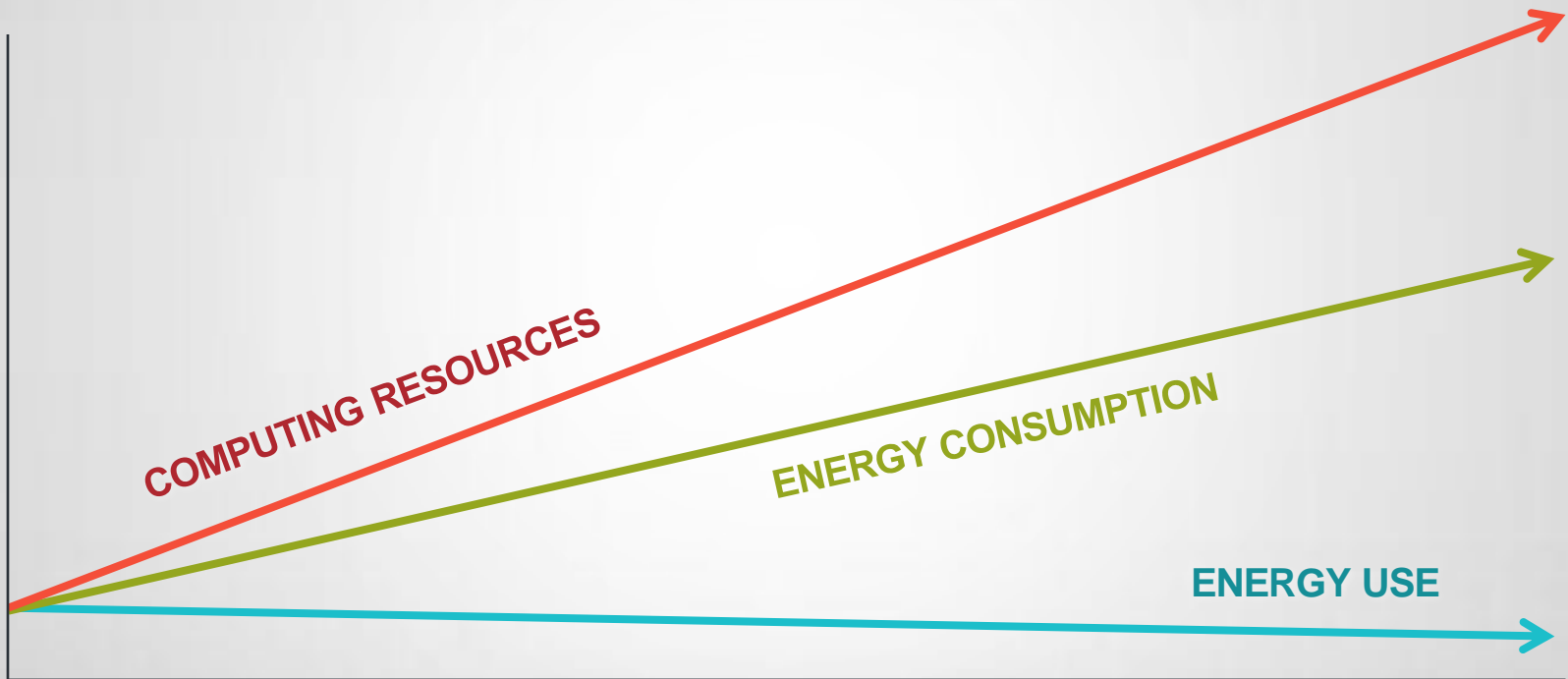
Efficiency Opportunity:
Stock Turnover

MOST DATA CENTER SUBMARKETS ARE GROWING RAPIDLY



NOT TO SCALE. FOR ILLUSTRATIVE PURPOSES ONLY.

MARKET ENERGY CONSUMPTION RAPIDLY INCREASING – GROWTH IN DCs OUTSTRIPS EFFICIENCY GAINS



NOT TO SCALE. FOR ILLUSTRATIVE PURPOSES ONLY.

OFFSETTING TRENDS DRIVING ENERGY USE

Increasing DC Efficiency



Large, Efficient DCs Dominate



New IT Stock More Efficient



New Purpose-Built DC Buildings
Efficient Infrastructure



Large Internal DCs Slow Growing

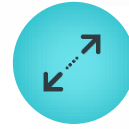


Small Internal DCs Declining

Increasing DC Power Consumption



Rapidly Increasing Number of DCs



Rapidly Increasing Size of DCs

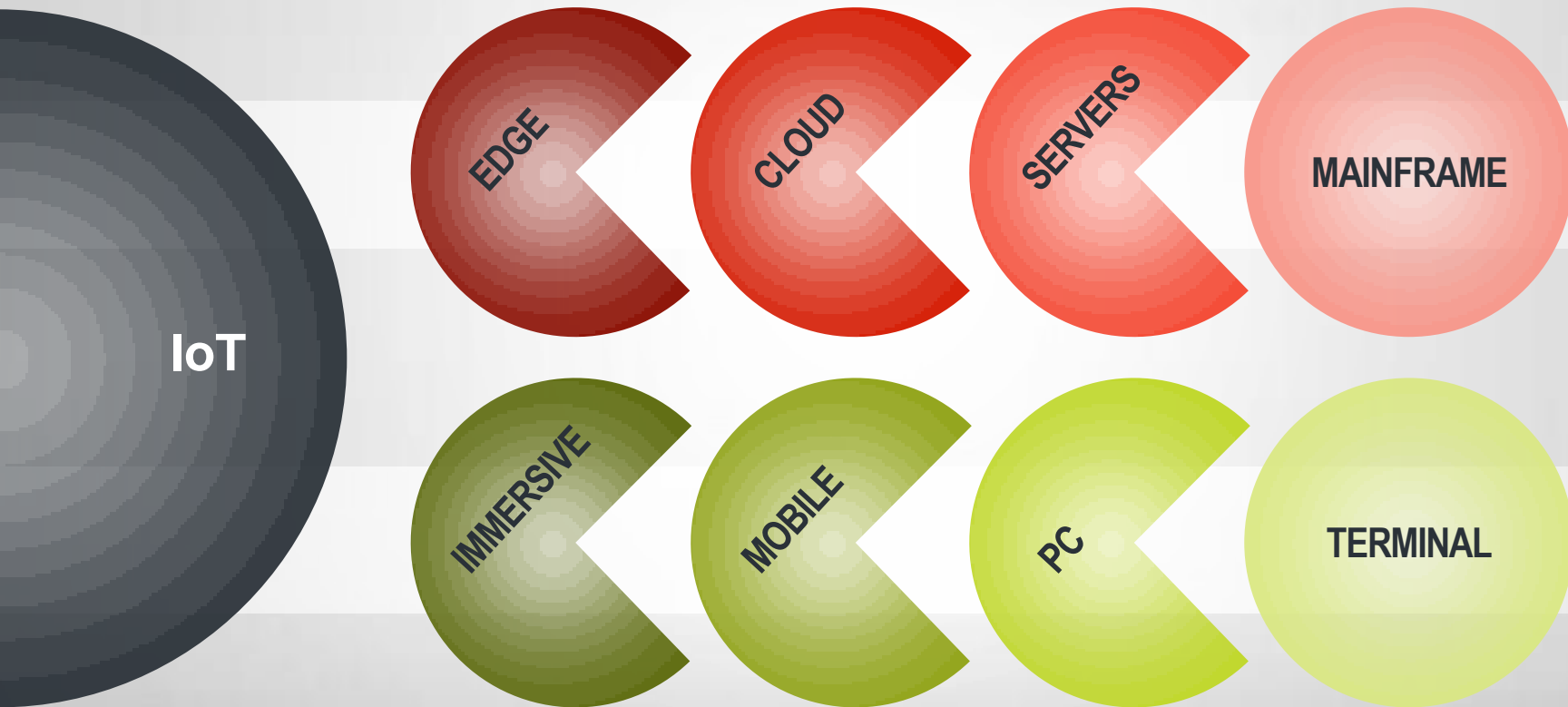


Increasing Density of Computing

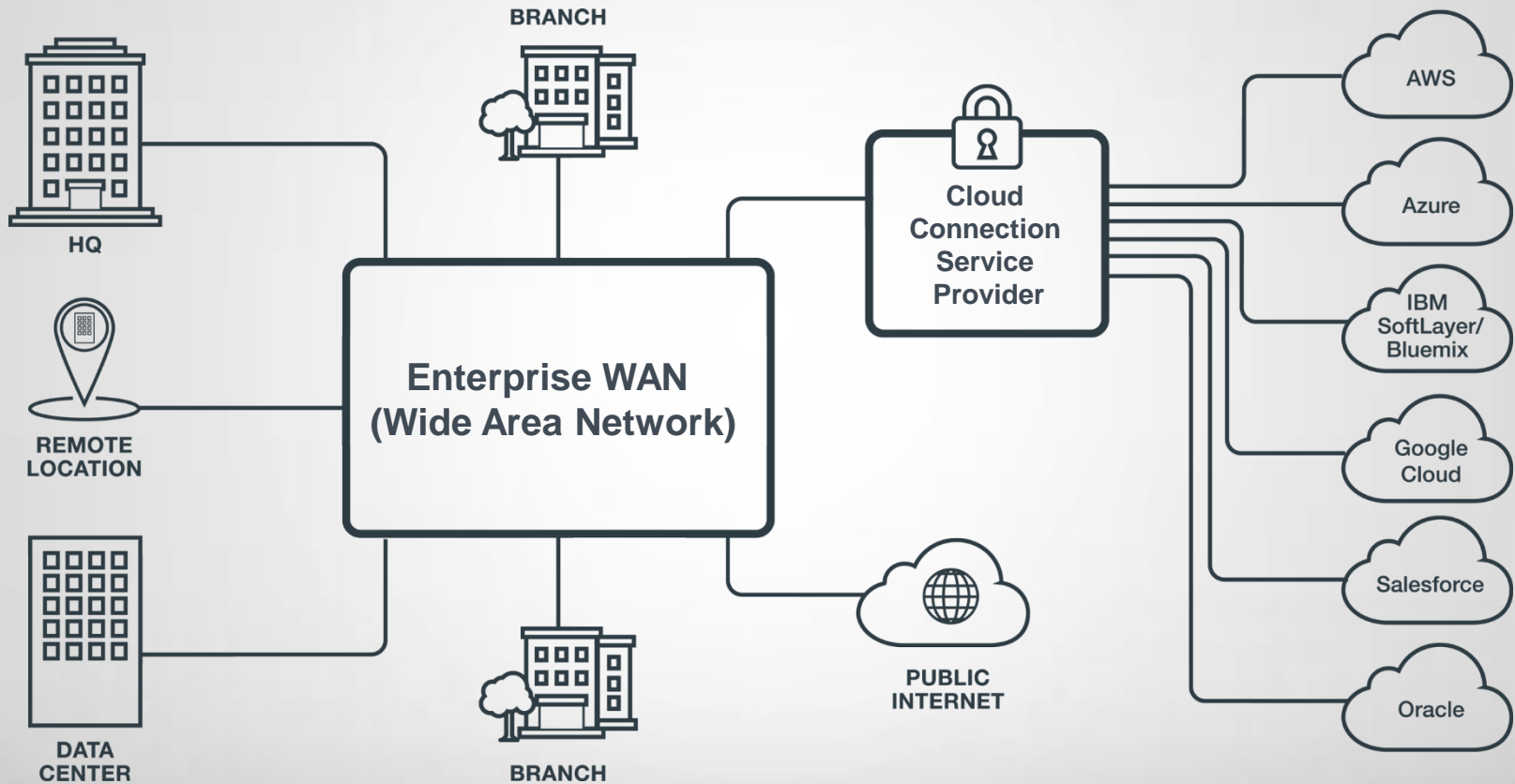


Cryptocurrency Mining Wildcard

COMPUTING RESOURCES – CONSTANT EVOLUTION



BUSINESSES INCREASINGLY USE A MIX OF DATA CENTER ASSETS



MANY MARKET ACTORS – INVOLVEMENT VARIES BY DC TYPE

DATA CENTER MARKET ACTORS	DATA CENTER TYPE			
	INTERNAL		SERVICE PROVIDER	
	SMALLER	LARGER	COLOCATION	HYPERSCALE
Managed Service Providers	Most Likely Involved	Likely Involved	May Be Involved	
Data Center Brokers			Most Likely Involved	
Architectural Design Firms		Likely Involved	Most Likely Involved	May Be Involved
Electrical Contractors		Most Likely Involved	Most Likely Involved	Most Likely Involved
Mechanical Contractors		Most Likely Involved	Most Likely Involved	Most Likely Involved
IT Equipment Suppliers	Most Likely Involved	Most Likely Involved	Most Likely Involved	Most Likely Involved
Infrastructure Suppliers		Likely Involved	Most Likely Involved	Most Likely Involved
Building Envelope Suppliers		May Be Involved	Most Likely Involved	Most Likely Involved

Level of Data Center Market Actor Involvement in Data Center Design and Operations:

■ Most Likely Involved
 ■ Likely Involved
 ■ May Be Involved

PACIFIC NORTHWEST ASSETS AND RISKS

Fueling Growth



High Connectivity



Low Power Costs



Low Land Prices



Renewable Power



Climate Considerations



Policy Incentives

Risks to Growth



Hyperscale growth may shift to other regions



Colocation market might be limited by cloud migration

LONG-HAUL FIBER OPTIC CABLES IN THE U.S.





**THE REGION SHOULD PREPARE FOR
POSSIBLE DATA CENTER LOAD GROWTH
IN EXCESS OF 10% PER YEAR**



CONCLUSIONS

