Beyond 3G:
TD-CDMA to LTE

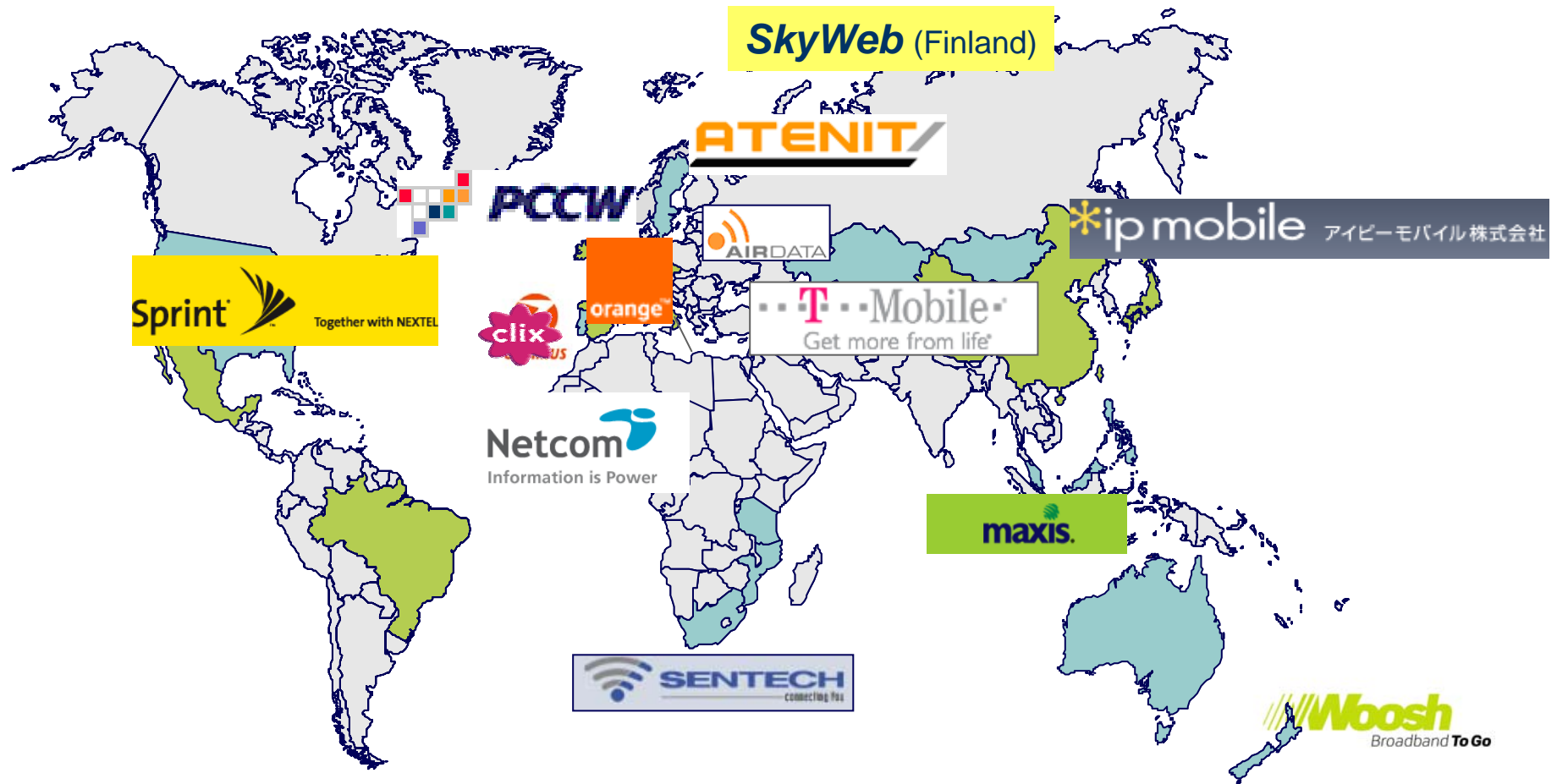VTC

Melbourne, may 2006

Roger Quayle, CTO, IPWireless

IPWireless Profile

World leader in Mobile Broadband technology using 3GPP TD-CDMA standard

> *Founded -* 1999

> *Funding: -* $200m+

> *Corporate HQ –* San Bruno, California

> *R&D center –* Chippenham, UK

> *Technology –* Mobile Broadband, With capacity to serve residential broadband market

>> High performance through Multi User Detection

>> Efficient shared channel architecture

> *Partnerships -* Technology sold and supported through licensees and partners

>> 5 Tier 1 vendors responding to recent operator RFP's

Major Operators (Announced)

SkyWeb (Finland)

ATENIT

PCCW

ip mobile アイピーモバイル株式会社

AIRDATA

Sprint — Together with NEXTEL

orange

clix

T··Mobile· Get more from life

Netcom Information is Power

maxis.

SENTECH connecting You

Woosh Broadband To Go

• Additional >10 smaller operators

IPWireless Generations Ahead

What's New ?

> "Enhanced Release 7"

>> Generalized MUD - Cancels inter-cell interference

>> MIMO - Built on MUD algorithms / engine - Doubles peak throughput

>> 64 QAM

>> Low latency

>> *Meets or exceeds all 3GPP Long Term Evolution Requirements (except 5 ms latency)*

> TDD / FDD dual mode

> LTE Evolution platform

> "TDtv" – TD-CDMA MBMS
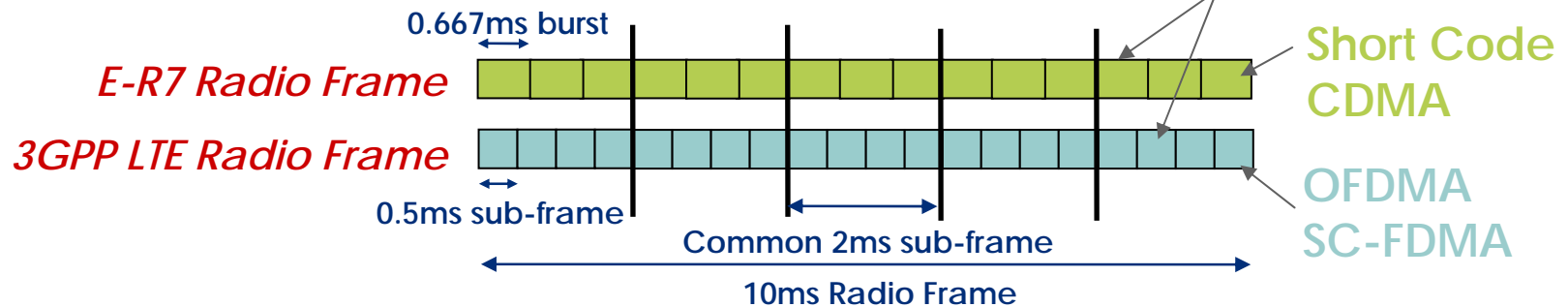
Performance – Current and E-R7 (TDD 10 MHz)

Downlink (8TS)

Uplink (4TS)

31.7

Avg=9.4

10

7.9

Avg=2.2

2

Avg=4

2.2

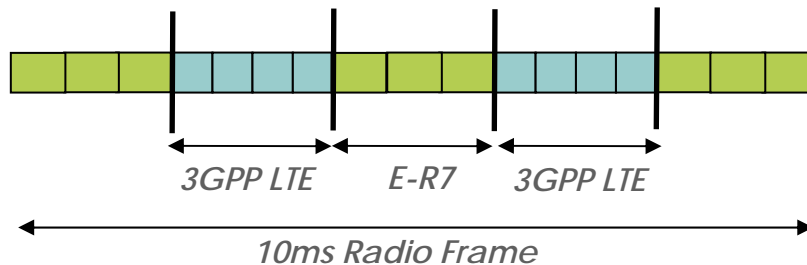Avg=2

1

1
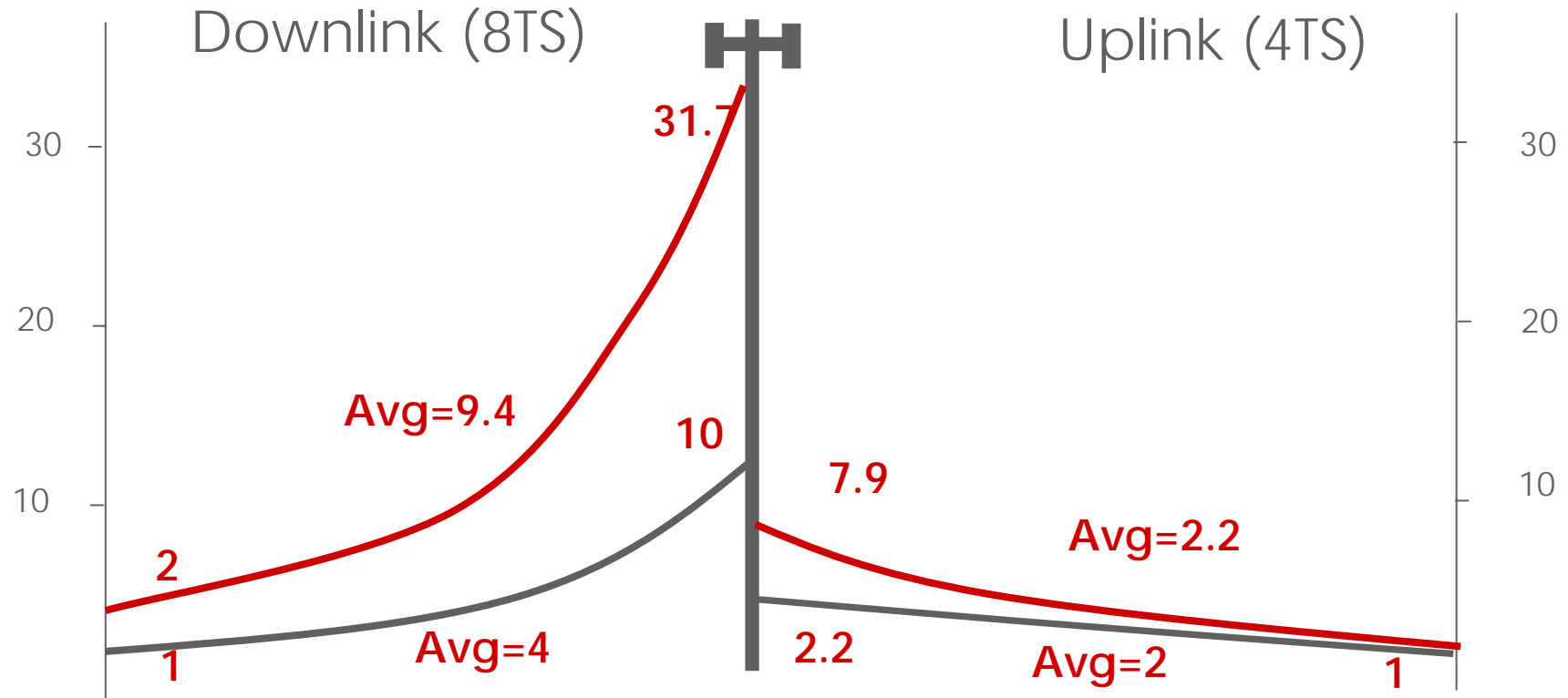
—— Current
—— E-R7, 2007

TD-CDMA's Self Contained Transmissions Allow For a Very Smooth Upgrade Path To LTE

E-R7 and LTE's Common Frame Structure

Both TD-CDMA and LTE utilize self-contained transmissions

0.667ms burst

E-R7 Radio Frame

Short Code CDMA

3GPP LTE Radio Frame

0.5ms sub-frame

OFDMA SC-FDMA

Common 2ms sub-frame

10ms Radio Frame

E-R7 and 3GPP LTE Radio Frame on a Shared RF Carrier

3GPP LTE   E-R7   3GPP LTE

10ms Radio Frame

Alternatively, 3GPP LTE and E-R7 Can Coexist in The Same Spectrum

Bandwidth W — E-R7 Carrier

Bandwidth W — 3GPP LTE Carrier

W/2   W/2 — Shared E-R7 & 3GPP LTE carrier

IPWireless
Generations Ahead
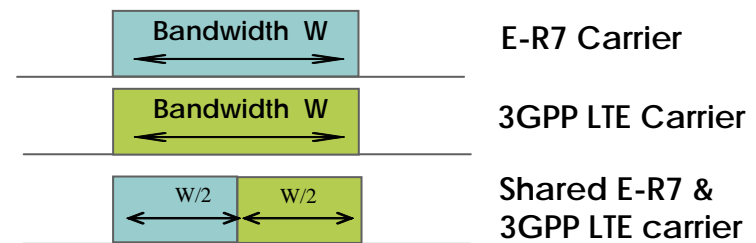
IPWireless E-R7 Meets key LTE Requirements

Parameter	Net Requirement Set By Operators	TD-CDMA Release 7 (FDD 5+5 MHz)
Downlink Peak User Throughput	5b/s/Hz	5.95 b/s/Hz
Uplink Peak User Throughput	2.5b/s/Hz	2.97 b/s/Hz
Spectral efficiency- Downlink	1.2 – 1.6 b/s/Hz	1.3 b/s/Hz
Spectral efficiency- Uplink	0.48 – 0.72 b/s/Hz	0.66 b/s/Hz
Cell Edge Rate - Downlink	1 – 2 Mbps	1.5 Mbps
Cell Edge Rate - Uplink	192-256 kbps	768 kbps
Latency one way (active state, single user, unloaded)	< 5 ms	20 ms
Channel bandwidths (MHz)	1.25, 2.5, 5, 10, 15, 20	1.25, 2.5, 10, 15, 20
Duplex Modes	Paired & Unpaired	Paired & Unpaired

Key performance boost for LTE will be in Latency

Significantly outperforms Mobile Wimax

IPWireless
Generations Ahead

TDtv Overview

> 3GPP standards compliant Broadcast and Multicast

> Allows cellular operators to own and control

> Low cost overlay on existing cell sites, or high sites

> 10 Mbps in 10 MHz – 33 QVGA channels @300 kbps

> Spectrum –3G spectrum, 2500 MHz , UHF

> Return channel for interactivity via TDtv (uplink timeslot, TD-CDMA, W-CDMA or cdma2000)

> Mobility up to 200 km/hr

> Low power consumption – discontinuous reception

> Chipsets – 2 options:
- Integrated in TD-CDMA SoC3 ASIC – no additional cost
- Low cost TDtv Chipset for phones, other devices

> Trials with Tier 1 operators in Europe, US and Asia

orange

Sprint
Together with NEXTEL

*ip mobile

TDtv Network Architecture

Up to 20 km

Iub

Unidirectional backhaul

Satellite provides cost effective solution for distribution

Broadcast INC

RNC	SGSN	GGSN

Basestations Designed As Very Low Cost Addition to cellular sites

Signals constructively combined in handset

Gi — Gm

Content

Broadcast Multicast Service Center (BM-SC)

Gi

Iups

UTRAN/GE RAN

GPRS CN

Iub

Cellular / Broadband Network

IPWireless
Generations Ahead